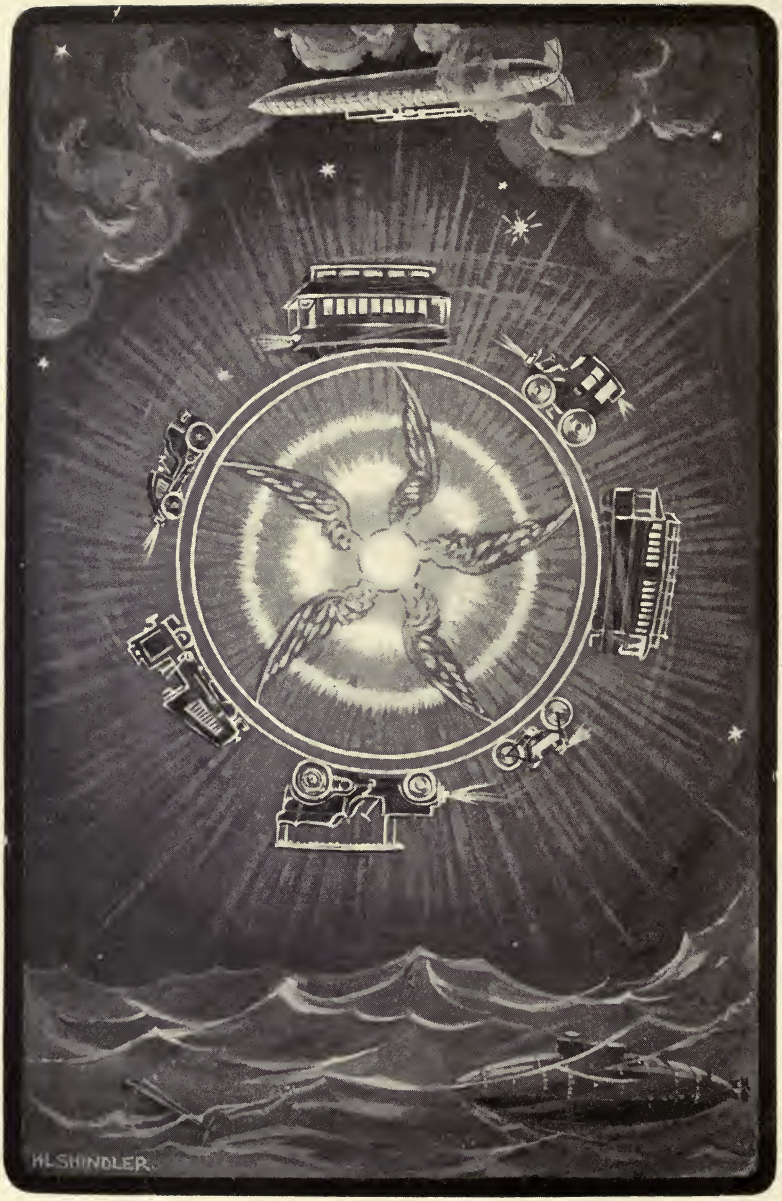
TUBE, TRAIN, TRAM, AND CAR

OR

UP-TO-DATE LOCOMOTION


H.L.SHINDLER.

TUBE, TRAIN, TRAM, AND CAR

OR

UP-TO-DATE LOCOMOTION

BY

ARTHUR H. BEAVAN

AUTHOR OF "MARLBOROUGH HOUSE AND ITS OCCUPANTS," "IMPERIAL LONDON," "CROWNING THE KING," ETC.

WITH MANY ILLUSTRATIONS

And an Introduction

BY

LLEWELLYN PREECE, M.I.E.E.

LONDON

GEO. ROUTLEDGE & SONS, LTD.

NEW YORK: E. P. DUTTON & CO.

1903

"THE CHARIOTS RUN LIKE THE LIGHTNING"

PREFACE

THE object of this work is to present the subject of Electrical Locomotion to the public for the first time, the author believes, in a popular form, giving interesting information about Tube, Train, Tram, and Motor-car, but avoiding, as much as possible, technical and scientific detail.

Electrical traction is of national importance, destined perhaps materially to abate the evil of overcrowding, by providing cheap and rapid means of access from centres of industry to country districts and *vice versa.*

It was predicted by George Stephenson in 1825 that his system would supersede all other methods of conveyance in this country. Similarly can it now be prophesied that throughout the world electrical traction will ultimately supplant all other forms. An age of electricity is dawning, when "power" may be obtained direct from fuel or from the vast store of energy existing in the heated interior of the earth, or even from the atmosphere that surrounds us; when every mountain stream and gleaming waterfall throughout Great Britain, and each tide as it rises and falls, will help to generate the subtle fluid, which, produced on a vast scale abroad, where giant cataracts and mighty rapids abound, may be imported to supplement our home supply, and be utilised in every manufacturing district; when all our main lines will be electric, and "light railways" ubiquitous; when coal-less ships and aerial machines, with perfected accumulators, may possibly traverse sea and ocean, and invade the domain of condor and eagle; when farms will be cultivated by electrical contrivances, and their produce expeditiously conveyed to market, and the sanitation of our streets be ensured by the universal use of horseless vehicles. An age that may witness "current" laid on for domestic purposes to every house in the land as a matter of course; and also as machine-power to village settlements, where artisans engaged in certain kinds of trade may work amidst the pleasant surroundings of home. And thus the abstract principle, "Back to the land," may become an accomplished fact.

To bring the body of this work precisely up to the date of its publication being obviously impossible, I take the opportunity of making passing reference to the railway disaster on the Métropolitain of Paris, when eighty-four passengers were killed, and which has caused the public mind to be much disturbed by the possibility of danger in the London Tubes.

As regards trams, the London United Tramways Company established a record of traffic during the August Bank Holiday period, the total for the four days being 878,000, that on Monday alone being 330,000 travellers. A serious electric tram accident occurred at Ramsgate in August, when nineteen persons were injured by the colliding of one car with another at a point where the lines converged.

Then, as to motor-cars. The great Gordon-Bennett race in Ireland this summer was won by a German. A tentative Act of Parliament for regulating the traffic, to come into force January 1st next, and to continue for three years, has received the Royal Assent, the speed limit being fixed at twenty miles per hour.

A service of motor hansom cabs is shortly to be established in London. The Fischer "combination" omnibus has successfully passed through repeated private trials, and will probably be adopted by one or both of the metropolitan chief companies.

Motor bath-chairs, to hold two people, and propelled by electricity, will be accomplished facts at the World's Fair, St. Louis, next year.

I have now to acknowledge, with thanks, the assistance of Sir William H. Preece, who kindly read through the proof-sheets of this volume just before he fell seriously ill in August, and of his son, Mr. Llewellyn Preece, who has written the Introduction, and I now leave "Tube, Train, Tram, and Car" to receive the verdict of those who travel.

ARTHUR H. BEAVAN

September, 1903.

INTRODUCTION

BY LLEWELLYN PREECE, M.I.E.E.

THE object of this book is to give the public a general idea as to the progress now being made in the application of electricity for transport purposes, and it was intended that Sir William Preece should write the introduction and correct the author so far as any technical misstatements were concerned. Unhappily, Sir William Preece has fallen victim to a very severe illness, which entirely incapacitates him from any work, and will prevent him from doing anything for some months to come. Just before his illness, however, he had gone through the proofs and made certain corrections, all of which, the author tells me, have been accepted, but owing to the great delay in the publication of this book which has already been incurred, and to the impossibility of discussing these matters with my father, I have not been able to check the proofs since the alterations were made.

The advances which, within the last few years, have been made in the application of electricity for the purpose of transportation are shown very clearly in this book, and if the author has made one or two flights on the wings of fancy regarding the future which may be somewhat startling to the reader, it must be remembered that if many things which are of everyday occurrence had been suggested to any of us fifty years ago, and if we had been told that it would be possible to travel at the rate of a hundred miles an hour, we should have been somewhat inclined to laugh. As the reader will learn, such travelling is to be very shortly a fact.

At the same time I do not believe that it will be so much with the high-speed work as with the tramway and light railway work that electricity will be of the greatest service to the public in the future.

I look forward to the time when there will be a network of light railways surrounding every town in the kingdom, enabling the population to spread itself out once again in the country.

Central power stations distributing electric current over a radius of fifteen or twenty miles will enable these railways to work at very low cost, and therefore carry passengers considerable distances at low fares.

The tendency at the present time being to reduce the hours of labour, whether mental or manual, the time at the disposal of a workman for travelling will increase, so that with an eight hours working day and cheap electric light railways, there will be no reason why the poorest labourer should not live in the country, and at least sleep in a pure atmosphere.

The adaptability of electricity to motor-car work has hardly yet been sufficiently realised. People see the luxurious electric brougham, described in this book, running on the streets of London and other large cities, but few have any idea that not only the wealthy aristocrat, but everyone will, before long, be able to ride in such carriages, possibly not so luxuriousy fitted up, but equally comfortable and speedy.

The usual cry at present is that electric cars are very nice, but the owners have great difficulties with the batteries. Undoubtedly batteries have given trouble in the past, and still do so to some extent. But if a man buys a horse and gives it in charge of the gardener's boy, he is likely to have trouble with his horse. In the same way, if a man buys an electric carriage and expects his coachman to look after it, he only naturally does have considerable trouble. There are several companies prepared to look after and maintain in continuous use, not only the batteries, but the complete carriages, and this is greatly improving the reliability of the electric car, and allaying the fears of those anxious to have such carriages.

Besides this, the battery itself is making great strides forward: its capacity per cwt. has largely increased, its life is much longer, and its reliability under great variations of discharge has considerably improved. In fact, it may be safely said that even now the electric car is more reliable than either the petrol or the steam car. At present it will not do the same distance on one charge, nor will it do the great speed other cars will, but this is the great reason why it should appeal to the

British public. The craze for high speeds does not affect the majority of people. I believe that it is only a question of a few years for the petrol and steam cars to be placed in museums and shown as monstrosities of the past, like the mammoth elephant, and that every cab, omnibus, and private carriage throughout the country will use electricity as the motive power.

In fact I do not think it unwarrantable to assert that, so far as this country is concerned, many of us will see the day when the only form of energy used for transportation will be that known as electricity.

LLEWELLYN PREECE

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TUBE, TRAIN, TRAM, AND CAR

CHAPTER I

THE OLD AND THE NEW ORDER OF RAILWAY LOCOMOTION

"The thinking minds of all nations call for change."—CARLYLE.

STEAM—THE OLD ORDER

AN immutable law of nature has decreed that whatever attains to perfection is doomed to perish, for

> "The world exists by change, and but for that
> All matter would to chaos back,
> To form a pillow for a sleeping god."

Thus it came to pass that in the period 1825 to 1835, when the main roads of Great Britain were at their best, when the then mode of travelling, though on a limited scale, had, as regards speed, punctuality, and organisation, reached the highest possible pitch of perfection, a little cloud like a man's hand, presaging the new order of locomotion, arose at the opening of the Stockton and Darlington Railway, and overshadowed the old method. So effective was the competition of the "iron horse," that in lieu of the fifty-four splendidly equipped vehicles which in 1835 carried His Majesty's mails throughout England, not a single coach left the

General Post Office, St. Martin's-le-Grand, in the year 1844; while the king's highways had become almost deserted.

Though this was barely sixty years ago, railways have evolved themselves out of their embryonic state into a condition approaching the fateful one of perfect development.

In early days, first-class passengers were boxed up in replicas of old stage-coaches, the second-class in open carriages exposed to the weather, and the third-class huddled together in seatless cattle-trucks. Contrast this with our luxurious Pullmans, and our corridor and vestibule trains for all classes, warmed throughout, lighted by electricity, and provided with lavatories, dining-saloons, buffets, and sleeping-cars. "With what further improvements can we allure the public?" ask anxious directors. One answer only is possible. "By bringing the mode of locomotion up to date."

This means, in the case of old-established railway companies, a complete and costly transformation, or an independent mono-rail track for long distances; under any circumstances entailing much hardship upon the shareholders. For at the moment when railway-engineers—improving so vastly upon George Stephenson's venerable engine,[1] built in 1822, and still at work for the Hutton Colliery, its weight only fifteen tons, its speed ten miles an hour—have constructed such magnificent locomotives as the "Greater Britain" for the London and North

[1] This is by no means the oldest steam-engine at work in the kingdom, the doyen being one built as far back as 1767, and used continuously ever since at Charles Clifford and Sons' Metal-rolling Mills, Birmingham. It is of beam type, and the oak beam was only replaced at the end of last year by one of iron. In 1812 a new cylinder was put in, but the rest of the engine remains as it was 136 years ago, even to the connecting-rod for rolling-mill purposes. It is said that this G.O.M. is more economical than many of the modern engines used in the trade.

FIG. I. QUEEN VICTORIA'S TRAIN ON THE GREAT WESTERN RAILWAY

Western Railway, or the ten-wheeled giant[1] for the Great Northern Railway, fifty-seven feet over all, weighing 100 tons, and capable of reeling off its 65 miles an hour with ease, electricity steps into the field, displaces the stately engine—resplendent in red, blue, green, or chocolate paint, glossy as the coat of some highly trained racehorse, and gleaming with polished brass and steel, finished in all its parts with exquisite accuracy, the very embodiment of energy under perfect control—and from some unpretentious-looking building afar off, drives our trains with unseen but resistless force, at the rate, if desired, of a hundred miles an hour!

The construction of an ordinary steam locomotive is an intricate operation, necessitating machine-shops, erecting-shops, foundries, forges, etc., covering acres of ground, as at Crewe, Doncaster, Derby, or Swindon. Not a hundred engines are exactly alike in pattern, and each one is supposed to be composed of over five thousand different parts, all of which have to be stowed away in a necessarily limited space.

"How is steam utilised by the locomotive?" is a question asked again and again (and not by children only) ever since Stephenson's engine started on its triumphant progress from Stockton to Darlington and back, and which, I venture to affirm, only a small percentage of travellers, even in 1903, can answer "right away," as our American cousins would express it.

[1] The biggest and most powerful locomotive in the world is stated to be the "Bessemer," built in 1900 at the Pittsburg Locomotive Works, U.S.A., weighing with its tender 175 tons. Its height is 16 feet from rail to top of smoke-stack, and it is capable of easily drawing a train of 4,000 tons at 25 miles an hour, or 8,000 tons at 15 miles an hour. Its hauling power is therefore enormous, and so it ought to be, as the diameter of the smallest ring of the boiler is 7 feet 10 inches. The nearest approach in size to this monster was constructed in Great Britain for the Santa Fé Railway in Argentina, and weighed 150 tons.

Briefly, then, as follows: Raised up on high is the mighty boiler. Remove its plates, and running through its entire length will be seen a cluster of some two or three hundred brass tubes, in diameter that of a penny-piece. At the rear of the boiler, on a lower level, is the fuel fire-box, with its grate and ash-pan, while in front is the smoke-box, surmounted by the familiar chimney or funnel, called in the United States the "smoke-stack," in British engines reduced to a minimum of height. Water from the tender surrounds the brass tubes, and when the fire is burning, flames, smoke, and heated gases rush through them, escaping *viâ* the chimney, but in their passage converting the boiling water into expanding steam, which, when the regulator is opened, is directed by valves into the hollow cylinders—sometimes placed below the boiler, but generally visible outside—forcing by its pressure the pistons backwards and forwards alternately, and, by means of intermediate machinery, transferring its energy to the driving-wheels.

The exhausted steam, after accomplishing its work, joins the smoke in the smoke-box, escaping up the funnel by jerks, which creates a forced draught through the brass boiler-tubes, and hastens the generation of steam.

ELECTRICITY—THE NEW ORDER

Contrast this with electricity, the definition of whose exact nature is a task I must of necessity leave to others, but its adaptation to the purposes of traction can be thus broadly explained :—

Dynamos or generators are situated at some fixed station, more or less distant, generating electrical energy, whence the current is transmitted along a central steel rail, or, in the case of some tramways, *viâ* overhead wires, returning to its place of birth by another rail or cable, and completing its circuit. It is "picked up" by a small locomotive fitted with motors that work the driving-mechanism, and thus propels the coaches or cars behind it at varying speeds.

The rotation of the dynamos is effected either by a torrent, waterfall, or swift-flowing river, absorbed by turbines, or by steam supplied from ordinary boilers.

In other words, we convert our water and coal into steam, and, indirectly, the heat in the steam into electrical energy; and the heavy locomotive that used to carry its own fuel, and manufacture its steam as it tore along with the train behind it, now leaves tender and boiler at home, and has its driving power, in the form of electric current, forwarded to it per centre rail, to be drawn upon when wanted.

The system is beautifully simple, and the machinery compact and uncomplicated. Smoke defilement is unknown, and the trains are comparatively noiseless. In short, electric traction is the refinement of mechanically applied power.

Now let us visit an electrical power station—a small one—and I have in my mind that of the Waterloo and City Electric Railway.

Hidden away behind a bewildering labyrinth of railway arches, in a *cul-de-sac*, approached from a back street, not a hundred miles from a great railway station, is a plain, very plain brick building, wherein, for aught one knows to the contrary, such prosaic articles as pots and pans, or cardboard boxes, may be in course of manufacture. Pass through a door, always on the swing, and an unpretending office is reached, furnished in the usual manner, and occupied by clerks engaged upon the ordinary duties of their vocation.

Access to the engineer-in-chief being granted, he courteously conducts us to the power room, whence issues the energy that drives the trains.

Imagination had pictured a great hall, filled with ponderous machinery whose component parts are cranks, steel rods, shafts, and toothed wheels, a wilderness of metal, moving with bewildering rapidity and thunderous

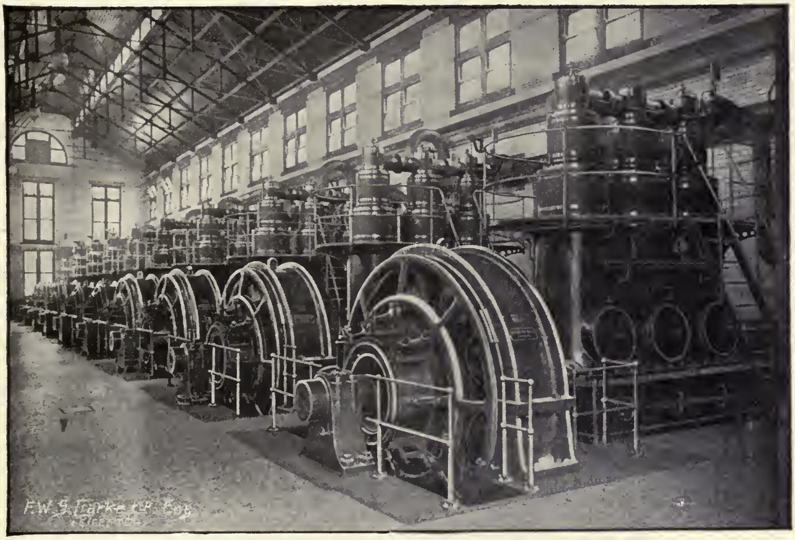

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FIG. 2. NINE WILLANS-SIEMENS DYNAMO SETS FOR ELECTRIC TRACTION, 700 H.P. EACH.

power, in an atmosphere redolent of lubricating oil, a vision of whirling wheels, an Ezekiel vision of wheels in the midst of wheels, instinct with life, such as the prophet saw 600 years B.C., by the River Chebar, in the land of the Chaldean.

Nothing of the kind! One portion of a moderate-sized apartment is devoted to the "fitting" of the motor locomotives, and at the other end, enclosed within a low railing, resting upon a bed of great solidity, and occupying but little space, is the machinery in duplicate, as a safeguard against breaksdown.

It consists of a vertical compound engine, supplied with steam from an adjoining boiler-house, whose cylinder is coupled direct to the fly-wheels of the revolving dynamos that are partly sunk into the flooring. These, with their electro-magnets, are so shut in, and so little can be seen of the working, that it all looks very mysterious and incomprehensible to the uninitiated.

In large power-producing machinery an iron staircase leads up to a platform above the dynamos, giving access to the loftier parts of the apparatus, which then, in its general appearance and compactness, somewhat resembles a modern marine engine. On the walls are endless dials, recording the amount of current generated, localising the exact position of the trains on the line at any given moment, and checking the quantity of current picked up by each engine. There is absolutely no smell, no outward indication of resistless power, while almost Arcadian quiet reigns in the neighbourhood of the machines.

That these small dynamos are capable of driving heavy cars filled with passengers at the rate of many miles an hour seems incredible; but faith, "the evidence of things not seen," must come into play.

The craving for mere size, however, will be amply gratified when the great power house at Chelsea, built to supply the Metropolitan, District, and other railways, is completed (*vide* Chapter V.).

But what on earth is a kilowatt, or a volt, an ohm, or an ampère?—expressions that are rapidly becoming as familiar as the word horse-power.

Well, "horse-power" was a term invented long ago by engineers, who blandly asked one to imagine that an ordinary horse was capable of lifting a weight of 33,000 lbs. (or some $14\frac{1}{2}$ tons) one foot high per minute. Now, electricity is a very exact science. There is no mere theory about it; and a unit is a definite quantity of power, known in that science as a "kilowatt hour." Thus, a kilowatt, or 1,000 watts, is the equivalent in measured work of $1\frac{1}{3}$ horse-power, equal to the lifting of 44,000 lbs. per minute, or the doing of so many units of work, either electric lighting, heating, machinery driving, or traction.

VARIOUS FORMS OF ELECTRIC LOCOMOTION

Electricity as a locomotive force is being presented to the public in various forms. There is the ordinary railway, like the Underground, that, cleansing itself, amending its ways, and becoming converted to the new order of traction, has been granted a new lease of life. Then there are new lines laid down, intended from the first to be electrical, with specially designed cars, diving beneath the Thames, and connecting the north and south of London. These are our metropolitan pioneer electric railways. There is also the system of railways specifically and popularly known as Tubes, most important factors in the travelling world of modern Babylon. Another division is the system known as Overhead Electric Railways; that is to say, rails laid upon iron girders supported by columns above the roadway, a notable example of which is the Liverpool Overhead Electric Railway.

Electric tramways are with us in Greater London for good and all, with their network of lines in every direction. Some are locally worked by the various Borough

Councils; others on a comprehensive scale by the London County Council, who now strongly advocate also another system, the Shallow-Underground, by which the cars run in a kind of open trench just below the surface in the middle of the street.

Next we have endless provincial and urban council electric tramways, including some very extensive systems for feeding the enormous traffic of cities and large towns in the Midlands and North of England.

Electric Light Railways, originally intended to be worked on rails laid down upon the ordinary highway, form a special class by themselves to serve short-distance traffic in country districts; but to all intents and purposes they are rural electric trams.

Lastly, we have motor-cars, carriages, omnibuses, cabs, vans, and cycles, that with electricity as their means of propulsion, will possibly ere long supersede every other form of traffic in our streets and along our roads and lanes.

To individualise these various outcomes of electrical traction spread over the length and breadth of Great Britain is impossible. Their names and their statistics are enrolled in *Garcke's Manual of Electrical Undertakings*, a work that, like *Kelly's London Directory*, grows bigger and bigger every year.

I propose, therefore, only to notice some of the principal ones; and, naturally, the pioneer railway lines should have the place of honour.

CHAPTER II

SOME PIONEER ELECTRIC RAILWAYS

"A worthy pioneer."—SHAKESPEARE.

THE GIANT'S CAUSEWAY RAILWAY

IN the month of March, 1883, by the opening of the Giant's Causeway, Portrush, and Bush Valley Railway, the sister island achieved the honour and glory of showing the way to the "predominant partner" in the matter of electrical traction enterprise; winning, however, only by a head, for in August of the same year the Brighton Beach Electric Railway was inaugurated.

Who amongst us can say they know Ireland well? To the average tourist it still remains an unexplored country. The travelling American, however, as a rule, does it from end to end. Commencing with Dublin, "doing" Killarney, and working round the magnificent west coast, he returns *viâ* the North Channel, always taking *en route* on the coast of Antrim the Giant's Causeway, thundered upon by storms from the wild Atlantic. There, almost within hail of Britain, are those strange groups of basaltic columns so familiar to geological students, intensely interesting, invested with many an old and mystic Celtic legend, yet until recently difficult of access, as other striking regions in Ireland—an island abounding not only in awe-inspiring scenery, but in sequestered spots of sylvan beauty; a fair land of mountains and hills, lakes and waterfalls, crystal streams, and splendid harbours; truly called the Emerald Isle; where the grass is greenest, and rare coniferæ flourish; where the myrtle needs no shelter, and the arbutus blooms and fruits to perfection, and flowers are everywhere, for every little enclosure in due season glows with the brightest of flax and potato blossom; and lanes

By permission of *Thos. Cook and Son, Ludgate Circus*

FIG. 3. THE GIANT'S CAUSEWAY.

and open country are gay with star-like marigolds, shamrock, violets, honeysuckle, meadowsweet, catsear, scabious, large purple bugle, and such-like lowly but welcome plants.

From Portrush it is easy to reach the Causeway, though once there, one often has to wait for favourable weather before proceeding to explore its cavernous wonders by water.

The present length of the railway is $8\frac{1}{2}$ miles of single line, its gauge being 3 feet. It is worked partly by steam and partly by electricity on the overhead system, the current being derived from a generating station three-quarters of a mile away, where three hydraulic turbines, fed by an adjoining waterfall, operate the dynamo. Although the railway is out of the way and on a small scale, the attractions of the Causeway and the surrounding district result in a respectable passenger traffic of over a hundred thousand per annum.

THE BRIGHTON BEACH RAILWAY

Under the sanction of the Brighton Town Council, the Magnus Volk Co., Ltd., now work the Brighton Beach Electric Tram-railway, which at its opening was regarded as a great novelty and curiosity, constituting an additional attraction and amusement to "London by the sea," and tens of thousands must have taken a ride in its little open cars since it came into existence twenty years ago. The gauge is but 2 feet $8\frac{1}{2}$ inches, the "feeders" are underground, the propelling system is electric, with a third rail, and its speed is about 12 miles an hour. Starting from the west pier, opposite the Royal Aquarium, it sets out on its one mile and a half route of single line and dips beneath the level of the Marine Parade to a level a little above the beach, passing *en route*, though hidden from view, many landmarks of old Brighton, such as Park Place and Gardens, Royal Crescent, Marine Square, and Lewes Crescent, and terminating at a point near Black Rock.

This was the eastern end of Old Brighton, noted for many an original character in the "twenties" and "thirties," not the least interesting of whom were old Martha Gunn, queen of the bathing-machines, and

Sak Deen Mahomed, a native of the East, who introduced the art of shampooing into the town, and lived to become a centenarian, his fame being enshrined in verse by James Smith, one of the authors of *Rejected Addresses*, who humorously predicted his longevity as follows :—

> "Sprung doubtless from Abdullah's son,
> Thy miracles thy sire's outrun,
> Thy cures his deaths outnumber;
> His coffin soars 'twixt heav'n and earth,
> But thou, within that narrow berth,
> Immortal, ne'er shall slumber."

Many have been the changes in Brighton since those days. Arundel Terrace, Kemp Town, Ultima Thule in the east; Adelaide Crescent with Palmyra Square, its western boundary. From the fields to the north of that square could be seen, a mile or so off, the village of Hove, the intervening space being dotted with farms. No one could have dreamt that a great railway-station would be built there, with minor ones at Kemp Town, West Brighton, and Hove. Old residents could not have pictured a Grand Aquarium, a Western and Eastern Pier, nor the destruction of their familiar Chain Pier. They would be amazed at the spread of Brighton in every direction, the springing up of palatial hotels like the "Métropole" and "Grand," and the increase of the population to some hundred and fifty thousand; while the coaching world, headed by the popular Sir St. Vincent Cotton, prince of amateur whips, and all the confraternity of coachmen and hackney-coach drivers, would have thought anyone a lunatic who had dared to prophesy that one day a conveyance drawn without horses or steam power would carry passengers along the Brighton beach!

THE CITY AND SOUTH LONDON RAILWAY

For many years prior to 1890, in Gracechurch Street, at a point near its junction with Eastcheap, could be seen every day of the week numerous omnibuses arriving between nine and eleven a.m., and departing between five and eight p.m., for the suburbs over the water. These 'buses regularly plied between London and Kennington, Walworth, Camberwell, Stockwell, Clapham, and Brixton (a few journeying to Dulwich and Peckham), for the special accommodation of dwellers in those favourite localities engaged in business during the day. Wealthy "principals" of mercantile and brokers' firms drove to and from their comfortable Surrey villas in well-equipped carriages, the junior members in smart traps or dog-carts; but the small merchants and smaller brokers, the head clerks and the rank and file who do all the hard work, had to make use of these omnibuses, and when exceptionally bad weather prevented the vehicles running, they had to get to and from their offices as best they could on foot. To the working man, living, say, at Brixton, and engaged upon a City job, the fares—4*d.* to 8*d.*—were prohibitive. The time wasted in these conveyances was great, and at the best it was an unpleasant way of travelling; overcrowding was common, and the "fight for the trams" in 1903 is as nothing compared to the frantic rush for those omnibus seats; while on wet days the sight was piteous.

It is true that City men could use the London, Chatham, and Dover Railway, to reach these suburbs, but this involved a walk to Blackfriars Station, and the facing of the crush on its dangerous platforms. There were also the alternatives of crossing Blackfriars Bridge and using the London Tramway Company's horse-cars, or of forcing one's way over London Bridge, tramping or "bussing" it along the Borough High Street, and, emerging at the "Elephant and Castle," there tapping the trams.

As a matter of fact, these ingenious alternative routes were seldom made use of. At the close of business, men of all ranks want to get home as fast as they can, and from some station not far from their counting-houses. Therefore, in the days I am describing, how could any of those gentlemen clad in irreproachable frock-coats and new glossy hats, who each day of the week issued from snug offices in Austin Friars, Drapers' Gardens, or Copthall Court, whose business was transacted over the way at the "House"; how could the brokers of Mark Lane and Mincing Lane, the underwriters at Lloyd's, the ship-brokers and ship-owners round about Fenchurch Street and Leadenhall Street, the flourishing bill-brokers of Broad Street, and the smaller mercantile fry; how could any of these, if resident on the Surrey side, be expected to go to and from business by way of Blackfriars?

However, this unsatisfactory means of communication was hardly likely to escape the notice of such astute experts as Mr. J. C. Mott, doyen director of the Great Western Railway, and his far-seeing friends. They took counsel together, and, after the usual hard task of *persuading* people, plans were matured, and in 1884 an enterprise was organised and incorporated as the City of London and Southwark Subway Company, to construct a line of railway from King William Street to the "Elephant and Castle," with an intermediate station at Marshalsea Road.

This was the initial stage of the present well-known railway.

At the outset, three points had to be considered. How was the subway to be constructed? What motive power should be employed? And how was the deep level to be reached by the passengers? A subway under the Thames was no novelty. The directors of the new line were not the "first that ever burst into that silent sea" of mud and gravel at the bottom of the swift-flowing river. Brunel had been long before them with his costly Thames Tunnel, and Barlow had years ago laid upon its oozy bed the Tower Subway of iron.

It was decided that a tube, or, rather, two independent tunnels of cast-iron rings, should be driven side by side beneath the bottom of the stream, a little to the west of London Bridge, and continued on the Surrey side.

On this system the work was begun by the contractors, Siemens Brothers and Mather and Platt, and proceeded with quite out of public sight. It was accompanied with many disheartening delays and seemingly insurmountable difficulties; but they were all successfully overcome, and the tubes were brought to a temporary end at the "Swan," Stockwell, to which charming retreat, by an Act of Parliament, 1887, an extension of the line had been sanctioned, making its length a little over three miles.

The motive power eventually selected was electricity, steam being impracticable, and the funicular or cable system considered unreliable. Access to and from the trains was to be obtained at the stations by means of capacious twin-lifts capable of holding many people at a time.

Then the problem of how best to utilise the ample "power," generated at the Stockwell Station, for hauling the cars, had to be seriously tackled. It was not a question of a toy line like that on the Brighton beach, but of the driving at fair speed, say 15 miles an hour, of comparatively heavy coaches laden with passengers, and at frequent intervals. Altogether it was a new departure in electric traction.

How the motor locomotives were effectually to pick up the current was the puzzle which had to be solved, or the enterprise might at the last moment collapse and the subscribed capital be lost.

After an infinite amount of anxious experimenting on the part of Mr. Mott and his scientific advisers—the narrative of which, as told me by that veteran, sounded like a romance—by a happy inspiration *the* way was hit upon; and all other technical difficulties overcome, the line was pronounced to be in working order (1890), after a series of trial trips, at one of which the writer had the privilege of being present.

CHAPTER III

SOME PIONEER ELECTRIC RAILWAYS (*continued*)

A TRIAL TRIP IN THE CITY AND SOUTH LONDON RAILWAY

ONE o'clock saw a large party of us, chiefly City men, amongst whom were numerous civil engineers, waiting at King William Street booking-office to descend into the bowels of the earth by one of the semicircular lifts, a novelty in point of size. Our turn having come, we duly filed into the elevator. The telescopic doors clashed upon us, and we stood for a second or two silently expectant, feeling like a batch of condemned criminals on a gigantic scaffold waiting for the hangman to draw back the fatal lever that would launch them into the other world.

Noiselessly the lift descended to an apparently fathomless depth, but in reality, I believe, some 90 or 100 feet. When released by the janitor, we found ourselves in a small, well-lighted, cool, and spotlessly clean, white-tiled station, whence was discernible a couple of small tunnels side by side, leading to unknown regions, seemingly all too narrow to accommodate even the miniature cars waiting for us at one of the narrow platforms.

Inspecting the tunnels, the classical man of our party, a wag in his way, who had hitherto made no remark, was heard to mutter something in Latin, which, on being coerced, he admitted was out of Virgil, and was translated thus: "This is the spot where the way divides in two branches." In vain we pointed out that the quotation was inappropriate, as the ways were *parallel.* He was obdurate, so we left him to his own reflections.

To most of us accustomed to roomy Pullmans and commodious railway carriages, the cars, though comfortable, seemed cramped, especially in height. The signal given, off we started, when we noticed that the cars fitted the tube with such nicety and economy of space that, could the windows have been let down, we could easily have touched the iron plates of the tunnel. We realised, too, that although there was no smoke or smell, the railway was by no means noiseless; neither, in the opinion of several of the experts present, was the running as steady as on the "Underground."

A hint had been given us that at some point where the line dipped and rose again the cars might come to a temporary standstill. As we rather uneasily recalled this, the speed gradually slackened, and finally the train stopped altogether, and simultaneously the incandescent lights began to pale, and at last subsided into filaments of sickly red. The situation was not a pleasant one. There we were; many of us with important engagements awaiting us later in the day; most of us with wives and children who would expect us home as usual when evening arrived, and grow anxious at our absence. There we were sealed up in a tube, for all we knew, at a point beneath the Thames. Not a sound reached us from the locomotive, or, indeed, from anywhere. Were we thus to remain indefinitely? For walk out we could not, there being no room outside the carriages. Would some memorial tablet let into the side of London Bridge, months hence, recall the fact that near it a goodly company of highly respectable citizens had perished in a living tomb?

I don't think we talked much. It was luncheon-time; we were hungry, and we felt like the occupants of the snowed-up cars in one of Mark Twain's stories, who gloomily eyed one another as starvation threatened, calculating upon whom, by an ingenious and complicated system of voting previously agreed to, would next fall the lot of being sacrificed for the benefit of the rest, and I believe I found myself unconsciously speculating on the plumpness of a youthful stockbroker standing by my side. But after a very few moments of suspense the train rattled on again, the lights reappeared, and presently we drew up at the Borough, the first station on the Surrey side.

Railway booking-offices are not usually things of beauty, least of all those on the Metropolitan, District, and suburban lines. Here, however, was a surprise, for we found quite a picturesque stone-and-brick building on the ground-floor, a cupola surmounting the prettily designed entrance, and a small dome with lantern by way of roof. And this was a sample of all the stations along the line.

The Borough recalled the Marshalsea that once stood close by; and there opposite was St. George's, Southwark, where Little Dorrit, accidentally locked out of the prison, was allowed by "the sexton, or the beadle, or the verger, or whatever he was," to take refuge in the vestry, where, years afterwards, she signed the marriage register when wedded to Arthur Clennam.

The next stoppage was at the Elephant and Castle—not the tavern of that name, where in the past on Derby Day the superabundant holiday traffic usually became hopelessly congested, but the City and South London's new station, close to Spurgeon's Tabernacle, Rabbits' great boot warehouse, and Tarn's vast emporium, that seems to occupy most of Newington Causeway. Onwards to Kennington Common, once the place of public executions for Surrey, now a well-kept miniature park. Beyond it, Kennington Oval, associated with cricket all the world over; and finally we arrived at Stockwell, the then terminus of the line, since extended to Clapham, where Tom Hood used to go to school at a house "with ugly windows ten in a row, its chimney in the rear," a style of architecture of which many specimens still exist round and about the Common.

At Stockwell we visited the generating station, recently much extended, and provided with entirely new plant, and, wondering at and admiring all we saw, learned from the chief engineer that the contretemps *en route* was due to a slight defect in the new and untried power-machinery; and thus at the point where the dip in the line was greatest, the cars stopped.

An excellent luncheon restored us all to eloquence and equanimity, extinguishing the cannibalistic feeling of half an hour ago, and, returning without any incident worth recording, we emerged once more in the City, to be greeted by the noise of the traffic that ever surges around King William the Fourth's statue.

Those were the "green salad" days of London's Pioneer Electric Railway Line. Now it runs without a hitch, and has been extended north as far as the historic "Angel," thus giving a direct route between Clapham and Islington. It has powers to exchange traffic with the Great Northern and the City Railway *viâ* Old Street, and also to connect itself with the Baker Street and Waterloo Electric Railway at the Elephant and Castle Station; and in a new building at Finsbury Pavement it now has commodious head offices.

At the last half-yearly general meeting the chairman, Mr. C. G. Mott, in the course of his speech, stated that the Board aspired to have a thoroughly first-class terminus in the City of London, and had deposited plans with this view. They proposed to construct this station between the present Bank Station and the King William Street statue.

That the City and South London Railway is most useful and popular is shown by the number of passengers it has carried—some ninety millions since its opening—the returns for last year showing about eighteen millions, over a total route of about seven miles. For the convenience of travellers, it eventually will have subways, connecting its Lombard Street Station with the Bank Station of the Central London Railway, and it already has them from its new London Bridge Station to the London, Brighton, and South Coast Railway. Finally, it can boast of possessing a station below a church—a unique position, I believe. St. Mary Woolnoth's foundations were completely removed, the vaults cleared out, and the whole replaced by huge iron girders, whereon the sacred edifice now rests, with the booking-office below.

THE WATERLOO AND CITY RAILWAY

The month of August, 1898, was unusually warm; and the heat was felt as much in the City as anywhere. Straw hats were universal; the shady side of the street, if there happened to be one, was thronged; secluded alleys and courts were resorted to by the knowing ones who could afford the time to linger there; and even highly respectable merchants were to be found sitting in shirt-sleeves at their writing-tables and wishing, with Sydney Smith, that they could "sit in their bones."

At the junction of the Poultry with Victoria Street, shadowed by the Mansion House, from each side of the road a mysterious hoarding had just been removed, revealing an iron railing enclosing a small area with a mysterious staircase bearing the announcement that it led to the subway to the new electric railway, connecting the City with Waterloo Station. Descending a few steps, and emerging into a tunnelled incline, the perspiring pedestrian quickly found that here, if anywhere, was a refuge from the heat, the coolest place in London, and that it was well worth while, on the pretence of urgent business across the water, to pay twopence each way, merely to drink in the refreshing air wafted backwards and forwards along subway, platform, and tube.

This was the Waterloo and City Railway, a short deep-level line on the tube principle, nearly $1\frac{3}{4}$ miles long, burrowing under the Thames' bed. At the terminus, by rather prolonged inclines and staircases, passengers could walk to the main or suburban platforms of Waterloo Station and catch the trains for Wimbledon, Hampton Court, Surbiton, etc.

Like the City and South London, this railway meets a great want. Before its opening, City men living down the London and South Western line had no alternative but to catch a South Eastern train from Cannon Street or Charing Cross; to take an omnibus *viâ* the Strand across to Waterloo Bridge; or to cab it by devious routes *viâ* Blackfriars Bridge Now they can reach Waterloo with ease, comfort, and economy.

Under agreement, the line is worked by the London and South Western Railway Company. The electrical equipment is by the famous firm of Siemens Brothers, the generating station being up a blind alley adjoining

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FIG. 4. WATERLOO AND CITY RAILWAY'S NEW PATTERN CAR

the dismal arched entrance to Waterloo from York Road. Each train seats 208 passengers; the average speed is 18 miles an hour, and its usefulness is proved by the fact that over two and a half million ordinary passengers were carried by it in one half-year, *i.e.* to December 31st, 1902 (not counting season-ticket holders), while the receipts for that period were £17,400.

During the busy hours of morning and evening the large trains are used and always fill up rapidly, but in the slack times of midday single motor-cars, each carrying 50 passengers, are sufficient to cope with the traffic. The cars are rather stuffy, and, like the train cars, are narrow and low. At each end is a small partitioned-off "cab," where sits a motor-man. No tickets are issued from the booking-office; but, as in an omnibus, the conductor comes round and collects the fares, giving a punched voucher in return, which is retained by the traveller.

THE LIVERPOOL OVERHEAD ELECTRIC RAILWAY

There are few overhead, or, rather, elevated, railways in the world. Somehow they do not seem to be popular, and the tendency, in England at least, is rather towards burrowing like the mole, than soaring above the street level.

In Germany there is a wonderful instance of electrically driven overhead line between Elberfeld and Barmen, on the mono-rail principle, the trains hanging from tracks suspended high above rivers and public roads. At the great Beckton gas works there has been in use since 1894 an iron-built miniature railway elevated on pillars, and it is a curious sight to witness busy little engines incessantly hauling coal trucks from the pier to the retort houses. An ingenious example of the elevated principle is to be seen at the Victoria Station, Manchester, where a railway on a very reduced scale conveys passengers' luggage from one platform to another, and idlers are never tired of watching it. The track, a double one, is suspended from the roof and runs between platforms five and six. The motive power is electricity, and the motor is placed between the wheels and the track, and it lifts and lowers a basket which holds about 15 cwt. of luggage.

A wonderful instance of a *very* elevated railway existed at Beachy Head while the new lighthouse was being built 600 feet distant from the base of the cliff, at that point 400 feet high. It conveyed material to the site, the descending load drawing up the ascending empty "skip" on the overhead suspension principle.

Our New York cousins have, in their elevated steam railway, long been familiarised with the system, but for Londoners it possesses the fatal objection that the occupants of the cars as they pass along can look into the front windows of the houses and spy upon the occupants. Running along docks, however, elevated railways are not objectionable; and the earliest example, in this or any other country, of electricity applied to overhead traction is at Liverpool.

Extending along the Mersey—that noble river whose tidal movement is said to be four times the outfall of the Mississippi—for a distance of 6½ miles are the Liverpool Docks, in importance undoubtedly the first in the world, but, until the Overhead Railway was opened, exasperatingly inaccessible to business men whose time was valuable, and bewildering to strangers by reason of their immensity.

Along the line of dock, it is true, ran broad-wheeled omnibuses built to run on the low-level dock railway, but so slow, in consequence of the pressure of traffic and the necessity for frequent shuntings for the passage of goods trains, that to reach the farthest dock usually occupied over an hour. To improve upon this it was proposed, as far back as 1852, to construct a high-level railway; but nothing practical came of it until 1888, when the Liverpool Overhead Railway Company took over the parliamentary powers obtained by the Dock Board, and setting steadily to work, created their line for passengers only, and, from the first, achieved a great success, the number of travellers amounting to many millions annually.

On the 4th of February, 1893, the railway was appropriately opened by the ex-Prime Minister, Lord Salisbury, whose devotion to the science of electricity is well known. Pressing a button at the base of a silver inkstand (subsequently presented to the Marquis as a memento), the engines that generated the electric current were set in motion, and by special train his lordship was conveyed over the seven miles of line, and afterwards entertained at a banquet by the Mayor, when, in an excellent speech, he dilated upon the prospect of electricity becoming the motive power of the age.

In the following month the railway was opened for public traffic, and, with its thirteen stations, its five minutes' service, and its cheap fares, practically extinguished the omnibuses, light or heavy.

From the Overhead Railway a splendid view is obtained of the busiest locality perhaps in the empire. Below are the railway trucks packed close with imported merchandise of all kinds: cotton from America and the East; grain from the ends of the earth; beef, bacon, cheese, butter, flour, and fruit from the New World; wool and tallow from Australia and Argentina. Waggons

By permission of the *Liverpool Overhead Electric Railway Co.*

FIG. 5. THE LIVERPOOL OVERHEAD ELECTRIC RAILWAY

and carts filled with Manchester goods, hardware, machinery, chemicals, and every imaginable kind of manufactured goods are alongside the big liners that come into port, discharge their cargoes, load up, and are out in the Mersey and off to sea again in a few days. Truly Liverpool is a wonderful place, and although her greatness as a seaport has been threatened by the opening of the Ship Canal to Manchester, it will be a long day before she surrenders her claim to be the chief marine approach to Great Britain.

CHAPTER IV

REMARKABLE ELECTRIC RAILWAYS

"Behold they shall come with speed swiftly."—ISAIAH v. 26.

MONO-RAILWAYS

A ONE-RAIL railway! What kind of novelty can that be, emanating no doubt from the prolific brain of some enthusiastic engineer possessed with an idea, a fad, a craze—call it what you will! We are accustomed to highly respectable trains running in an orthodox manner on double rails. A projected, many-railed track we have also heard of to carry ships bodily across the Isthmus of Panama. But the idea of a single-rail "Flying Dutchman" or "Wild Irishman" seems chimerical.

It is not so, however, and the system has been solemnly and deliberately sanctioned by Act of Parliament.

Nowadays one need not be astonished at anything. Take cycling, for instance. Long ago, when velocipedes—three or four-wheeled, uncanny machines—were mere toys wherewith youths loved to dislocate their joints on the lower terraces of the Crystal Palace, no one dreamt that bicycles, outraging all the laws of gravitation and practically mono-wheeled, would ere long be used on road and field and moor, on mountain-side, on steppe and desert, over barren Asiatic tundras and snow-clad

Yukon plains—in short, wherever adventurous mankind has penetrated.

The mono-rail train, like a bicycle, runs on one linear track, but, unlike that hopelessly collapsible machine, requires no balancing, and cannot capsize, and under proper conditions is the safest known method of travelling at very great speed.

"*Faire prose sans le savoir*" is a familiar aphorism of Molière, but perhaps it would astonish most of us to be calmly told by modern engineers that all our lives we have, *without knowing it*, been travelling on mono-railways! They assert that although it is true that the ordinary engine with its coaches rests on a *pair* of rails, the fact that the space between the rails is cut away is immaterial, as it is rendered a single track by the rigidity of the carriage axles, and if these were loose, of course the train would overturn.

Nature has no example of mono-railwayism (to coin an expression), unless it be the gossamer or shooting spider, that upon a single invisible thread spun from its body ascends to aerial heights on a kind of self-manufactured mono-rail, Dame Nature being too lavish and too wise, in the perfect freedom she accords to birds, beasts, fishes, and insects, to restrict their movements to one undeviating path.

In the moral world there have always been mono-railists, men of one fixed idea, from which they could not, or would not, budge—apostles of an ambition, a creed, a theory, a political conviction. The world has had its Alexander the Great, its Napoleon, Buddha, St. Paul, Mahomet, Martin Luther, Ignatius Loyola, Wycliffe, its Palissy, George Stephenson, Mungo Park, John Bright, and Cobden.

It has been left to the inventive mechanical genius of the nineteenth century to develop the mono-rail system. Doubtless those inscrutable people, the Chinese, knew of it, and applied it in some way long ago; and perhaps the yet more mysterious dwellers in ancient Egypt—whence all wisdom seems to have descended—utilised it after some unknown fashion.

Blondin, in his marvellous feat of trundling a wheelbarrow containing a man along the high-level rope, used a hempen mono-rail; and the wire cables stretching across the Thames at the reconstructed bridges at Kew and Vauxhall, acting as travelling ways to convey the excavated soil from the coffer-dams in large iron "skips" or buckets, were another species of mono-rail; while at home in brickfields, and in mines, and on plantations in distant lands, miniature railways have been used for years to carry clay, ore, and produce, over plain and hill and dale.

In India a peculiar kind of tramway truck has been in use for some time, with two or three flanged wheels which run on a single rail, and a large balance-wheel on one side of the truck to prevent it toppling over. Produce of all kinds can easily be drawn upon it by a couple of coolies, and its efficiency on country roads has been highly spoken of.

Germany presents us with a recent and curious example of the application of the principle to locomotion. In the Wupper Valley near Dusseldorf and Cologne there are two towns, Barmen and Elberfeld, about eight miles apart, mutually engaged in chemical and textile industries, and this separation of the sister-towns was an obvious disadvantage to both. But now they are joined by a wonderful railway, constructed on an elevated line running six miles of its course above the River Wupper, a tributary of the Rhine, some sixty to a hundred feet wide. The carriages are suspended, and work upon a single rail, a development of the travelling cable-way system. This rail is rigidly fastened to an iron framework of girders, and supports the cars hanging therefrom by means of two steel "bogies" with two wheels. Thus they can pass round sharp curves without slackening speed and with the greatest safety, its motive power, electricity, being applied by two motors on each carriage which drive both wheels with equal force at a speed fixed at thirty-one miles an hour, and attainable fifteen seconds after starting.

As elevated railways of this type are somewhat costly, and a simpler and cheaper form would be a desideratum, a short line across country was built as an experiment at Cologne-Deutz. The stays, measuring from 9·6 feet to 28·5 feet, were made either of wood, or of iron tubes, and met at the top in a cap, from which was jointed the sheet-iron supports that carried the mono-rail. By means of this jointed connection, the strain was always of a central character, and, therefore, more easily borne. At intervals of about 660 feet a couple of stays were firmly braced together, in order to give stability to the overhead structure and to take up the longitudinal thrust. In consequence, even with light locomotives, the traction power was very high, and on the line at Deutz it was found that a locomotive drawing two carriages full of passengers could ascend a gradient of 1 in 6 with perfect safety.

But a means of adapting a mono-rail to every condition had some time before been thought out. In 1883–4 Charles Lartigue, the eminent French engineer, developing the principle conceived by the great Telford, constructed some small lines in Tunis and Algeria for carrying esparto grass. The cars were drawn by animals in a special form of mono-rail, the model upon which Mr. F. B. Behr, ASS. INST. C.E. — who modestly disclaims all originality in the matter — has worked for years, greatly improving in practical details the original design, and constructing for the first time mono-rail trains that have been successful in the carriage of both goods and passengers by steam and electricity.

The Lartigue single-rail system, as perfected by Mr. Behr, is as follows, but of necessity my description is a mere outline.

Dismissing all preconceived ideas of rails laid down upon the ground, we must imagine a heavy double-headed steel rail firmly bolted on to the summit of a girder supported by trestles, the whole rigidly framed upon massive sleepers. We thus have a permanent way somewhat resembling a continuous A-shaped metal viaduct, raised about five feet from the surface, or a succession of iron barriers—such as road-menders make use of to divert the traffic—set ends on, secured

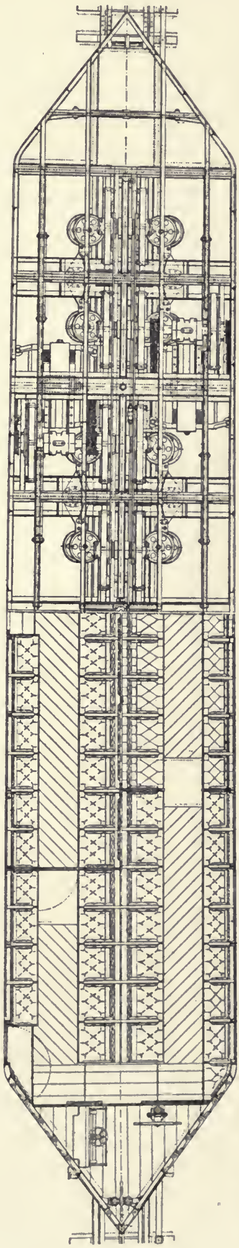


FIG. 6. PLAN OF A BEHR MONO-RAILWAY CAR

By permission of Mr. F. B. Behr, Ass. Inst. C.E.

to each other and to the ground. Now take an ordinary railway car with seats arranged as in an omnibus, but with two additional rows back to back in the centre. Remove the axles and wheels, extending the sides and ends of the car almost down to the ground level, thus providing beneath the flooring an enclosure with ample room for the locomotive machinery. All along the bottom of this enclosure is an opening or space, about five feet high—extending between the middle rows of seats—that fits the A-shaped viaduct, so that the car is suspended, or, as it were, sits upon the mono-rail, whereon roll six vertical grooved wheels that, when set in motion by the electric current, propel the cars. Thus we have a train apparently without wheels, these together with the apparatus being completely hidden away between and beneath the passengers' seats. On each side of the A-shaped trestle are fixed two guide-rails fitting close into horizontal grooved wheels effectually checking all oscillation. In front is the bogie locomotive motor with a pointed bow, the stern of the car also being pointed, so that the entire arrangement resembles when seen from above a great stickless rocket with a sharp and flexible snout.

As the sister isle was the first to adopt electricity to a railway (*vide* Chapter II.), so was she the pioneer of mono-railism. In County Kerry, Munster, near the Shannon's mouth, stands the little town of Listowel, and 9½ miles distant is Ballybunion. To connect these a mono-railway for passenger and goods traffic was opened on March 1st, 1888, and has worked ever since without any difficulty. The trains are drawn by a steam locomotive divided in two, one on each side of the mono-rail—a kind of twin-screw arrangement—and with their smoke-stacks and giant lantern between them, present a strange and rather comical appearance, while the track meandering at its own sweet will across country without fencing of any kind, adds to the novelty of the little line.

Its great safety has been amply demonstrated by the only mishap that has occurred to it. Some miscreant had deliberately removed the fastenings from over thirty yards of the line at a critical point where a reverse curve began, and close to a bridge. At full speed, a train carrying 200 passengers came up to the loosened rail, which gave way, breaking the coupling chains and, luckily, bringing into action the automatic Westinghouse brake. The permanent way was ruined by the shock, but the fall absorbed the force of the reaction, and deposited the carriages quietly on the ground without injury to anyone, and without even breaking a window. On an ordinary line the train would have been thrown off the metals into the river with terrible consequences. Shortly after the line was opened, the Lartigue system was adopted in France, from Tours to Pannissieres in the Loire Department.

The Ballybunion and Listowel Railway is the indirect father of a modified form of mono-rail which is expected to appear this year at the Crystal Palace. It is called the Electric Mid-Railway, the invention of Mr. W. R. Smith, and as the line is to connect the existing railway station with various points in the grounds, it should be well patronised at the modest penny fare which is to be charged. Being an entire novelty, it has a specially good chance of success in this particular situation. The single rail is placed below the carriage, the weight of which is balanced upon it after the fashion of a bicycle. On each side of this single track runs a trestle carrying a rail on a level with the centre of gravity of each carriage. This rail serves the necessary purpose of supporting the carriage and of also preventing derailing.

A similar device had been suggested—and possibly has been carried into effect on the New York and Washington D. C. Line—when it was proposed to elevate a track above the earth on a single line of upright beams, the trains to be kept steady by an auxiliary rail on either side, but which would only come into play on rounding curves.

HIGH-SPEED ELECTRIC RAILWAYS

In Belgium, Mr. Behr, who throughout his labours there received the personal encouragement and patronage of King Leopold II., successfully built an experimental high-speed mono-rail line at Tervueren in the neighbourhood of Brussels, as an annexe to the Exhibition of 1897. To find suitable ground was the great difficulty. The line had to cross ten public roads, and in the absence of compulsory powers, leases for the land had to be arranged with grasping occupiers and owners. The soil was bad, big cuttings and embankment were unavoidable, and finally the line consisted of nothing but steep, up-and-down gradients. In fact, all the conditions were most unfavourable, notwithstanding which, the result of the experiment was conclusive in showing that with the mono-rail and perfected electrical traction, very high speed, double that of existing passenger express trains, could be attained with absolute safety, a principle which Mr. Behr had for a long time past been particularly impressed with, but which he maintains is not possible on the ordinary two-rail track, even with electricity as a motive power.

In November, 1901, Mr. Behr went to Berlin, and investigated the experiments carried out during forty days by a number of engineering experts on a military track laid down between the German capital and Zossen. It was hoped that a speed of 160 miles an hour would be attained and maintained, and, as a matter of fact, starting from a low speed, the train gradually reached that of 87 miles; then, for a moment only, 95 miles; and for an instant of time, 100 miles per hour; but it was at once discernible that the ordinary two-rail permanent way, though straight, could not bear the terrific strain imposed upon it; the rails bent at many places, while the hundred-miles-an-hour rate had so destructive an effect as to render impracticable any attempt to create a higher record. The air resistance was found to be considerable. With a square-fronted instead of a pointed coach, it was appreciable, and the suction behind the train resembled the pressure of the water at the stern of a mail steamer, and was calculated to equal two-thirds of the "bow" resistance. These experiments went to prove that for excessive velocity an ordinary railway was absolutely unsafe.

A year before this, a steam locomotive train had been tried in America by the Baltimore and Ohio Railway Company, on the Adams principle of reducing the atmospheric resistance to a minimum. It consisted of six cars, a tender, and an engine of fifty-seven tons. The entire train was sheathed down to within eight inches of the track. There were no projections, and all the windows were flush; the cars were coupled close together, and the rear one was run off to a point, the train resembling one long sinuous and flexible carriage.

With this comparatively light engine it is said that the forty miles between Baltimore and Washington were covered in thirty-seven and a half minutes. But it was claimed that with a more powerful locomotive the train could have been easily run at the rate of one mile in thirty-five seconds, or nearly two miles a minute.

These speeds appear tremendous, but custom would soon reconcile us to them. Our forefathers thought fifteen miles an hour terrific; and one of the objections to Stephenson's ideas was, that at such a speed, not to mention a twenty- or twenty-five-mile rate, no human being could draw breath.

Since then we have quietly acquiesced in and equally welcomed a style of travelling varying from 35 to an average of 58 miles an hour, and even consider it no great feat to run a special viceregal train from Euston to Holyhead—263½ miles—in five hours without stopping, and are not astonished to read of last year's record run of the mail express from Boulogne to Paris—168 miles—at an average speed of 68 miles an hour!

Still, 120 miles every sixty minutes without stopping is a large order, and in practice would give some remarkable results. For instance, a resident at Putney could be whisked from the station nearest to him, and thence to a point adjoining his office—say in Seething Lane, some seven miles off—in less than five minutes. Brighton could be reached from town in twenty-five minutes; Dover, in forty; Edinburgh, in three hours twenty minutes. Inverness—663 miles away—could be arrived at from Euston in six hours twenty minutes, instead of the fifteen hours thirty-five minutes of the ordinary express; and Paris—allowing one hour thirty minutes for the Channel passage—in three hours forty-two minutes.

THE MANCHESTER AND LIVERPOOL ELECTRIC EXPRESS RAILWAY

Now, the contention of the advocates of the monorail principle is, that only by that system can very high speed be safely attained; and when one comes to closely examine the cars in which this hundred-and-ten-miles-per-hour travelling is achieved, confidence is at once inspired, because of their low centre of gravity and consequent unlikeliness of derailment.

There remains only one question—*Cui bono?* What useful purpose can be served by being able to get from Liverpool to Manchester in twenty minutes instead of over an hour? On an emergency, such as a sudden necessity for the services of a medical specialist, a matter of life or death perhaps, or on the occasion of any crisis in domestic or mercantile life when the instant presence of some one distant individual is imperative, it might be of immense service. But in the usual course of business, do not existing railways bring merchant and broker, importer and manufacturer, face to face quickly enough, and are not telephones and telegraphs and the post sufficient to carry through big transactions between the centre of the cotton trade and the great city on the banks of the Mersey? Public opinion, which demands increasing speed in every phase of life, especially in travelling, declares they are not sufficient; for we live in an impatient age when every hour of detention on a transatlantic passage is begrudged.

Therefore it is not to be wondered at that in 1900–1, after the most exhaustive inquiries and criticisms, the royal assent was given August 17th, 1901, to the Manchester and Liverpool Electric Express Railway, which was duly authorised by Act of Parliament. It must be premised that the line, like our London Tube, does not provide for goods traffic; that the time occupied by the journey being so short, neither luggage-van, lavatory, or refreshment buffet is required, and that all trains consist of a single car, couplings being a source of danger at so great a rate of speed. But as the trains run every ten minutes, and carry about forty persons each time, a large passenger traffic is provided for.

Well—a broker has been telephoned for by his client, a wealthy cotton-spinner in Manchester, anxious to consult with him personally; so he at once leaves the flags of the Exchange, and after an eight minutes' walk arrives at the Express Railway Station, near the entrance gate of the Blue Coat Hospital in School Lane. He considers that in getting into and out of the lift he has lost two minutes, but he just catches his car and starts for a run of 34½ miles to Manchester, and since it is his first experience of lightning travelling, he notices everything connected with the new line. There are many curves, he finds, all necessary in order to avoid conflict with the vested interests of other railway companies; the gradients, he observes, at points about three-quarters of a mile from the Liverpool and Manchester stations, are steep—1 in 25, and 1 in 30—but of service in accelerating and breaking the trains.

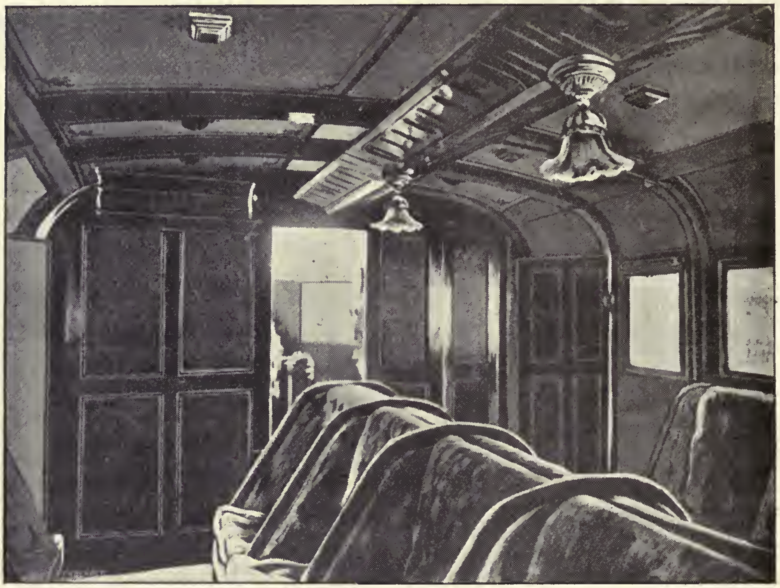
Unlike the Listowel mono-rail line, the Manchester and Liverpool express is fenced from end to end with an unclimbable barrier, and as there are no level-crossings and no means of access, there is no possibility of trespassing. Also, for the security of the workmen employed in maintaining the track as on an ordinary railway—the system of "packing" the sleepers and inspecting the various parts being common to all railways—a clear space of three feet is left between the passing trains, and strong posts, ten feet apart, are fixed along the centre of the space for the labourers to hold on by when an express rushes by. Collisions, our broker quickly perceives, are impossible, there being no switches, and notwithstanding the multitude of passengers (some twenty thousand per day) there are never more than two cars on the line at a time, and there are no stoppages between the two termini.

For signalling purposes, the line is divided into four sections of about five miles each, and as the train passes by, its electric motor automatically operates the signal and immediately "blocks" the section behind it, so that the train following cannot advance until its leader has cleared the five-mile division.

The driver and conductor are both together in the front part of the train, so that the conductor has ample time to look out for the signals, to apply the brakes, and assist his mate. The brakes are of the Westinghouse pattern, and the two combined can stop the cars in about 800 yards, even at the speed of 110 miles an hour. These can be aided by Mr. Behr's ingenious device, which Sir William H. Preece considers quite practicable, viz. louvres or shutters, which, when opened, materially increase the air resistance.

Past Toxteth Park, Garston, Halewood, Widnes (whose only rival in sheer ugliness is perhaps London's Stratford-by-Bow), and exactly half-way, Warrington, conspicuous for the inkiness of its river Mersey, and noted for its glass, wire, and chemical industries; famed for its network of waterways, especially for the great but evil-smelling ship-canal; noted in history—when but a hamlet, with a clear trout-yielding stream—as the camping-ground of the young Pretender when on his march to Derby in 1745; and associated with Mrs. Gaskell (whose "Cranford" is identified with Knutsford, a neighbouring village), the two Bishops Claughton, Viscount Cross, Luke Fildes, R.A., and "Warrington" Wood, the sculptor.

Close by, in the parish of Great Sankey, is the power-generating station of the railway, the current obtained being 15,000 volts on the triphase alternating system, converted in five sub-stations placed along the line, into a continuous 650 volt current. Every car has four traction motors arranged in pairs, each with a full-speed capacity of 160 h.p., equal to 110 miles an hour. The



By permission of *Mr. F. B. Behr, Ass. Inst. C. E.*

FIG. 7. INTERIOR OF A BEHR MONO-RAILWAY CAR

cars are comfortably upholstered; the seats are separated and placed back to back in the middle, those along the sides facing inwards, as in the Twopenny Tube. The lighting is, of course, excellent, and the ventilation perfect, though to prevent accident the windows are fixed, and the doors, while the train is in motion, are automatically locked.

As regards the cost of this novel undertaking, our

Liverpool friend had beforehand ascertained that the capital had been fixed at £2,800,000, and that an average of eight persons per train would more than cover the expense of the enterprise.

Swiftly leaving Warrington in the distance, the express shoots onwards—past Eccles, Pendleton, and Salford—and reaches the terminus at the west side of Deansgate, in the busiest part of Cottonopolis, where, again using the lift, our honest broker speeds to the Exchange in another eight minutes, and in forty-five minutes after leaving Liverpool is in deep business conference with his principal at Manchester.

Contrast this with the existing facilities of the old system for rapid transit between the two places; and those who know their Manchester and Liverpool well, will at once be able to decide whether or not the electric express better meets the requirements of those to whom every minute is of consequence.

The London and North Western Railway (which has a perfectly straight bit of track to Manchester, unequalled, except on the Great Eastern between Littleford and Lynn—21 miles—and on the South Eastern between Nutfield and Ashford—32 miles) runs expresses without stopping from Lime Street and Edge Hill to the Exchange Station, Manchester, doing the journey in forty minutes.

The Great Central Railway, by an indirect route, *viâ* Garston and Widnes, runs expresses from their Liverpool station (St. James's) direct to the Manchester Central, in from forty to forty-five minutes; but on neither line is there such a thing as a ten minutes' service, the intervals between the direct expresses ranging from forty-five minutes to so much as four hours.

Plans, it is said, have been submitted to the Board of

Trade for a mono-railway between Edinburgh and Glasgow. The proposed construction is similar to that of the Behr mono-railway between Liverpool and Manchester. It is quite unlike the canny Scot to rush into sensational experiments for a speed of 117 miles per hour, especially as a few years' waiting for the completion of the Liverpool line would prove or disprove the possibility of the scheme.

CHAPTER V

REJUVENATING THE METROPOLITAN INNER CIRCLE

"So that thy youth is renewed like the eagle's."—Ps. ciii. 5.

CONSTRUCTION OF THE METROPOLITAN AND METROPOLITAN DISTRICT RAILWAYS

CAN anything be satisfactorily rejuvenated? Is there any truth in the Medean story that old age can revert to the vigour of young manhood?

In 1903 the usual reply is "No." If a theatre becomes dilapidated, it is pulled down. If a railway-station gets much out of repair, the company proceeds to reconstruct, and not to patch up. If a macadamised thoroughfare gives signs of too much wear and tear, it is broken up and relaid with wood blocks.

In fact, rejuvenation on a large scale is so seldom attempted that the scheme for renovating and electrifying the Inner Circle Railway may be regarded as something remarkable.

For convenience we will call it the Inner Circle, but, as we all know, it is a dual concern controlled by the Metropolitan and the Metropolitan District, both of them old enough to have a respectable history.

Fifty years ago railways within the boundaries of Inner London were non-existent, the nearest points approached by the country lines being at Battersea, Euston, St. Pancras, Shoreditch, Paddington, London Bridge, and Waterloo—miles away from the central districts.

It was an ideal time for omnibus companies, who charged pretty well what they liked: and for cabmen, whose fare was nominally restricted to eightpence a mile, but who were masters of the situation when passengers with luggage had to be conveyed from the termini. Yet, although many suggestions were made, including that of a great central station where all the lines might converge, the travelling world was considerably startled in 1854 by a proposition laid before Parliament to construct an underground line from Farringdon Street to Bishop's Road, Paddington; and so astonished were capitalists that although the bill passed, the money was so slow in coming in that work could not be begun until six years later!

In planning the route a golden opportunity was lost of anticipating the Twopenny Tube; but the opposition of Oxford Street was so fierce that the line had to be poked away beneath the Marylebone Road in the north-west of London, convenient for residents in Paddington and Bayswater, but useless to other districts, and, what was more important, it did not go to the Bank, the centre of the business world.

However, we, then as now, were but a slow people, therefore really comprehensive schemes found little favour in the "fifties" and "sixties." For three years the Marylebone and Euston roads were closed to traffic, and presented the appearance of a besieged city's outskirts where deep trenches and fortifications were being made. The roadway was removed to a great depth; pipes and sewers were taken away and replaced; foundations were underpinned, and a series of solid brick tunnels were slowly and laboriously constructed and covered up. The plank pathways, the noise, and the smells, drove householders along the route to desperation; and, on nearing the City, the problem of dealing with the old Fleet Ditch was at one period thought insoluble. No wonder that, what with compensation to owners of damaged property, the acquisition of necessary land, and engineering difficulties, the cost of the line at some points mounted up to a million sterling per mile!

At last the first section was completed; and in September, 1862, a trial trip was made. A contemporary picture represents the train passing Portland Road Station, its open trucks in the rear full of enthusiastic guests waving flags and tall hats—after luncheon probably—evidently delighted with the success of the undertaking. But at the formal opening, January 9th, 1863, a grand banquet was given in the Farringdon Street Station, three long tables occupying the rail and platform space, with a [shaped table on a daïs for the principal guests.

The following day thirty thousand passengers journeyed over the line, and everybody in London talked about the Underground as somewhat of a marvel. But people exhibited strange ignorance on the subject, nervous people preparing for wonderful possibilities, imagining that the cellars would collapse as the trains thundered by, or that the houses would tumble through on to the line, flinging their occupants before some passing engine!

Yet, after all, the Underground was only an ordinary tunnel (such as pierce a score of hills), placed in an exceptional position in the midst of London.

Bit by bit, as years went by, the Metropolitan Railway extended itself eastward and westward to High Street, Kensington, whence the District Railway that had sprung into existence went ahead and got as far as Westminster, its line being partly open and partly tunnelled. There the District stuck for three years, and then found its way into the City (a great boon as an alternative route).

At the Mansion House Station it seemed determined to rest for a long period; the Metropolitan showing the same propensity at the Moorgate Street sheds, until City men began to give up all hope of the two ends ever meeting.

It came about at last, however, and the year 1884 witnessed the completion of the irregular Inner Circle—a total length of about 12½ miles—by way of Bishopsgate, Aldgate, Mark Lane, the Monument, and Cannon Street, without any serious disturbance of the traffic, but with much wonderful underpinning of warehouses and offices (a notable instance of this operation being beneath King William the Fourth's statue, which weighs over 250 tons!).

At first there were no smoking-carriages, but the numerous complaints on the subject induced the directors to alter their rules, and they went to the other extreme, so that now non-smokers think there seem to be more smoking-carriages than any others.

In its young days the Metropolitan was clean and its atmosphere tolerable. In fact, it had been proposed to use smokeless engines, but for some reason the idea was abandoned, and, as the main railway lines began to send out feelers towards the inner districts of London, they sought for, and obtained, running powers over the Underground, junctions being made with the Great Northern Railway and Great Western, the London and North Western, and the Midland. Consequently, the number of trains immensely increased, and the smoke nuisance was intensified. Ventilating shafts were adopted, and afforded some relief, but the imprisoned fog of winter precipitated the "blacks," and summer weather only made the atmosphere still more stifling; while Baker Street, Gower Street, and King's Cross stations and tunnels were positive infernos, and for how many deaths from asthma and bronchitis they were responsible no one knows!

The rolling-stock of the Metropolitan became dirtier and dirtier, grime and disfigurement settled down upon it, and everybody's experience of it resembled that of Mrs. Lilian Rosamond, described in Chapter VIII.

THE NEW DISTRICT RAILWAY

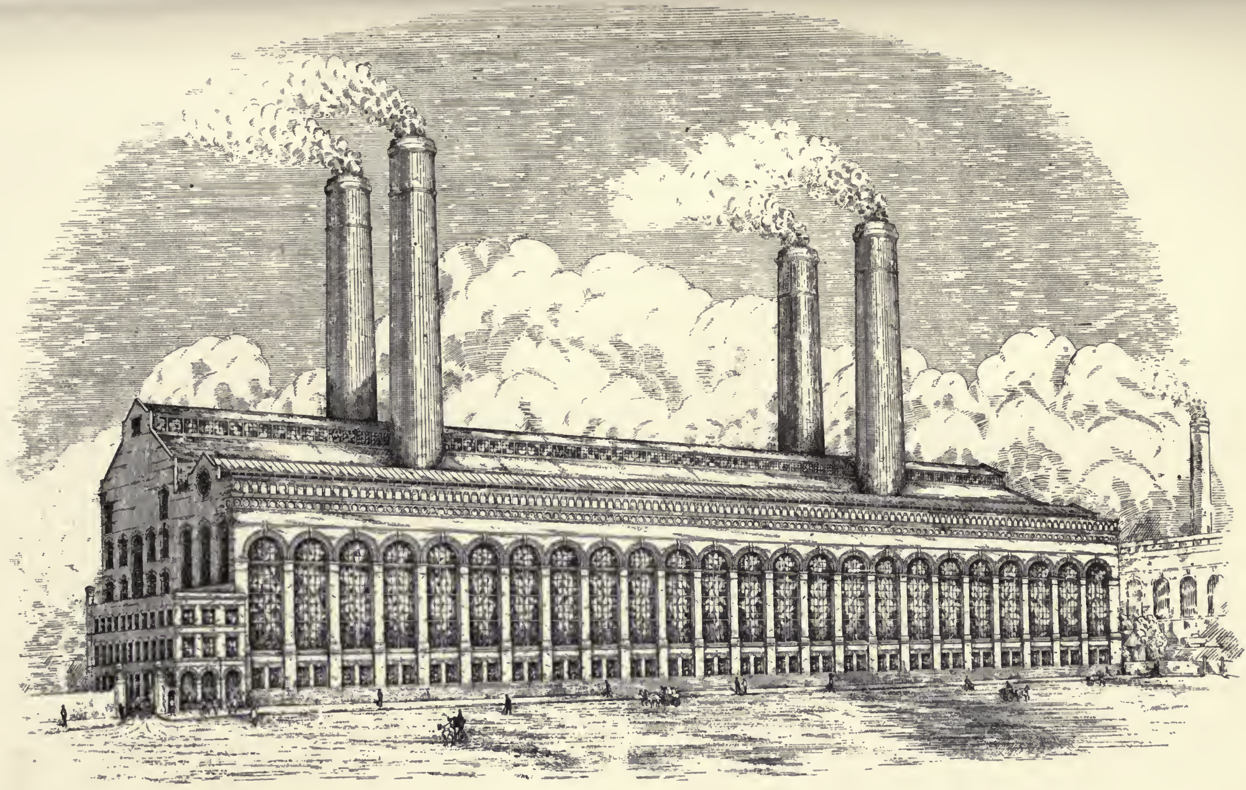
Just opposite St. Mark's College, Chelsea, is a narrow thoroughfare called Lot's Road, leading to a creek that separates the Borough from Fulham. Tradition says that the locality was formerly known as "The Lots" (about four acres in extent), and was granted to a Sir Arthur Gorges by the lord of the manor, in lieu of certain rights over land which he gave up for the formation of the Kensington Canal; but incredulous old folk dismissed this tradition with contempt, and maintained that there was a Chelsea personage named Lot, very distantly related to the patriarch's nephew, who pitched his tent in the fertile Jordan Valley, and that the dismal Chelsea wastes so much resembled the desolateness of the fatal plains, that diligent search therein might even result in the discovery of the Pillar of Salt, brought over to this country at some remote period by a pious descendant! But whoever, or whatever, the name Lot may represent, it is now associated with one of the greatest electrical undertakings of the age—the huge generating station of the Underground Electric Railway Company of London, Limited, who, as at present arranged, will supply the District and other railways with power.

At the bottom of Lot's Road, and at a point on the Middlesex bank of Battersea Reach, facing the ugly parish church of St. Mary, is the mouth of Chelsea Creek, filled twice a day by the muddy waters of the Thames, and here the Electrical Works are being erected. They are in sight of an obscure cottage in Cheyne Walk where the painter Turner lived in concealment, and where he died. The building, with its four great chimney-shafts, is unæsthetic to a degree, and Turner would probably have thought it ruined his favourite landscape. But it represents something more valuable than æsthetic effect.

When Matthew Doulton, in the infancy of steam, took the Russian Prince Potemkin round the works at Soho, Manchester, the distinguished visitor inquired, "What do you sell here?" "We make and sell here," replied James Watts' partner, "that which all the world wants—*Power*." And this, on a scale undreamt of by the famous engineer, is what the Underground Electric Railway Company of London will produce, in view of the river scenery so much admired by the chief of impressionists, and which he never wearied of depicting.

This temple of electric force will be the largest in the Old World. In New York, the Manhattan and the Metropolitan companies both have power stations slightly smaller. The Rapid Transit Commission have projected one that will be bigger, while the Waterside station of the Edison Illuminating Company (partially completed) is on a still larger scale. It has, however, been stated that the biggest power scheme on earth will be at Massena, on the St. Lawrence River, Canada, where there will be fifteen Westinghouse machines, equal to a total of 75,000 kilowatts.

Within the temple there will be turbo-generators fifty feet in length and ten feet high, constructed by the British Westinghouse Company at their Trafford Park



By permission of the *Underground Electric Railways Co. of London, Ltd.*

FIG. 8. ELECTRICAL POWER HOUSE (THE LARGEST IN THE OLD WORLD) LOT'S ROAD, CHELSEA, TO SUPPLY THE METROPOLITAN DISTRICT AND OTHER RAILWAYS WITH CURRENT

Works, Manchester, capable of producing the prodigious quantity of 60,000 electrical kilowatts, at a pressure, or force, technically speaking, of 11,000 volts. In other words, about 100,000 horse-power could be sent out, theoretically equal to the lifting of over 1,000,000 tons a foot high every minute.[1] Six such power stations could, therefore, move the great pyramid of Cheops (over 6,000,000 tons weight), and carry it bodily off on colossal rails, and dump it down anywhere to order.

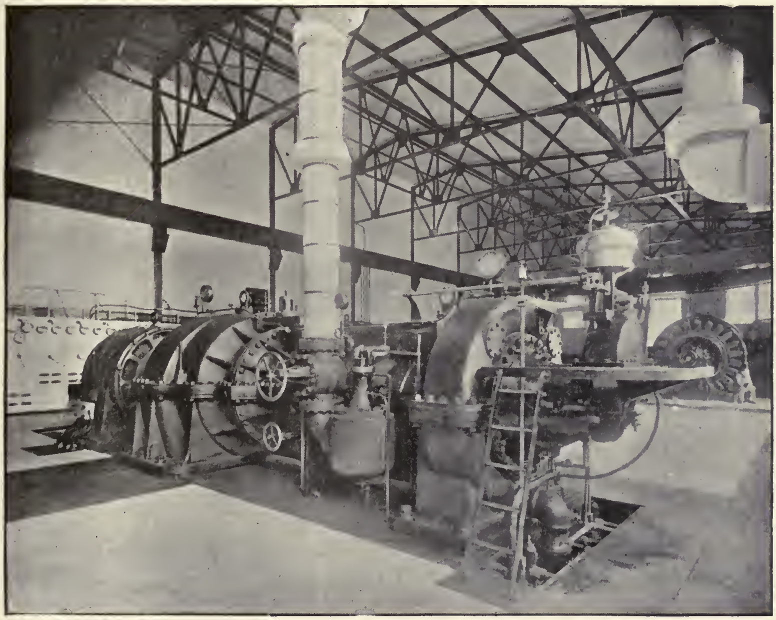
For condensing purposes, an enormous quantity of water will be required, and every twenty-four hours 19,000,000 gallons of water (at times mounting up to 40,000,000 gallons) will be drawn from the creek for use in the power house.

The force of 11,000 volts will be much too powerful for direct application to the purposes of locomotion. It requires reducing by transformers and rotary converters into the safe and ordinary current of about 550 volts, which will be effected at sub-stations—Earl's Court, South Kensington, Victoria, Charing Cross, Mansion House, and other places along the line. To these the current will be sent from the power house, and reduced by the transformers into ordinary low-pressure voltage, and the fiery O.P. spirit tamed to a pleasant and portable "under-proof" standard! The current will then be distributed to two conductor-rails, one located between the present running rails, and the other outside them. The motors on the trains will receive the current from one rail by means of a sliding contact-shoe, and return it to the other rail in the same manner. In passing through the motor the electricity causes the armature to revolve, which motion, by means of gearing, is communicated to the carriage axle.

[1] See Chapter I.

So much for the driving-power of the trains. But what kind of trains do the public expect?

Surely not the old carriages cleaned up and re-upholstered—made "to last a little longer," until broken up for firewood and old iron. The public will not be



By permission of the *Westinghouse Companies, Ltd., London*

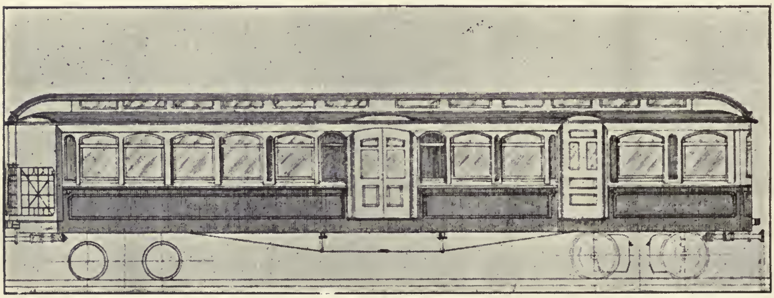
FIG. 9. A 2,000 H.P. WESTINGHOUSE STEAM TURBINE, RESEMBLING THE TURBO-GENERATORS (EACH OF 7,500 H.P.) IN THE CHELSEA POWER HOUSE.

disappointed in the new cars, nothing as yet having been seen in London to equal them.

The trains will be run on the principle of the multiple unit. That is, each will be made up of seven coaches—three long motor-cars and four trail-cars—with a motor-man's cab at each end, and one in the centre. These eight-wheeled coaches will be rectangular at the sides—not sloping like those of the Waterloo

Tube Company—and very roomy, 52 feet long and about 8 feet 2 inches wide inside, and about 8 feet 7 inches from the floor to the middle of the roof.

The arrangement of the seats will be somewhat different from that of the Tube. There will, of course, be corridor cars, which will be entered from the platforms, through telescopic doors; there will be also sliding doors. The gain in leg-space will be great, the centre gangway giving a clear 4 feet, and there will be fewer cross seats. Each train will hold about 338



By permission of the *Underground Electric Railways Co. of London, Ltd.*

FIG. 10. A NEW METROPOLITAN DISTRICT RAILWAY CAR

passengers; the ventilation of the cars will be perfect; and the height sufficient for a giant. As the District tunnels are 25 feet in diameter, and 15 feet 9 inches from the rail level to the crown of the arch, there will be about 2 feet of head-room, about 2 feet 6 inches between each train, and the same between the trains and the sides of the tunnels.

Compare this with the present Inner Circle trains that carry about three hundred passengers, with gangways that, even in the first-class compartments, leave no room for incomers to avoid a leg entanglement, and whose height will hardly admit a tall man in a tall hat to stand upright. Also compare it with the dimensions of the Central's cars, which are 39 feet long, 8 feet wide, and whose height to the middle of roof is only 7 feet 5 inches, the gangway narrow, with seats in each car for forty-eight people. The space in the cars of the City and South London, and the Waterloo and City, is still more exiguous.

It is proposed to run about twice as many trains as at present, each journey to be made in about two-thirds of the time now required; that is to say, the trains that now run about ten miles an hour will, it is anticipated, work up to at least fifteen miles; the total carrying capacity being estimated at 70,000,000 per annum, increasable, if necessary, to 100,000,000. There may be an all-night service, for the convenience of people engaged at Covent Garden market, and for journalists and others whose work lies in the vicinity of Fleet Street. A somewhat novel and economical feature will be that the trains, during the stock hours of the day, can be run in short lengths, as in the City and Waterloo Railway, and, with their triple motors divided, will resemble those strange Naidæ worms of the Annelida class that possess the power of increasing by mechanical division. They will also be able to go forward and backward without reversing the motor engines.

Brilliant will be the lighting of the cars and stations; the tunnels, too, are to be illuminated. Fresh air will be obtained by the frequent movements of the trains through the tunnels, while smoke and smuts will, of course, become things of the past. The stations, with their wide and roomy platforms, will in some cases be lengthened by fifty feet to accommodate the three-hundred-and-fifty-feet-long trains, and be thoroughly cleansed and repainted, and the tunnels may possibly be whitened by means of "spraying"—the principle adopted at the Chicago Exhibition for the finials of the pavilions.

The question of classes, fares, and tickets has not yet been settled, but we may assume that the system adopted will be somewhat like that of the Tube. The entire project closely resembles the Metropolitan Underground Railway of Paris, and the Boston Subway. Lifts are not at present contemplated, and probably their absence will be no great loss to active travellers, nor even to the "old, subdued, and slow," for trains will so quickly succeed one another that the missing of one will involve no serious delay. Possibly, however, as time goes on, some new and convenient form of sloping footway may be adopted.

But alas! for the lovers of the beautiful, the directors, we are told, "have not decided that they will be warranted in sacrificing, on æsthetic grounds, the revenue derived from advertisements."

Then, again, as there will be little or no waiting, even the most impatient of *voyageurs* will hardly need the diversion obtained by a trial of the omnipresent penny-in-the-slot machines, or the contemplation of the numerous works of art displayed on the station walls. They will not even need the bookstalls, much less to gape at the contents-bills of the daily paper.

And, provided the glass roofs be kept clean, and the atmosphere innocent of smoke and gas, might not the stations—sheltered as they are from the vagaries of weather, and brilliantly lighted—be transformed into modified winter gardens, with sturdy flowers and shrubs filling up nooks and corners, and bold paintings (frequently renewed) of distant lands, seascapes, and historical subjects, in the recesses now covered by "Reckitt's

Blue," etc.? The frequent stopping of trains would be actually welcomed, and people would travel by the "Circle" for the sake of seeing the novelties! In fact, every station might be converted into a thing of beauty.

One other suggestion for the directors of the new Inner Circle. Cannot something be contrived in the new cars to effectually deaden the sound of the closing and opening of doors, so irritating to modern nerves, and unpleasantly associated with the "banging" in the old carriages, and the "clashing" of the telescopics in the Tubes.

THE NEW METROPOLITAN RAILWAY

The Metropolitan Railway will be electrified in a very similar manner to the District Railway, the system being the same, *i.e.* alternating three-phase, converted at sub-stations into continuous current. Access to the platforms will be by short staircases, and not by lifts. It is said that when steam is abolished the appearance of the stations may possibly be improved, but the advertisements are too important a source of revenue to be removed, and, as the Company says, "they act as a relief to the bare walls, and their withdrawal would answer no good"! An effort will be made to cleanse the tunnels, but it has not yet been decided what method will be adopted.

There exist an abundance of open spaces, ventilating-shafts, and holes, and the frequent passing of trains in contrary directions will necessarily keep the air in motion, and thus, as in the District, the problem of ventilation will solve itself.

The cars will be of the corridor type, seven to a full train, each end car and the middle one having a motor, and if the contingencies of the traffic do not require a large train, it will thus be possible to divide it and run it in two parts. The seating will be both transverse and longitudinal, and considerably over four hundred passengers it is said can be accommodated in each full train. As to day and night services, their frequency, the fares, and the distinction of classes, nothing has yet been decided.

About a mile from Wembly, where "Watkins' Folly," as it is locally called—at one time aspiring, like Babel's, to "reach unto heaven"—shows gauntly against the sky-line its first stage of only 150 feet, is Neasden, where, on land belonging to the Metropolitan Railway, is being erected its power house (the most extensive in the kingdom owned by a single railway company), capable of producing some 14,000 kilowatts. Water in abundance will be obtained by means of artesian wells now being bored in the chalk; and coal can be readily supplied. The current will be applied to cars, as on the District, by a conductor-rail placed in the near side of the permanent way, with a return fixed in the centre of the running track. By the end of 1903 it is hoped that the work will be sufficiently advanced for some trains to be run by electricity. Finally, as the Metropolitan's engineer-in-chief remarks, there will be no marked novelties, but "the very conversion from steam to electric traction will prove a great novelty and an attraction. New cars of the latest type will be introduced, the stations will be bright and cheerful, the atmosphere pure; travel will be undertaken with a greater degree of comfort, and freedom from disagreeable odours. In short, nothing that can reasonably be expected to be performed in the interests of the public will be left undone."

AMERICAN CAPITAL

A good deal has been said in reference to the source whence the necessary capital has been obtained for rejuvenating the Inner Circle, patriotic people objecting to the so-called Americanising of this great undertaking, though it is hardly a logical objection.

If British capitalists are lacking in enterprise, there is no reason why London should wait until they evince it. The world will not go to sleep while Lombard Street hesitates. As Mr. Perks, M.P., Chairman of the District Company has said, out of the five millions sterling invested in the new Underground Electric Railway Companies of London, Limited, less than two millions were held in America, and three millions on this side the Atlantic. "I do not care," he said, "where the money comes from, so long as it is good money"—a wise remark, like the *non olet* of Suetonius. What matters it whence the materials of a sovereign have come? They cannot be ear-marked, and whether its gold is Brazilian, Australian, South African, or American, is of no consequence. It is a legal tender, and worth twenty silver shillings.

Another matter that has engaged public attention is the apparent difference of opinion between the Metropolitan and the Metropolitan District Companies, as to the control of the Inner Circle. Nature has designed them to be one, and but for vested and promoters' interests, they probably would have been one from the first. They are not merely brother and sister, but are united by a closer tie, therefore their motto surely ought to be *Quis separabit!*

Let us hope that long before the scheme is completed there will be a reconciliation, and a satisfactory working arrangement made "out of court" between these two parties to an unnecessary divorce suit.

The two lines have carried their millions of passengers, and the rejuvenated Inner Circle during its new and beneficent career is destined to carry very many millions more, and prove a great boon to the metropolis.

CHAPTER VI

THE CENTRAL LONDON ELECTRIC RAILWAY

"Tell by what paths, what subterranean ways."—BLACKMORE.

HISTORY OF THE RAILWAY AND ITS CITY SUBWAYS

WHEN those electric traction pioneers, the City and South London, and the Waterloo and City Railways, were opened respectively in 1890 and 1898, they were regarded by the public with a certain amount of apathy. But when, in July, 1900, the Central London Railway, inaugurated by the Prince of Wales, was opened for traffic, and it was realised that the line was laid literally in the centre of London, beneath one of the greatest street routes in existence, viz. Cheapside, Newgate Street, Holborn, Oxford Street, Bayswater and Uxbridge roads, and was capable of dealing with a gigantic stream of passengers at a uniform fare for any distance, it arrested universal attention, and for a time nothing was talked about but the deep-level system for metropolitan railways; and by general approbation the Central was forthwith dubbed "The Twopenny Tube," a name it will always retain.

Like most great enterprises, the Tube Railway had to contend against considerable opposition before legislative sanction could be obtained for its construction. It was incorporated on August 5th, 1891, after a great battle with Parliament and local authorities, in which affray the late Mr. J. H. Greathead, M. INST. C. E. (deviser of one of the methods of shield-excavating for driving tunnels), took a conspicuous part, and the principle of a "free-way-leave" beneath the streets was successfully confirmed.

The original directors were Mr. Henry Tennant (at one time General Manager of the North Eastern Railway Company), Lord Colville of Culross (Director of the Great Eastern Railway Company), Sir Francis Knollys (Director of the Great Northern Railway Company), the Hon. A. H. Mills (of Glyn, Mills, Currie, and Co.), and the Right Hon. D. R. Plunket (Director of the North London Railway Company). Thus the railway element was strongly represented; the financial to a small but very important extent, and Court influence by two prominent members of the households of the Prince and Princess of Wales.

The Company was authorised to construct a double underground line from Liverpool Street to Shepherd's Bush (about 6½ miles); but the plan was modified, and the Bank of England became the City starting-point. In their prospectus the directors modestly predicted an annual passenger traffic of some forty-two millions (or seven millions per mile of line); but this estimate has been largely exceeded, the average being about fifty-two millions per annum, or one million per week.

The Company's capital ultimately reached the sum of nearly four millions sterling, so the line can hardly be called a cheap one in point of construction; for, although the "way-leave" beneath the streets was free, land had to be bought for the surface booking-offices, costly shafts had to be sunk to the requisite depth, and tunnels driven, and numerous subterranean stations had to be built. Thus, apart from the cost of the rolling-stock and installation of a large current-generating station, the initial expenses soon mounted up.

All the booking-offices and stations are built on one principle, each with its great electric lift; but special interest attaches to the City terminus.

It was necessary to make use, somehow, of the open space between the Mansion House, the Bank, and the Royal Exchange—an ideal spot for a central railway station. But how was it to be effected? For years the Civic Fathers had contemplated the construction of subways for the safety and convenience of foot-passengers at this, which has been termed the busiest—as it is almost the most dangerous—spot in the world, though I doubt whether in the year 1903 Piccadilly Circus does not run it hard.

The Central Railway Company approached the Corporation on the subject, and eventually it was agreed between the parties that the Railway Company, in return for being allowed the privilege of constructing their station beneath the open space, without payment, should make the public subways, and hand them over in perpetuity to the City.

So for many months the pavement in front of the Royal Exchange was disfigured by a lofty wooden hoarding, which completely concealed a shaft, wherein some mysterious work was progressing. But beyond this there was no outward indication of what was going on below; and, although the entire roadway in front of the Mansion House was being undermined, the vast traffic continued as usual.

Arranging this station proved to be one of the stiffest bits of engineering work ever attempted. Drain-pipes were ubiquitous—a perfect tangle that had to be diverted.

There were old disused and long-forgotten pipes, electric cables, hydraulic power pipes, pneumatic tubes, gas and water mains—a maze and wilderness of underground communications. These were all rearranged in a special pipe-tunnel, 14 feet wide. Then, at a depth of about 20 feet, the booking-office was built, bit by bit, of steel-work, which had previously been temporarily put together in a field to ensure its fitting exactly into the excavation prepared for its accommodation—an area 145 feet one way and 75 feet the other, its outline being on the curve. Its roof, consisting of girders supporting steel troughing, was filled up with concrete, and finally with asphalte, upon which thousands of people pass daily without realising what is below them. Access to the booking-office is gained by numerous entrances *viâ* the public subway: two on the Royal Exchange pavement, two at the bottom of Mansion House Place, one at the Poultry corner, and one at Walbrook, one in front of the Safe Deposit City buildings, two each at the corners of Princes Street and Cornhill, and one at St. Mary Woolnoth Church. The entire arrangement reminds one of a mole's subterranean fortress, with its galleries for entrance and exit branching off in various directions.

These subways, immense conveniences which should be adopted at every *rond-point* in London—though it is a strange fact that *habitués* of the City seldom use them, they being patronised chiefly by the "work-girl" and by casual visitors to the central "square mile"—are 15 feet wide and 9 feet high, are lined with glazed brick, and have electric-lighted stairways at the above-mentioned places.

DESCRIPTION OF THE RAILWAY

Some fifty feet below the Bank of England Station are the twin-tunnels and their platforms, approached by five lift shafts of twenty feet, and one stairway shaft of eighteen feet diameter; at a deeper level still are the tubes of the City and South London Railway, crossing the City *en route* to Islington.

These great passenger lifts work with wonderful smoothness (*facile descensus Averno est*), and without them no fewer than ninety-three steps would have to be painfully descended.

We are all familiar by this time with the other ten surface stations of the Twopenny Tube (at the Post Office, Marble Arch, etc.). They are nearly all alike, and look as if they were waiting for a substantial and lofty building to be erected upon them, and have little claim to architectural beauty. The platforms, necessarily rather contracted in area, are clean and bright, owing to the extensive use of opalite tiling and glazed bricks, ever spotless, and practically indestructible. Each train consists of six eight-wheeled bogie-cars, $45\frac{1}{2}$ feet long, with well-upholstered seats, arranged longitudinally and crosswise, for forty-eight passengers. The lighting is effected by means of eight sixteen-candle-power incandescent lamps, supplemented by small shaded electric lights, excellent for reading by. The windows, of course, do not open, but practicable ventilating louvres are arranged above them. Entrance is obtained at each end of the car, and the telescopic gates are cleverly and expeditiously manipulated by the attendants. Straps are placed along rods on each side of the roof to aid passengers in traversing the cars, and above the seats are racks for parcels, etc.

The electric locomotives[1] are curious in shape, with the driver's cabin in the middle, and a backward and forward

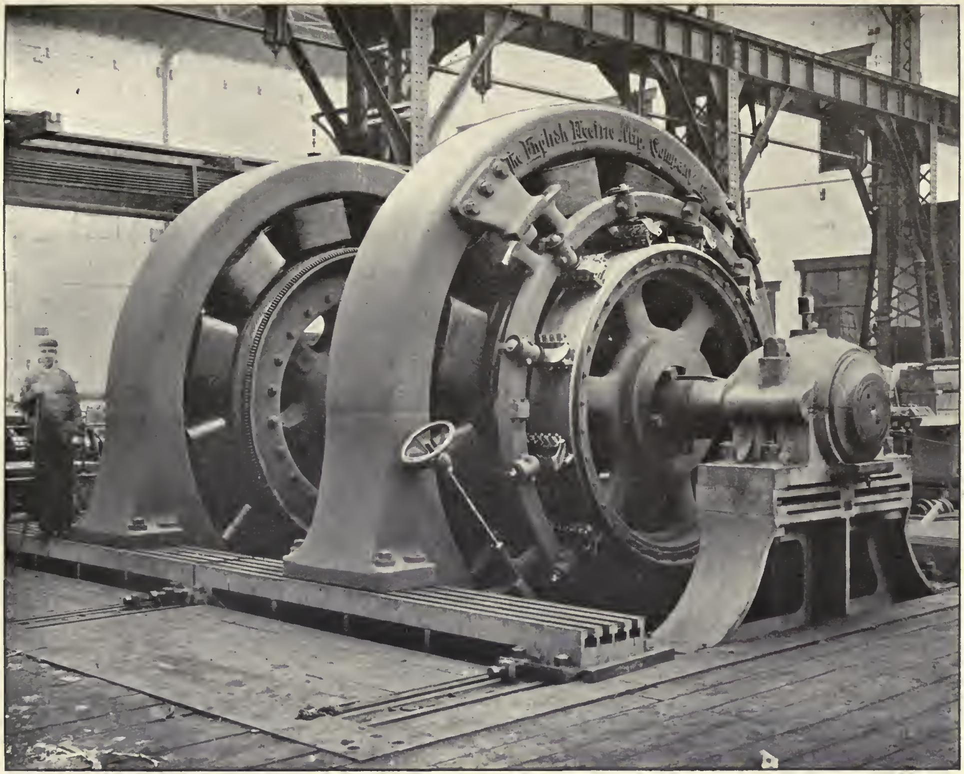
[1] These have since given place to motor-cars built in America.

slope for the apparatus looking like gigantic coal-scuttles back to back. They have eight wheels, and are fitted with motors, one for each axle. The current is collected from a central third rail by means of two cast-iron shoes which rub along it, and is led through an automatic circuit-breaker and switched to the controller in the driver's cabin, thence to the motors, returning to the track rails through the wheels. The total weight of a locomotive is about forty-four tons, and the average speed is about fourteen miles an hour, the running time from the Bank to the western terminus being twenty-four minutes.

At Shepherd's Bush—once, as its name implies, a rural suburban hamlet, suggestive of pastoral pursuits, flocks of sheep and lambs, washings and shearings of fleeces—is the chief power station of the Central, sub-stations being situated at the General Post Office, Marble Arch, and Notting Hill Gate.

The premises cover sixty-eight acres, with plenty of room for locomotive and car sheds, shunting tracks, boiler and engine houses, the latter most impressive from the size of their six Corliss compound horizontal engines, each rated at 1,300 horse-power, though, as in so much American machinery, the somewhat rough exterior detracts from the appearance, especially in the eyes of British engineers, accustomed not only to internal mechanical perfection—as in the Central's engines—but to nicety of finish throughout. These giants are coupled direct to Thomson-Houston dynamos, with the capacity, if required, of 5,100 kilowatts, or 6,800 indicated horse-power.

Amongst other contemplated improvements is that of loop-lines between Liverpool Street and the Bank, which will materially help to accelerate the traffic.



By permission of *Dick Kerr and Co., London*

FIG. II. A TYPICAL ELECTRIC POWER GENERATOR—TWO DYNAMOS, EACH OF ABOUT 1,600 H.P.

Some remarkable results, not very satisfactory to those interested in vehicular traffic, have arisen from the opening of the Twopenny Tube. The standard of travelling has gone up steadily; improvements in 'buses are constantly demanded (garden seats, spiral spring cushions, etc.) and—somewhat slowly—conceded. Yet, to quote the words of an omnibus official, "*they* (*the public*) *want more!*" And this at a time when fares have steadily decreased, and the cost of fodder and maintenance have seriously increased. Worse still, the Tube's existence has been keenly realised all along the line of its route, ladies especially preferring to go on a shopping expedition by means of the well-lit Tube than by the not over-clean, and decidedly slow and stuffy, omnibus. The London Road Car Company's returns along Oxford Street and Holborn showed last year a decrease nearly equivalent to the Tube's increase, and the London General Omnibus Company's report for the half-year—December 1st, 1901—was so disappointing, owing to dear forage and decreased passenger traffic, that its stock fell at one bound ten points, from 105 to 95—a grave depreciation in value.

The Tube, during the six months ending December 31st, 1902, carried 22,425,776 passengers, a daily average of 121,879, out of which big total 2,770,854 were workmen at a penny per traveller. On Coronation Day 202,000 people journeyed by the Central.

ITS VENTILATION

At the commencement of its career the Tube's atmosphere and temperature were remarkably sweet and equable, not varying much from 62° either in summer or winter. During a spell of hot weather it felt delightfully cool, and when east winds blew it was warm compared with the atmosphere outside.

Trips in the Tube were at one time seriously suggested for the cure of various maladies as a modification of that usual last resource of the medical profession, "change of air."

Before the advent of the Tube, however, many fond mothers with little faith in the pharmacopœia regarded the Underground as a sanatorium for children's complaints. Tunnel air, they affirmed, was good for croup, whooping-cough, and various other ailments. A doctor travelling on the Metropolitan once noticed a woman in the same compartment pull down the window upon entering a tunnel and hold outside a child she was carrying, so that the youngster might get the full benefit of the foul atmosphere. When the doctor inquired the reason for this extraordinary performance, she told him that "tunnel air" had been found to be a complete cure for croup. And only the other day an East End mother was discovered by a guard giving her baby two rounds on the Inner Circle because she had been told by a herbalist and bone-setter that a sulphurous atmosphere was good for whooping-cough.

But the ideal state of things in the Tube did not continue, and accusations respecting its ventilation began to be whispered about and finally proclaimed from the housetops (*vide* Chapter XIX). However, practical steps were taken to ensure its efficiency, and at the last meeting of shareholders the chairman said that the Company had now a better character for ventilation than any other company in London.

At Bond Street Station a powerful fan has been placed at the base of the lift shaft, which, under ordinary pressure, removes the vitiated atmosphere from the permanent ways, fresh air taking its place at the various halting-places. The fan, forty-eight inches in diameter, and electrically driven, displaces 30,000 cubic feet of air per minute, and is capable of entirely exhausting the tunnels in a fraction over three minutes. The fan is worked every night after the trains have ceased running, and travellers by the early trains literally breathe the freshest of fresh air.

If a train in the Central should break down and come to a stop in the tunnel, though it would not, of course, be run into—the block system making that all but impossible—it might be necessary for the passengers to get out. The question naturally asked is, "How shall they alight? And where shall they go when they have alighted?" A fact that not every traveller knows is that a narrow path at the side of the rails leads to the nearest station, which cannot be more than a quarter of a mile off, so that no serious athletic feat is required to get out at the rear of the train and walk along the Tube.

ITS ANNUAL SALE OF LOST ARTICLES

Like the great trunk-lines, the Central has an annual sale of articles left in the carriages and not claimed; but the collection differs considerably from the miscellaneous assortment brought together by, say, the Great Northern or Great Western. Heavy impedimenta are, as might be expected, absent; but who could have been the owners of the 25 bottles of whisky, the 13 boxes of cigars and cigarettes, the 300 ladies' umbrellas, and the 264 gentlemen's umbrellas, the walking-sticks innumerable, the 150 pairs of spectacles and eyeglasses (showing that the light is so good that reading is a favourite way of passing the time), the 44 fur necklets, 920 pairs of gloves and 14 muffs, the

166 empty purses, and the multitude of books, chiefly fiction? While every week someone very mysteriously leaves behind a spirit-bottle—evidently recently emptied of its contents—enclosed in cardboard and done up in a neat parcel.

How the Twopenny Tube, and others like it, were constructed will be described in the next chapter.

CHAPTER VII

THE TUBULAR SYSTEM

> "Thy arts of building from the bee receive;
> Learn of the mole to plow, the worm to weave."—POPE.

ORIGIN OF THE SYSTEM

LAST year there were sounds of strife in that financial atmosphere where dwell Titan capitalists, who think and talk and dream in millions; a battle of giants, like the conflict imagined by Milton, when the satanic host levelled "triple-mounted rows" of deadly tubes with such effect against seraph and seraphim, "that whom they hit none on their feet could stand, though standing else as rocks." But the conflict now past, concerned tubes of another kind—iron railway tubes, that seem to be the destiny of underground metropolitan travellers. The Morgan group, the Yerkes' combination, and other great coalitions, mustered their battalions for the fray. The London County Council, following the policy of Lord Stanley's army at Bosworth field, hovered aloof ready to take advantage of the defeat of either; the Corporation of London anxiously watched from afar; the great suburban railway companies shivered in their shoes; a parental Legislature held the balance impartially between the combatants; while the people whom the matter most concerned—some six millions of Londoners

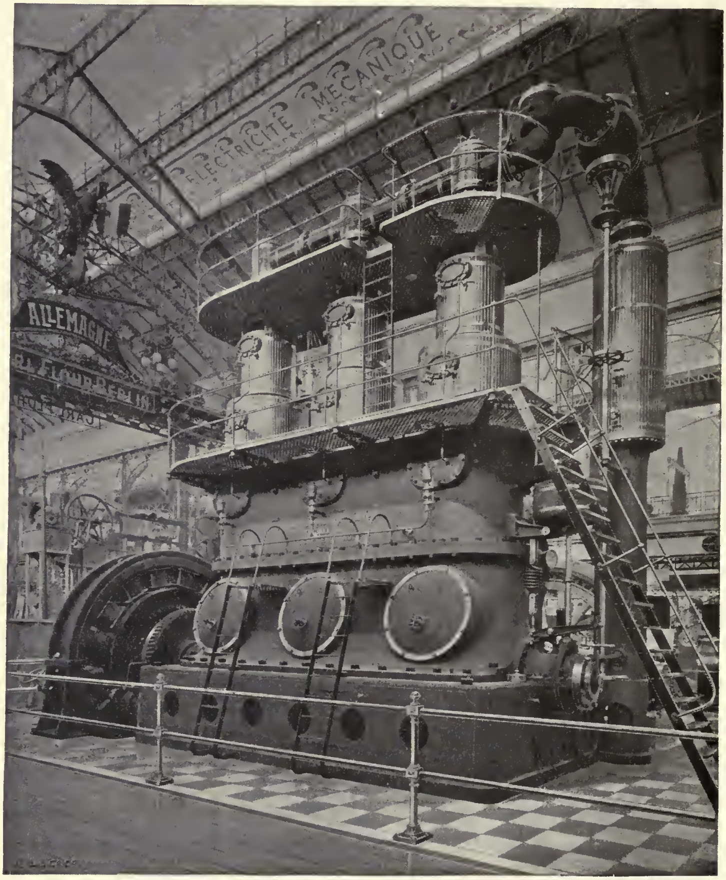
—had to sit down with folded hands and, patiently or impatiently, await their fate.

Recollecting this tangle and uproar of conflicting interests, it behoves everybody to have some notion of the subject of the Tubes and their construction.

Like many other things in the world, there is nothing new in the idea of boring a hole through the earth and lining it with brick or iron. As Pope suggests, mankind doubtless learnt the art from Nature, though the correctness of the poet's zoological knowledge is hardly shown in the examples heading this chapter. For ages past—before London existed—that skilful excavator, the mole, tunnelled through the earth, making roads and galleries, the friction of his fur, set perpendicularly on his skin, lining his tube so that the soil did not fall in. The larvæ of the humble caddis-fly covered the inside of their cases with fine silk; and the trap-door spider lined its 12-inch long shaft with similar material to prevent the tumbling in of loose particles and to afford itself a foothold in climbing up; while the ant constructed her galleries and stuccoed them with the finest grains of soil, so that the inner walls presented a smooth, unbroken surface.

With the advent of man and his civilisation came the extensive use of furs, and in these the grubs of the moth—in the abstract the most engaging of creatures—made galleries whenever they got a chance, lining them with their own silk, wherein to undergo their transformation into the pupa stage.

Well-experienced engineers, such as the vine, beech, pine, and bark-boring beetles, are all tube-makers; but it is the pholas, or *teredo navalis*, who is the arch-borer, so skilled an expert in lining, that, though only the size of a quill and "soft in body," he pierces the hard timbers of ships and quay-piles, lining the tubes as he proceeds with a saliceous substance as hard as china. The body of the Teredo is like a long white worm,



By permission of *Willans and Robinson, Rugby*

FIG. 12. A 3,000 H.P. TRIPLE EXPANSION CENTRAL VALVE ELECTRICAL ENGINE

varying from a foot to two inches and a half in length, and about the width of a finger. From him, it is said, the elder Brunel took his idea of the shield which he employed in constructing the tunnel beneath the Thames after the shaft had been excavated.

But his clever system was crude, and not calculated to cope with porous or aqueous soil; therefore, when the stratum of clay, through which the work was being carried forward, broke off abruptly, a serious influx of water took place. The work had to be abandoned, and was only completed after much delay and ruinous expense. In a commercial sense, it was an utter failure.

Since Brunel's time, engineering has developed its resources *pari passu* with the development of science. Hydraulic force displaces the primitive screw power, and steel plates the cumbersome timber works used in the Thames tunnel.

Tunnelling through rock, like the Mont Cenis and St. Gothard mountains, is a comparatively simple engineering feat, as no lining is required; so also is the ordinary railway tunnel, carefully bratticed and propped inside, and securely cased with brick or stone. But it is, as the Great Western Railway knows to its cost, in dealing with water-bearing strata, *vide* the Severn Tunnel, that a system is required, not only to protect the men as they bore with a gigantic centre-bit through clay, chalk, or gravel, but, pholas-like, to line the tunnel simultaneously. This is obtained by the use of the famous shield invented by the late Mr. J. H. Greathead, and employed by him in the construction of the City and South London and Waterloo and City Railways, though he did not live to witness the adoption of his principle in the Twopenny Tube.

RAILWAY TUBES, HOW THEY ARE BORED

A revolution in tunnelling has been brought about in constructing Tube railways. By the new process a great cylinder or shield at the bottom of a shaft is pushed forward by hydraulic power into the soil ahead of it. The navvies work inside, excavating the earth in front of them, and fit up iron segments at the rear of the tail end of the cylinder, or shield. Thus, on the one hand, the exact size and shape of the tunnel is ensured, and the workers are fully protected from the risk of the roof falling in.

This arrangement of shield and iron tube resembles an old-fashioned single-drawn telescope; the outer case being the shield, and the inner tube the lining of the tunnel. These shields have fronts that bear a row of steel knives forming a true cutting edge, and are so arranged that they can, if required, bore a circle slightly larger than the iron segments of the tube. As the shield slides away from the inner tube, the space it occupied is filled in with what is called "grout," a kind of porridge of water and lime, which soon sets as hard as stone. This is ingeniously blown in through apertures in the iron lining by means of compressed air, and effectually fills up cracks accidentally formed in the soil, which might otherwise extend to the surface and cause subsidence in the foundations of buildings. Theoretically, therefore, no disturbance of the ground below or above the tubular lining is possible.

In the pioneer Tube railways, the City and South London for instance, the diameter of the tunnels was only 10 feet 6 inches, that of the Central 12 feet, but the Great Northern and City Company made a new departure by fixing the width at 16 feet. For the construction of this railway, the shield was designed by Mr. E. W. Moir, M. INST. C.E., and varies in some important respects from the Greathead shield. A remarkable photograph, which, by the courtesy of the *Tramway and Railway World*, I am able to present to the readers of this book, shows this shield at work in the construction

By permission of the *"Tramway and Railway World" Publishing Co., London*

FIG. 13. SHIELD AT WORK IN A TUBE RUNNING TUNNEL

of a running tunnel, 16 feet in diameter, on the above line. The Great Northern shield is much more powerful than any hitherto employed. Greater hydraulic force is applied, and the "jacks" are more numerous, and considerably larger. The shield used for the sixteen-foot tunnel may be taken as typical of others up-to-date. Its cylindrical skin is composed of half-inch steel plates riveted together at the bottom of the indispensable shaft, which may be, in the future, anything from 50 to 500 feet beneath the surface. In length, the shield from the rear to the cutting edge in front is 8 feet 9 inches, half of this being used by the excavators (as in Brunel's Thames tunnel), the after part for the erectors of the metal segments of the tube. Round the shield front are mounted ten heavy cast-steel cutters, the pressure upon them being no less than two tons to the square inch, the hydraulic rams exerting this pressure direct upon the back of the cutters, and the purchase is taken off the edge of the nearest tunnel segment already in position. The excavated soil is taken away in trolleys, which, as in a mine, are drawn by ponies on a miniature track, and afterwards sent up to the surface by the nearest shaft.

London clay is generally the kind of soil thus bored through in the metropolitan tubes. The Central, while sinking the shafts, met with it 29½ feet below the surface; but before this was reached, 12 feet of made ground, 18 inches of loam, and 16 feet of gravel, had to be pierced.

The London clay ran almost without a break between the Bank and Shepherd's Bush, the only hiatus being at a point between Red Lion Street and Berner's Street, where the Woolwich and Reading strata cropped up, which proved to consist of hard, red, streaky clay, some beds of white sand, and, strangely enough, beds of hard limestone rock, whose presence had not been anticipated.

Tube railways are carried out at considerably varying depths; the Central running in places 100 feet (*i.e.* the height of Westminster Abbey's nave) below the road, and at the Bank only 65 feet.

Some of the proposed tubes burrow much deeper; for instance those of Charing Cross and Hampstead Railway will be from 120 to 216 feet below the surface. Apparently, there is no reasonable limit to the depth at which engineers are prepared to lay their railway tubes.

THE TUBE MOLE AT WORK

By an instinct—the heritage of years—of a kind that prompts gamekeepers to slaughter indiscriminately eagles, hawks, crows, magpies, owls, and even squirrels, classing them with such vermin as pole-cats, stoats, weasels, and rats, ignorant farmers and gardeners wage war against the mole, asserting that in driving his tunnels he throws up unsightly heaps of soil, and, worse still, loosens and destroys the roots of plants and grass, totally ignoring the fact that Mr. *Talpa Europæa*, though he may occasionally disturb the earth around, acts as a very efficient surface drainer, and still better, is a persistent chaser and devourer of his natural prey, the wire-worm, and other injurious insects.

Our Tube mole throws up no hillocks, but he is accused of being the source of much mischief, and of endangering the houses on the surface—damaging, as it were, their roots—by the vibration arising from the continual passage of trains along the iron galleries and the consequent subsidence of the ground. This has given rise to numerous complaints, so pronounced as to become the subject of an official inquiry.

Some foolish objections have been raised to deep-level railways, and equally unreasonable claims for injury done by them have been brought into court. Where a vibration clause is inserted in any Tube Railway Bill, there might be ingenious claims manufactured for compensation. For instance, a watchmaker might come forward and say that the vibration caused by the railway prevented him from setting his chronometers, or a wine merchant might say that his wines were shaken up; and in this way the company might be subject to endless litigation.

When it was proposed to bore tunnels 70 feet below the royal demesnes of Hyde Park, St. James's Park, and the Green Park, and as much as 216 feet below Hampstead Heath, approximating in the former case to the height of Queen Eleanor's memorial at Charing Cross, and in the latter to that of the twin towers of Westminster Abbey, it was at once urged by the representatives of a certain Preservation Society that the trees, plants, and flowers of the three parks would be detrimentally affected by the Tube, and that the Hampstead Heath tunnels would "very probably drain the upper surface of the soil and destroy vegetation all round." To which unthought-out contention Mr. R. E. Middleton, a well-known civil engineer, replied that "at the depths proposed for the parks the tunnels were to be constructed through a stratum, not of loose soil, but of stiff London clay, so that any question of destroying trees, plants, or flowers was rather absurd; in fact, vegetation would in no way be affected." He might have added the argument that, although ordinary railway tunnels abound, no one had ever heard of the overlying fields and woods being deleteriously affected by them.

CLAIMS FOR DAMAGE BY TUBING

Now, in dealing with the matter of alleged injuries to buildings from vibration set up by Tube railways, I quote the following case to show how visionary are some of the claims brought against Tube Companies.

On the 14th of October last, at the Lambeth County Court, an action was brought against the Great Northern and City Railway Company by an individual living in Hoxton for damage alleged to have been done to his premises by the construction of the tunnels. The plaintiff stated that in consequence of this the repairs of his house had cost him £62, and that in another house of his, cracks had appeared. A photograph, taken twelve months before the tunnels were made, which showed a crack in front of one of the houses, was pointed out to the witness, who said that he had never noticed it.

For the defence Mr. Douglas Young stated that he acted for the Company when the tunnels were about to be constructed, and, anticipating claims of this nature, he caused photographs to be taken of all houses which showed cracks on the line of route. The cracks shown in the photos then taken were practically in the same condition now. The repairs necessary were not caused by damage done by the tunnels, and came entirely within the repairing clauses of the leases. The jury returned a verdict for the defendant Company on the ground that no damage had been done by them.

On the other hand, among the Tube Railway cases brought into court last year and this, was the following, which illustrates the contention that though there may be a certain amount of truth in the plaintiff's arguments, exaggerated ideas prevail as to the sums that can be claimed for injury, present or prospective. It also shows the uncertain state of the law on the subject of ownership of the subsoil—a hard legal nut.

In the London Sheriff's Court, 17th April, 1902, Mr. Under-Sheriff Burchell sat, with a special jury, to consider a claim for compensation brought by Mr. William Howard, of 11, Cornwall Terrace, Regent's Park, against the Baker Street and Waterloo Electric Railway.

Mr. Morton, K.C., said that in August, 1900, Mr. Howard became aware that a subsidence was taking place, and that the walls of his house were cracking, this being unmistakably due to the borings for the railway which were being made underneath the property. In the course of these borings the Company had taken away part of the subsoil of the claimant's premises without having given notice to treat, and this, counsel submitted, constituted a distinct trespass. The value of the property, counsel contended, had been deteriorated to the extent of at least £50 per annum. Mr. Howard's lease had ten years to run, the rental being £200 a year.

After expert evidence had been given, the Hon. A. Lyttelton, K.C., for the railway company, said it was ridiculous to assert that the Company had committed an act of trespass. They disputed the claimant's alleged ownership to land sixty-five feet below his premises, and were determined to fight the question in the courts, inasmuch as it was one which affected the whole of the electric tube railways in London.

One witness called on behalf of the Company said that the damage to the property could be remedied by the expenditure of a ten-pound note.

The Under-Sheriff said that an important feature of the case which the jury had to decide was whether the claimant was the owner of the subsoil. As such he would be entitled to compensation for any vibration that might occur when the railway commenced to run in about two years' time. He left it to the jury to decide their verdict under two heads, namely, "what damages had at present been sustained," and, "what damage was likely to accrue through vibration."

After a brief deliberation the jury awarded £357, in one sum, as damages.

On the 6th of February of the present year, before Mr. Justice Ridley and a special jury, the hearing was resumed of the case in which Mrs. Dawson, a widow, carrying on the business of a draper at the junction of City Road and East Street, sued the Great Northern and City Railway for £10,000 damages, alleged to have been caused by the tunnelling operations in the vicinity of her premises. The claim included some £4,000 which it is estimated it would cost to put the buildings in a proper state of repair, and £5,000 representing loss of business during the time it would take to complete the work of reinstatement.

The jury returned a verdict for the plaintiff under the following heads: Amount for taking the subsoil occupied by the tunnel, £50; structural damage, £2,000; damage to trade and stock, £2,100; total, £4,150.

Mr. Dobb asked that judgment should be entered.

Mr. McCall thought the judge had no power to enter a judgment of the High Court because the proceedings were in the form of an interpleader action.

Mr. Justice Ridley said he would give judgment in the sense in which the word was used in the Lands Clauses Act.

Judgment was given accordingly.

At a meeting of the Auctioneers' Institute held last year, Mr. G. M. Freeman, K.C., speaking on this subject, pertinently remarked that various questions were likely to arise between the promotors of the new order of underground railway and the owners of adjacent property, and he gave it as his opinion that the assertion that no possible damage would be caused, had not been wholly verified, and that the rights of compensation to persons equally injured ought not to depend upon whether a piece of the subsoil under the street was or was not appropriated. In his judgment, all owners who could prove damage done by the construction or working of an underground railway, should have the same title to compensation.

VIBRATION

The outcome of the Board of Trade inquiry last year into the vexed question of tube vibration was interesting. It showed that alleged annoyance from vibration has not been altogether imaginary, and some novel facts were produced. Fourteen meetings were held, and evidence was given by some of the residents along the line of the Central Railway route, their habitat ranging from Bucklersbury in the City to Kensington Palace Gardens in the west. A large number of the witnesses represented householders having "frontages," and among others, the Holborn Borough Council. They all deposed as to annoyance caused by the vibration, and were of opinion that the shaking was most perceptible when the trains first began running in the morning; between five and eight p.m.; and shortly after midnight, just before the trains ceased running.

Had any of these gentlemen resided on the north side of Victoria Street, near its western end, they would hardly have complained about mere vibration. In that delectable locality the backs of the houses overlook the Metropolitan District Railway, and if the dining-room happen to be in the rear, as in many of the flats it is, every wine-glass and tumbler on the table quivers in a fearful manner, all the ornaments tremble, and the whole apartment is agitated as each train thunders by.

But even this is nothing, contrasted with the daily experience of dwellers in suburban side streets, where passing of steam-rollers, pantechnicon-vans, and other elephantine vehicles, not only shakes the tenements to their basements, but forces out the mortar that is supposed to bind together the brickwork, dislocates the window-frames, turns askew the pictures on the walls, and would eventually, if not seen to, reduce the "eligible villas" to ruin.

However, the Board of Trade Committee, as in duty bound, personally investigated the Tube complaints and satisfied themselves that vibrations, sufficient to cause vexation to the inmates, were really felt in some of the houses near the Central, and the result of the inquiry was as follows:—

That it was a matter of chance whether any given train caused a slight, or a severe, vibration; also that trains which produced much *tremblór de tiérra* in one house, as likely as not caused but little in another, and that apparently different apartments in the same residence were not similarly affected by one and the same train. It was demonstrated that the locomotives, and not the cars, were responsible for the greater part of the disturbances, the reason assigned being that too great a springless load was carried on each axle of the engines, a method of construction adopted to obviate the necessity for gearing.

Acting upon the Committee's representation, the Central Railway Company ordered two new types of locomotives, in one of which the "unspring-borne" load was much reduced by gearing. The other was not distinct from but attached to the train, the motors being carried at one end of two or more coaches—the motor-car system of electric traction in fact. The difference in weight was remarkable; the original gearless engines being 44 tons, the new geared pattern 33 tons, while the motor-cars only came up to 20 tons.

Some novel experiments were made, and in order to identify the trains, the houses in which the observers took their places with recording instruments were connected by telephone with the signal-boxes at the adjoining stations. Quite satisfactory were the results, and it was found that, during some two hours, the passing of every train drawn by the heavy gearless locomotive was distinctly felt, but was not discernible when the new engines were attached. Therefore the Committee concluded that, so far as the Central was concerned, the adoption of motor-cars would so reduce the *tremblement de terre* as to cause all real annoyance to cease, though the sound of the trains, particularly at night, might still be detected. As to the oscillation of the cars—a rather marked feature in the Tube—it was attributed by the Committee's experts to the unevenness of the surface of the rails. As these leave the rolling-mills they are usually slightly curved, and the process of straightening them *in situ*, however skilfully carried out, inevitably leaves a certain amount of waviness. When the speed is high, a condition of things soon arises whereby the irregular impulses produced by the uneven rail surfaces establishes a rocking movement of the rails and the road-bed, converting both into an elastic instead of a rigid support. This is increased and maintained by the pounding of the gearless locomotives in the narrow tubes, intensified by the hard unyielding material of which they are composed.

Another fact to which the Committee called attention was, that in consequence of the small diameter of the tunnels (12 feet), the fit was too close, and the pressure in front of the trains necessitated greater power to overcome it than if more space had been left between the roofs of the carriages and the tubes.

In the agitation respecting damage alleged to have been done by the construction of the Tubes, it was proved that provided the apertures are made of sufficient size, and suitable locomotives used, and the permanent way properly laid with stiffer and deeper rails, the chance of injury to houses by the *moviéndo la tiérra*, as the Spaniards call it, can be reduced to a minimum.

Modern science tells us that earth tremblings are with us at all times and in all places to an extent not realised. We are assured that, by Professor J. Milne's instruments, quiverings, and slopings of the earth's crust, insensible to the most delicate spirit-levels, can be detected. It is now known that earthquake movements can be felt right through the earth, and all round its surface. Latterly, Professor Milne has also discovered that his observatory in the Isle of Wight sinks slowly during a part of the year, and rises as slowly during another part—as if the breast of the earth were heaving. For five months in the year, the tall buildings in a city may be heeling over towards the west; then they come back with extreme slowness to the perpendicular, and finally cant a little to the east.

Surely, then, we need not complain about an occasional mild earth-shake produced by the passing of the useful Underground, or Tube trains, seeing that the good they do so far outweighs their defects.

CHAPTER VIII

TOURING IN THE TUBES

A SKETCH

"She doth stray about."—SHAKESPEARE.

MRS. ROSAMOND was a pleasant, chatty, little woman, and a universal favourite. Her abundant hair was brown, her eyes, shaded by long dark lashes, were deepest blue, and above them rose, not the "bar of Michael Angelo," but a low, smooth, and pretty forehead, where, however, a phrenologist would have looked in vain for the faintest trace of the "bump of locality." She was a shrewd judge of character in men and women, especially the former. She loved beautiful scenery and everything refined in art and literature. She had great sympathy with the suffering and distressed; but her ability to take mental notes of things and places, and to find her way about towns and cities, as some do by instinct, was utterly wanting in Lilian Rosamond; yet, with the strange perversity that impels people with bad eyesight to drive dog-carts or motor-cars, or to steer yachts, she persisted in going about strange localities unaccompanied, and when any expedition was planned, audaciously posed as an authority on quickest and best routes. But she was a native of the fair "North countree," and, lying *perdu* beneath her sweet disposition, was a vein—a thin one—of self-will.

"Why," she argued, "should she not find her way about like other people? Had she not from childhood lived at Lymm, Cheshire, and roamed about that district without difficulty? Had she not frequently travelled to the old county city? Had she not braved the terrors of the Great Central Station at Manchester *en route* for Halifax—changed carriages there, in fact? And had she not once actually journeyed all by herself to London on a visit, returning safely to her own town?" All of which was perfectly true, but she omitted to add that, in going up to town, her parents had, as it were, to see her "labelled and consigned" through the medium of a fatherly guard, while her friends in town had been strictly enjoined on no account to miss meeting her at Euston, and never to let her go anywhere in the metropolis unaccompanied. In fact, her family were in an agony of suspense until she was back again.

Mrs. Rosamond had married a gentleman-farmer of Welsh extraction, and her life had fallen on pleasant lines in a remote Radnorshire village bearing an unpronounceable name made up of consonants. The year 1902 arrived, and with it, in June, an invitation from her sister-in-law to spend Coronation week with her in Edith Road, West Kensington; and off she started, her easy-going husband, who had seldom tested his wife's sense (or absence) of locality, and had no suspicion of how much it was lacking, merely remarking as he saw her into the train, "Now, my dear, mind you wait at Paddington a reasonable time to see if Annie is there to meet you. She is not always punctual, and if she does not turn up, take a cab. Don't attempt to get to Edith Road by omnibus or Underground Railway. You don't know London, and a four-wheeler will be cheaper in the long run. Now, don't forget this, there's a dear little woman, or I shall worry all day long about you."

In the same carriage with her was a lady of uncertain age, whom Mrs. Rosamond quickly guessed to be unmarried and an "organiser"—one of those assertive, independent, "heel-less" women of the genus *plantigrade*, who know everything and want no assistance from anybody. Falling into conversation, Lilian Rosamond remarked that she hoped to see the King's procession to the Abbey, a seat having long ago been secured for her, and that she had been told she would have to go a very long distance from the West End and might have to start by the first train on the Twopenny Tube to the Bank, and that then by *another* Tube she somehow would get to the Borough High Street (where her "stand" was situated) by way of the "Elephant and Castle."

This led to the subject of West Kensington, her destination, and how she proposed reaching it from Paddington. "Why," said the plantigrade lady, "what on earth made your husband tell you to take a cab? It is two miles off at least, and you are sure to be overcharged. Never mind what he said. Men are always extravagant in these matters. Besides, you can think for yourself; you are a woman, not a baby. Now, I'll tell you what to do. If your sister is not at the station, book your luggage—you say you have not got much with you—to be sent on by the railway parcel van, cross the road to the Praed Street District Railway Station, get out at Notting Hill Gate, cross the road there to the Tube station, and for twopence you will be at Shepherd's Bush in a few minutes."

This suggestion seemed to Mrs. Rosamond good and attractive, but she bravely resisted the allurements of a journey by an unfamiliar route; and, recalling her husband and his injunction, after waiting a quarter of an hour at Euston and finding that no one came for her, she allowed herself to be stowed away by an attentive and sympathetic porter into a stale, straw-smelling four-wheeler, and arrived safely at No. 28, when cabby promptly asked, and received, half a crown—a moderate eighteenpence more than his legitimate fare; but cabmen, like everybody else, must live somehow!

The longest day recorded in the almanac dawned clear and fair, and Mrs. Rosamond, rising at an unearthly early hour, started for Islington, where she had promised to breakfast with a relative—an unusual kind of feat to attempt, but easy of accomplishment by leaving Shepherd's Bush very early for the Bank of England, where, as it was explained to her in an off-hand, businesslike manner by her sister's husband, all she had to do was to hit the right subway, book afresh at the Bank Station of the City and South London Electric Railway, and "in a jiffy, as easy as A B C" (so he put it) she would find herself at the "Angel," Islington, and be with her aunt in time for the coffee and rolls.

Mrs. Rosamond was delighted at the prospect, and no happier woman than she stood outside the Tube's terminus that bright summer morning.

The booking-office was full of people—of the working class, thought fair Mrs. Rosamond, who, observing that each person paid the sum of three-halfpence through the glass partition that screened the clerks from too close contact with the public, tendered that modest sum like the others, without specifying her destination. But though plainly, she was too daintily dressed and too self-evidently a lady to escape notice, and was rather surprised at being asked if she wanted a workman's ticket.

"Oh no!" she hastily exclaimed. "I am only going to the Bank, and then to Islington on a visit." "Well, then, your fare is twopence." And she received in return a small slip of paper and not the familiar pasteboard ticket covered with undecipherable letters and figures.

Following the crowd, Mrs. Rosamond dropped the document into a sloping box fixed at the side of the gate and presided over by a railway official, the process suggesting to her lively imagination the method by which votes are recorded at a School Board election.

Wide open stood the door of a gigantic lift, the like of which she had never seen, which quickly filled with a compact mass of some fifty men and a sprinkling of women. There were upholstered benches at the sides; and a civil young artisan offered her his seat, but Lilian preferred to stand and look about her. The electro-lighted apartment was not æsthetic, and the unsightly advertisements, and notices warning travellers against smoking, spitting, or standing too near the doors, did not add to its beauty; and when the telescopic gates were clashed together and fastened, the whole thing reminded Mrs. Rosamond of a great cage full of specimens of the British *Homo Sapiens* packed for conveyance and exhibition to inhabitants of other regions.

Suddenly, gently, and noiselessly the lift began to descend, and it seemed as if it would never stop. But stop it did, at a depth of seventy feet, which might have been seven hundred so far as Mrs. Rosamond's sensations were concerned. Once again the iron gates clashed, and the wild animals—I mean the passengers—streamed forth, our fair traveller following, to the platform.

Was she dreaming? Had she, like Alice in Wonder-land, suddenly become diminutive, and was she waiting for a well-groomed little white rabbit, with gold watch and chain, to emerge from what resembled a burrow at the end of the station? It was so *very* small. Everything was on a reduced scale, the standing-room was a mere strip of planking, the tube like a pea-shooter. Surely it would not take in the train! However, it was deliciously cool and light, and the tiles that lined the station were, as she found by touching them with her gloved hands, perfectly free from smuts.

In a few moments, from the open cutting at the opposite end of the platform, where lay the shunting tracks, a bright light and metallic clattering heralded the strange-looking chimneyless locomotive. Behind it came five attractive-looking cars joined together, and gleaming with light. At their point of junction were telescopic gates, flung open as soon as the train stopped, and Mrs. Rosamond, who had just time to observe that there were not *two* rails only on the track, but a *third* in the middle, hurried into the first car she could find, and the earliest train on the Tube glided into the tunnel *en route* for the Bank.

Lilian Rosamond at once discovered that the cars just fitted the Tube. She would like to have touched the sides, but as the windows were sealed up this was impossible.

Everything looked delightfully clean, and, considering the crowd, she was lucky to find a seat next to an intelligent and quiet-looking, middle-aged man, who turned out to be a foreman engaged upon great building works proceeding in the City. The speed increased, and the noise and the rattling of the cars increased in proportion—a condition of things she had not expected, and it was a relief when the train slowed down and made its first pause at Holland Park. Here a few workmen got in, but not a soul got out! Mrs. Rosamond, looking about her, noticed that her *companions de voyage* were not in appearance such as she had expected at so early an hour. It is true they nearly all smoked—cigarettes mostly—some sticking to the old-fashioned short clay pipe charged with most pungent tobacco; but they did not swear or use strong language, they were not all dressed in corduroy, nor were their clothes dirty, neither did they universally carry huge "bass-bags" containing saws, and other sharp and nasty tools. Her neighbour, the foreman, with whom she soon got into a lively conversation, told her that most of the men (masons chiefly) were employed on a "big job" at Finsbury, and would travel to the Bank. He also volunteered the information that he lived in Caxton Road, close to the Shepherd's Bush Station of the Tube; that he had to get his own breakfast at 4.30 or thereabouts, or wait until he got to the City, when he had it at a snug little coffee-shop in Moorfields; that he had used the Tube ever since its opening in 1900 day after day, starting by the first train in the morning, and returning, as his place and work suited, along the route at all hours, from five o'clock to eight, and sometimes (though seldom) by the last train from the Bank at 12.30 p.m.; and that the cars between the former hours—when people were leaving the City for the day—were more crowded than in the early morning, in fact crammed, with not even standing room.

At Notting Hill Gate there was a rush of operatives. By this time the cars were packed, and the little woman perceived the uses of the sliding leather straps suspended overhead, to which the unlucky seatless ones, who filled up the whole of the gangway, held on like grim death, to avoid tumbling about as the train oscillated.

At the Marble Arch some few persons, a dozen or so, tried to push in, but the five cars were *complet*, and so they continued, until, at the British Museum Station, a section of the passengers alighted, as also at Chancery Lane and the General Post Office. Then, after a run of $6\frac{1}{2}$ miles from Shepherd's Bush in twenty-four minutes, the Central "early workmen" pulled up at the Bank terminus at a platform resembling the others all along the line.

Mrs. Rosamond went up in a big lift, not to the surface as she expected, but found herself landed in a broad asphalted, bewildering subway lined with white bricks. Brilliantly lighted white passages seemed to stretch away in all directions, full of people tearing about here, there, and everywhere in the utmost confusion, some ascending steps that appeared to lead to the daylight, others descending slopes that ended in more brick-lined passages. At once she recalled her host's injunction "to hit the right subway" for the Islington Tube Line, but becoming a trifle excited and confused, she went up the staircase that looked the shortest, and found herself in Cornhill, along which she strayed a short distance, and came to St. Michael's, when she thought she had reached the station, because she had been told it was underneath a church. But there was no City and South London Railway, and her host had omitted to say that the subway between it and the Bank was contemplated only. So Lilian asked her way, and quickly found what she was seeking close by at the corner of Lombard Street and King William Street. And now, growing confident by experience, and perceiving that the booking-office and general arrangements resembled those of the Two-penny Tube, though on a smaller scale, she went to the booking-office window and tendered twopence. The clerk politely inquired, "All the way, miss?" and on her replying in the affirmative, demanded, and received, fourpence, giving her an ordinary ticket in return. She thought this strange, being different from the Tube system, the more so when she saw no glass box wherein to drop it. But there was the lift, and so she descended. Alas! when she got to the bottom, she forgot to make inquiries, being absorbed in meditation about her husband. "What was he doing at that particular hour?" she wondered. "Had he gone out fishing? Was he making the rounds of his farm, and looking after his pet livestock, the pigs?" A train came up, and without giving the matter a second thought, she got into it, and found the cars pretty nearly empty. They were narrow and low, and the atmosphere was close.

Away they sped, by London Bridge, the Borough, the "Elephant and Castle," Kennington Park Road, the Oval, and Stockwell, but the guard did not call out the names of these stations, and only when the terminus was reached did Lilian rouse herself from her reverie, and stepping out of the station after giving up her ticket, gazed aghast, not at the "Angel," Islington, which she knew was a locality nearly all bricks and mortar, but upon a large open space—Clapham Common! In fact, the poor *voyageuse* had gone down the wrong lift at the Bank Station, and had failed to notice the names of the stations as she came along.

To recover her equanimity, Mrs. Rosamond thought she would stroll about a little before going back to

Islington, which, it was explained to her, was at the other extremity of the line. Much refreshed by an hour's walk and the novelty of the *terra incognita*, she booked again, and resumed her pilgrimage, determined that this time there should be no mistake.

What was it? Was it fatality? or was it some mischievous whispering spirit that caused her to keep mentally repeating the words, "Bank Station"? An echo, perhaps, of the instructions received the evening before. Anyhow, she did not go straight on, but as soon as the train reached the City, she alighted at the Bank, and found herself once more in the maze of subways branching off from the Central's booking-office. The little woman was in despair. What must she do? It was no use asking her way, everybody seemed in too violent a hurry to attend to other people; so she walked mechanically down a disagreeably steep asphalted incline and along a wood-paved, white-tiled tunnel, and saw at the end an electric Tube station. There was the usual narrow platform, the glazed tunnel, the electric light, and the four-car train, but no queer-shaped engine, and the carriages looked smaller than those of the Central and of a different build, the glazed sides sloping inwards towards the low roof. There was no booking-office, so she stepped into the train, where, as in an omnibus, tickets were issued and punched for the sum of twopence. The cars were narrow and stuffy, and she did not like them, but looking up, she caught sight of a brass plate giving the name of the engineers at Preston, Lancashire, and this quite cheered her.

In about five minutes the train stopped, and everybody got out and streamed up stairways and along passages into what proved to be a vast railway terminus —Waterloo; and she realised the dismal fact that by inadvertence she had taken the Waterloo and City Railway, instead of the City and South London! It was the word "City" running in her head that had done the mischief.

Nothing was left but to return, and so, through lofty cavernous regions beneath the terminus, over bridges, and down endless slopes of wood-paving, she managed to reach the up-platform.

Now came the rush of early City-bound men, season-ticket holders, who had travelled by the London and South Western line from all parts of Surrey served by it. They came pelting down the inclines as if their lives depended upon catching a particular train. Most of them carried neat hand-bags, suggestive of legal documents or company prospectuses, and nearly all had a morning paper. The bulk of them were well dressed, with an indefinable air indicative of the suburban resident. Mrs. Rosamond found them exceedingly pleasant, and was soon chatting with a military-looking gentleman, irreproachably groomed, with a lined and shrewd face, and old enough to be her father. He was, in fact, an eminent solicitor in Tower Royal, Cannon Street, who, hearing of her adventures, appeared to sympathise very deeply. "A little *too* deeply," said her husband, on hearing her narrative, not that he was distrustful or jealous, but he preferred to do most of the sympathising himself. The man of law tried to be facetious, and in explaining at some length the difference between metropolitan "tubes" and the "Underground," so confused Mrs. Rosamond that she ended by thinking they were one and the same thing—a fatal error on her part, as we shall see. Dilating upon the subject, and upon the trials she had endured that morning, he remarked that he was sure her friends and the world in general would be great losers were so pleasant and vivacious a lady as herself to remain underground. At which fair Rosamond smiled—she had beautiful teeth, and a smile became her; but she grew somewhat reserved in manner when he insisted upon escorting her along the right subway, and felt decidedly relieved when he courteously left her on the pavement at the "Poultry," by Mappin and Webb's.

It was getting on towards eleven o'clock, and Mistress Rosamond, who, beyond a cup of coffee hastily swallowed before she started, had tasted nothing for six hours, began to feel faint, experiencing that distressing sensation which makes one think the ground is about to rise up and strike one, and that hearing and vision are about to fail. She *must* have something to eat and drink, but *where?* Dimly she recalled how in the old days a very dear brother, who knew his London well, was fond of expatiating upon the merits of certain reliable places in the City where the inner man could be most satisfactorily refreshed—Birch's, Sweeting's, Pimm's in the "Poultry." Why, she was actually standing in the "Poultry"! So, following the curt, but respectful, directions of a civic policeman, who must have been at least six feet two inches in his stockings, she, without crossing the road, easily discovered the haven of refuge in question, and being shown up to the ladies' dining-room, sat down at a table near a window which looked upon busy Cheapside.

Though rather too early in the day for the regular menu, consultation with a grey-headed waiter—who strongly reminded her of some Church dignitary (a dean for choice) in layman's attire, and who became immensely interested in his client, partly because her blue eyes recalled to him those of a daughter "lost awhile"—resulted, within twenty minutes, in a dainty repast, some scalloped oysters, a "portion" of the choicest Scotch salmon cold, with cucumber, and dainty roll and butter, followed by a cheese soufflé, and—by the "dean's" advice—neither tea, coffee, nor wine, but a glass, just one glass, of Pimm's "particular" stout, a beverage our traveller was unaccustomed to, but found an admirable accompaniment to her fish luncheon. The bill was paid with a handsome *douceur*, which the "dean" condescended to accept; and refreshed, and with renewed determination to carry out her original line of march, Mrs. Rosamond stepped out and walked along Cheapside.

There the shops at once attracted her attention: the jewellers, the hosiers—in one of which latter she bought some neckties and collars for her spouse—the print-sellers, and the London Stereoscopic Company's seductive window. Here she looked up at the church clock far above her head, and finding the time getting on, and becoming just a little flurried at the discovery, started at once to resume her wanderings. "If you please, constable, can you tell me the nearest way to the Underground Railway?" "Straight as you can go, miss, down the lane, Bow Lane, in front of you, and you will find the station across the road at the bottom." "Thank you very much," and, mentally, "What a fine set of fellows the City policemen are! I wonder if they are all married; where do they live, and what are their wages?"

Straight down the narrow lane she went, and at the Cannon Street end asked another policeman the way to the Underground. He pointed to the opposite side of the road, and, stopping the traffic, conveyed her across, and she found herself in the Mansion House Station of the District Railway.

There were no officials to be seen, only the booking-clerks, one of whom, with the professional instinct for turning an honest penny for his employers, instead of advising her to return to the Bank close by, up Victoria Street, promptly recommended her to book by the District Railway to Bishopsgate Street, get across Finsbury Circus to Moorgate Street, and then take the City and South London Tube Railway to the "Angel."

By this time Mrs. Rosamond had become too tired to discuss the matter, and was disinclined to go back by the way she had come. So she got into a first-class carriage of a Circle train, and, with a sigh of relief, settled down snugly into the far corner.

Whether it was the reaction, or the effect of the glass of stout, was never known, but after passing Cannon Street Mrs. Rosamond began to feel drowsy and dreamy, imagining she was nearing home in the local train, and wondering if her husband had received her telegram, and would come to meet her. She fell asleep, and a lovely picture she made, with lips slightly parted, and her long, curved eyelashes resting, like a child's, on her soft cheeks. There was revealed just a few inches of well-fitting black silk clocked stockings, neatly-turned ankles, and a charming pair of very small dark tan shoes.

Time sped on, and, with it, the Circle train, past Bishopsgate, Farringdon Street, and King's Cross, with its maze of metropolitan underground lines; through dismal tunnels, black with smoke; through brick-lined cuttings, foul with sooty deposit; past stations, each one hung, by way of adornment, with the same monotonous, highly-coloured "works of art," drawing attention to Colman's Mustard, Reckitt's Blue, Nestle's Milk, Bovril, Oxo, Lemco, Globe Polish, Ogden's Cigarettes, Bird's

Custards, and Stephen's Inks, and provided with penny-in-the-slot machines, with bookstalls bearing a strong family likeness, and with here and there a refreshment bar, where buns and sandwiches of the Mugby Junction type might be had.

At High Street, Kensington, where the engine was changed, the guard looked in, admired the sleeping beauty, and discreetly withdrew in silence.

In the middle of the tunnel between Sloane Square and Victoria, the train pulled up with a jerk, the signal having been suddenly put against it. Mrs. Rosamond woke, and looking at her watch, found that she must have been slumbering nearly an hour, and a fellow-passenger told her that by the time the train reached the Mansion House Station she would have completely traversed the circle of the Underground! "Well, I *will* see this matter through," she said to herself, "and I will not go again into that horrid Bank Subway. After all, I shall soon be at Bishopsgate Street." So she went on.

How, on her arrival there, she escaped having to pay the full fare, no one knows. She kept her own counsel; but the ticket collector and the guard probably thought she was too nice to be worried with interrogations.

Her brief impressions of the Underground were that only in a few respects was the Tube an improvement upon it. The Inner Circle Trains, she thought, ran more smoothly; there was less rocking of the carriages, and less rattling noise; but they were badly lighted; the banging of doors was awful; the atmosphere sulphurous and stifling; and carriages, stations, staircases, and tunnels looked as if they had not been cleaned for months. Worse than all was the mode of pulling up the train with a jerk, which, at each stopping-place, almost invariably threw the alighting passengers into their fellow-travellers' laps.

Resolved now to ask her way at every step, she contrived, by minutely following directions, to find and to cross Finsbury Circus, whence she was quickly in Moorgate Street, and at once discovered the City and South London Railway Station. Continuing to seek information for the Islington lift, the Islington platform, and the Islington train, she would not budge an inch until she had been thoroughly posted up. Once more in a Tube car, and by way of Old Street, and the City Road, she at last arrived at the "Angel," and felt as if she had indeed reached the gates of heaven!

Milner Street was close by, and she was soon at her aunt's house, but, alas! not to breakfast, for it was nearing twelve o'clock. That relation, an impatient woman, tired of waiting, had gone out for the day, and had left no message! This was too much for the little woman, it was the last straw, and flinging herself on the sofa, she thought sympathetically of how in the past

> "A north-country maid up to London had strayed,
> Although with her nature it did not agree;
> She wept and she sighed, and she bitterly cried,
> I wish once again in the north I could be."

Quickly she returned to Shepherd's Bush, *viâ* the Bank and the Twopenny Tube, in the latter finding a totally different class of people from those she had travelled with in the morning, and plenty of room for everybody. She went back home the next day, sacrificing her seat for the Coronation procession; and she registered a vow that if ever she came to London again she would study closely the route for any proposed expedition as carefully as if she were on an "unaccompanied" Continental tour.

She kept her vow; and, I believe, eventually, her "bump of locality" became considerably developed.

The moral of this practically true sketch is, that in view of the complicated system of metropolitan Tubes and Undergrounds, no one without an experienced escort, unless endowed with a talent for locality, can hope to get about London without trouble and difficulty. In fact, a *Metropolitan Bradshaw*, or *Metropolitan Guide to Underground London* is urgently needed.

CHAPTER IX

LONDON'S TANGLED TUBES

"Tangled in the fold of dire necessity."—MILTON.

THE TANGLE

TO inflict upon the readers of this book a map of existing and projected railways in London would be cruel; and for them to try to master it would be torture worthy of the Inquisition, with loss of reason as the inevitable result.

Roughly speaking, the lines above and below ground stream inwards from the outskirts, after the fashion of the tramways; with this marked difference that there is a direct communication from east to west by the Central Railway, and an Inner Circle route engirdling the middle portion of Greater London.

As with the tramways, the routes of nearly all these lines appear to have been adopted happy-go-luckily. "Here are Highgate, Walthamstow, Beckenham, Kew, Hendon," say the promoters; "what we have to do is to make a railway from these suburbs, and, somehow or other, get as near the metropolitan centres as possible, and dump down our passengers. The problem of inter-communication is not our business. We leave that to others." So the lines of the various companies meander away, often by the most indirect routes, and finally arrive more or less near their objective destinations, Charing Cross, or the Bank of England.

If Napoleon the Great with prophetic glance could have foreseen London linked to distant villages in every direction, these hamlets growing into towns, and as population increased, being irresistibly drawn into Greater London's maelstrom of brick and mortar, even he would have been appalled by the problem of how to give ready means of access from one part to the other. Anticipating railways and electric tubes, he would probably, with the marvellous fertility of resource that distinguished him, have formulated a plan whereby a given circular space in the metropolis would be divided into sections, a mile square, with a station in the centre and at each corner, so that all within that area would have access to a railway, at no point more than half a mile distant, the tube railways below the surface, and others above, converging at a great central depôt. On reaching the limit of the circle, the lines (that would necessarily cross under and over one another) would, by means of loops, return and keep up a continued circulation of traffic from rim to rim of the circle, which, as the city grew bigger and bigger, could be enlarged, and the lines extended, the process continuing *ad infinitum.*

This, of course, would have been an impossibility; the characteristic British love of half measures and of temporising being opposed to any really comprehensive and imperial scheme, and local jealousy would not have tolerated the necessarily masterful, though wise, domination of a One Man Power in carrying out the plan.

Therefore the great railways and the suburban railways were allowed to do pretty much as they liked, as seen in the entire absence of system in approaching London, and in dealing with its vast traffic.

To meet the difficulty a central station has often been mooted, and much good would ensue therefrom if it accommodated *all* the lines. Recently, in connection with the Great Western Railway, the idea has been revived, and the site of Christ's Hospital suggested. In fact, it is an open secret that overture upon overture has been made on the subject, but the enormous price demanded by the old school authorities has always been the bugbear.

The feasibility of an Inner Circle Tube, however, linking together all the lines, with ramifications to serve the suburbs, worked jointly under a pooling arrangement by the various companies, has commended itself to certain experts.

It is true that four of the great trunk lines are already connected by subways with the Inner Circle Railway—the Great Eastern at Liverpool Street; the Great Western at Praed Street; the London, Brighton, and South Coast at Victoria; and the South Eastern and Chatham at Cannon Street, Blackfriars, and Victoria. The Brighton Company has already a subway connection between London Bridge and the City and South London Tube Station there, and the Mansion House subway will by-and-by be similarly connected with the City and South London Bank Station.

Also there are the purely suburban lines to be considered, such as the South London Railway, worked by the Brighton Company; the Metropolitan Extension, a part of the Chatham Company's local system; the West London Railway, which gives a north-to-south connection at Chelsea for several companies; the Hammersmith and City Railway; the Hampstead Junction Railway (from Willesden to Tottenham); and the local services of the London and North Western; the Great Northern Railway (already committed to a tube); and the Midland Railway, which, with the

Great Northern, has access to the south of London, *viâ* Ludgate Hill.

But the matter now engaging public attention is not Subways, but Tubes—how to disentangle the different schemes, and evolve order out of chaos.

The Tubes open for traffic are the Waterloo and City Railway; the City and South London Railway; Clapham Common to the "Angel," Islington; and the Central London from the Bank to Shepherd's Bush. While those in progress more or less advanced, are the Great Northern and City Railway; the Brompton and Piccadilly Circus Railway; the Bank to Finsbury Park; the Baker Street and Waterloo Railway; Paddington to Waterloo, and thence *viâ* St. George's Circus, Southwark, to the Elephant and Castle.

All last session members of the House of Commons were, so to speak, overwhelmed with Tubes.

> Tubes to the right of them,
> Tubes to the left of them,
> Tubes in front of them,
> Volley'd and thundered!

But the Select Committees fared worse, the task before them being even more arduous. There were promoters who sought for powers to construct Tubes to cross and recross proposed and existing lines, and even to bore parallel with others, while some wanted to create isolated and disconnected sections, leading apparently nowhere. Petitions and protests against the various schemes poured in from innumerable sources; from every quarter petitions in favour were also laid down at their feet. Truly, the members of the Committees found that of making many Tubes (as of books) there was no end, and that much railway promoting was a weariness of the flesh.

Long and loud waged the conflict of the various aspirants to bore through the foundations of London. The smaller promoters' attention finally became fixed upon the financial and legislative duel of two magnates, each representing a similar and important scheme for joining together the existing unlinked metropolitan tube lines.

It was as if through some narrow gorge leading to desirable pasturage, the smaller denizens of wood and forest tumultuously endeavoured to force a passage, and falling out by the way, their strife was suddenly arrested to watch the single combat of two rival antlered monarchs of the glen, who fought to the death to obtain the sole right of way.

Out of the Parliamentary hurly-burly emerged triumphant the well-known Yerkes group with its comprehensive scheme (the first in the list given below), the only very important one sanctioned.

Thus closed the session of 1902, and in the Railway Committee Rooms, for a time at least, the

> "Fiery fight is heard no more,
> And the storm has ceased to blow."

The following Tube Railways were authorised:—Brompton and Piccadilly Circus Railway (Acts 1897, 1899, 1902), that of 1902 authorising *inter alia* its amalgamation with the Great Northern and Strand. The Charing Cross, Euston, and Hampstead Railway to be continued to Edgware by a previously authorised line (Acts 1893 to 1900 and 1902). The City and Brixton Railway, to cross the Thames independently of the City and South London Tube, and to have stations at St. George's Circus, Southwark, and at Kennington Oval (Act 1897), with a new City station communicating with the South London Railway (electric). The Great Northern and City Railway, Finsbury Park to the Bank. The Metropolitan District Railway (Act 1897), a Deep-level Electric to work with the Brompton and Piccadilly Tube. The North West London Railway (Act 1899) from the Marble Arch to Cricklewood.

THE ROYAL COMMISSION

For some time past it had been made clear that no Select Committee of the Houses of Parliament, however efficient, could be expected to cope with the problem of metropolitan combined tubes, tramways and vehicular street traffic; and in view of the probability of other Tube Bills being promoted during the session of 1903, it was strongly urged upon the Government to consent to a Royal Commission on the matter.

So, before the meeting of this year's Parliament, a Royal Commission was appointed with a most comprehensive programme of arduous work.

General satisfaction seems to have been expressed with the composition of the Commission. No better chairman could have been found than Sir David M. Barbour, whose acquaintance with official inquiries is probably greater than that of anyone else in Great Britain, he having been associated with several Royal Commissions. Special knowledge bearing on the peculiar problems to be solved, characterises most of the members. Sir John Wolfe Barry is perhaps the best-known consulting railway engineer in the country, having acted in this capacity to many of the leading railway companies, and, in 1901, having taken part in the inquiry respecting vibration on tube railways. Sir George Trout Bartley has represented North Islington in the House of Commons for nearly eighteen years, and from lifelong residence in

London has a wide knowledge of its needs. Earl Cawdor has been Chairman of the Great Western Railway for the last eight years. Viscount Cobham has been a Railway Commissioner since 1891, and prior to that, was temporarily Deputy-Chairman of the Great Western Railway. Sir Joseph Dimsdale, being a banker, has had wide experience as a financier. Ex-Lord Mayor, and City Chamberlain, he represents in the House of Commons the City of London, which is vitally concerned in the question of efficient transit. Mr. G. S. Gibb, the General Manager of the North Eastern Railway for the past twelve years, is a railway expert of great experience. As Permanent Secretary of the Board of Trade, Sir Francis J. S. Hopwood has a specially trained mind, and an intimate acquaintance with railway matters, having been formerly Secretary of the Railway Department. Mr. C. S. Murdoch, C.B., has been for many years in the Government service, and has acted, since 1896, as Assistant Under-Secretary of the Home Department. Sir John P. Dickson-Poynder is a member for the Chippenham Division of Wiltshire, and represents St. George's, Hanover Square, at the County Council. Sir Robert T. Reid, K.C., member for Dumfries since 1886, was Attorney-General in the last Liberal Government, and may be regarded as the official representative of the Opposition on the Commission. Lord Ribblesdale, a member of the London County Council, was Chairman of the Joint Committee of the Lords and Commons on Tube Railways in 1901.

Soon after the appointment of the Commission it was suggested that the labour would be considerably lightened if the subject of pedestrian and vehicular traffic included in their programme were eliminated or, at any rate, indefinitely postponed, and attention concentrated upon Tubes and Railways, making—as they have the power to do—an interim report; and thus avert disastrous delay in the realisation of the Tube Schemes before the Parliament of 1903.

Early in the session a somewhat significant announcement was made in the House of Commons, in reference to these schemes; only two of which were very important, viz., the Central London's proposal to complete the circle; and the North-East London Railway scheme, which (if passed) will embrace twenty-two miles—nine being in tubes—tapping the traffic between the City and Leyton and Walthamstow, whose combined population is over two hundred thousand people.

The following is the statement made on the 2nd of March by Mr. Jeffreys, as Deputy-Chairman of Committees, who said he had had the advantage of a conference with the Chairman of Committees in the House of Lords and the President of the Board of Trade, and they had come to the conclusion that certain of the bills connected with London traffic ought to be postponed until the result of the Commission dealing with this matter had been reported. The deep-level railways which they thought ought to await the completion of this inquiry were the Central London Railway; Great Northern, Piccadilly, and Brompton (New Lines and Extensions) Bill; North-West London (Marble Arch to Victoria) Railway Bill; Clapham Junction to Marble Arch Railway (Nos. 1 and 2) Bill; Metropolitan District Railway Works Bill. There were certain other Bills which they thought might go to Committees, viz.: Charing Cross, Euston, and Hampstead Railway Bill; Great Northern, Piccadilly, and Brompton Railway (Various Powers) Bill; Baker Street and Waterloo Railway Transfer Bill; and the City and North-East Suburban Electric Railway Bill.

There were, besides, certain other railway measures which were doubtful, and these, they thought, ought to be held over until the Chairman of Committees of the House of Lords, the President of the Board of Trade, and himself had considered them. These Bills were the City and South London Railway (Angel and Islington) Bill, and the Metropolitan District Railway (Various Powers Bill).

But the Royal Commission is, after all, only a temporary expedient; and the question remains, as to what shall be the Governing Power of London's railway traffic; for it must be taken for granted that both the City Corporation and the London County Council frankly admit that the underground locomotion of the metropolis has become so complicated that the general supervision of some great public department is necessary. Is it to be the London County Council, the Board of Trade, some new body resembling the Light Railways Commission, or a joint committee of members of both Houses of Parliament, appointed each session, to consider all questions affecting locomotion in or near London?

Here we are reminded that the London County Council has been considering whether or not to apply for parliamentary powers to take over the burden of linking together the various districts of London by a series of tubes. A colossal undertaking, involving, it is said, a capital of fifty millions!

Whether it be advisable for the Council, in addition to its other heavy responsibilities, to extend its municipal trading on so vast a scale, is doubtful; for it has the ratepayers to consider.

If it be the fact that mercantile enterprise cannot grapple with the task, then there would be good and sufficient reason for the Council or the Government to attempt it. But private capital is generally obtainable for a really promising scheme.

Besides, such gigantic undertakings obviously require men of good business capacity and considerable railway experience to devote their time exclusively to the work. One would think that county councillors (as such), efficient as they may be, have already as much work as they can readily get through, from one week's end to another.

CHAPTER X

LONDON'S LATEST AND LONGEST TUBE

"Green pastures and Piccadilly."—W. BLACK.

SANCTIONED by the Legislature as one of the most comprehensive schemes laid before it last year for linking together existing underground, as well as trunk, lines, the Great Northern, Piccadilly, and Brompton Railway, now under construction, has attracted such universal attention, and traverses such hitherto exclusive quarters, that it deserves more than a passing reference.

From a traveller's point of view, the effect of this new railway will be far-reaching. Dwellers near District Railway termini, such as Wimbledon, New Cross, Bow Road, South Harrow, Hounslow Barracks, Richmond, and intermediate stations, will have, by means of exchange—at Earl's Court Station with the Metropolitan District Railway; at Gloucester Road and South Kensington Station with the Metropolitan and Metropolitan District Railway; at Piccadilly Circus Station with the Baker Street and Waterloo Railway; at Cranbourn Street Station with the Charing Cross, Euston, and Hampstead Railway; and at King's Cross and Finsbury Park Stations with the Great Northern Railway—ready access to practically all centres and quarters of our big city; its own immediate objective from Earl's

Court being Finsbury Park, a distance of 7½ miles. It is similar in construction to the Central. The cars, built at Loughborough, will resemble those of the new Inner Circle, and the driving force will come from the Power House at Chelsea.

Truly, under pleasant scenes will the new Tube be carried—as fashionable, romantic, and historical a route as any in London. Here is Earl's Court, where, in the midst of market gardens far away from town, once stood John Hunter's house, where the great anatomist kept a menagerie of wild beasts to experiment upon, and in the dead of night boiled down the body of O'Brien, the Irish giant, to obtain the skeleton, which now adorns the museum of the College of Surgeons. The well-known Edmund Tattersall lived close by for many years at Coleherne Court, on the site of one of either Fairfax's or Lord Essex's redoubts (they appear to have had a good many), thrown up after the battle of Brentford, when the victorious Royalists were expected to cross the river (which they never did) and besiege London.

Gloucester Road, the next station, recalls the fact that when the District Railway came there, it was still a mere lane with hawthorn hedges, a blacksmith's forge somewhere near, while pleasant paths right and left led to orchards, in the midst of which was St. Jude's Church, so famous later on for its fashionable congregation and its eloquent preacher, the Rev. Dr. Forrest, now Dean of Worcester.

From Gloucester Road the Tube runs under pleasant Stanhope Gardens and part of Harrington Road with its fine mansions, to South Kensington. The ground about the Hoop and Toy Tavern close by was, so tradition says, designated in the draft Parliamentary Bill for the

Great Western Railway terminus. At that time the site was sufficiently countrified to satisfy those who would banish railway stations to Jericho or to the uttermost verge of London, and remained so for a long time; and I have been told by an old Bromptonian that he has seen a covey of partridges put up where the Natural History Museum now stands.

At this point the new Tube—leaving its course parallel with, but at a far deeper level than, the District Railway—proceeds unaccompanied to Piccadilly, and, so to say, enters the Brompton Road at the Oratory of St. Philip Neri, formerly a very plain brick edifice erected by the Oratorian Fathers, who had begun their good work on a humble scale in King William Street, Charing Cross, in a building subsequently occupied by Woodin, the ventriloquist, and later on by Toole, as his own peculiar theatre.

The present conspicuous basilica is at last completed, all but the towers. Adjoining it, down an avenue of trees, recalling the approach to Shakespeare's last resting-place, is Holy Trinity Church, Brompton, reminiscent of Dr. Irons, its vicar, who ultimately became Rector of St. Mary Woolnoth, beneath which is the City station of the City and South London Electric Railway.

Brompton Square is close by, associated by many of us with a once popular song, "Ada with the golden hair," composed and sung by G. W. Moore, of the Christy Minstrels. In this Square have dwelt many actors and actresses: Wigan, Buckstone, Robert Keeley, etc.; and also Shirley Brooks. At one corner used to be a house standing a little back from the road, occupied by an eccentric individual whose craze was to have several clocks in every room, and the task of keeping them in order encouraged a watch-and-clock-maker to settle down in a small shop next door. Another feature of his craze was to present a watch of some kind to every lady he knew; so that his neighbour must have done a fair business. A bank now occupies this site, and the author recollects watching the strong-room being built deep down in the gravelly soil peculiar to South Kensington. Next door will be located the unpretentious Brompton Station of the new railway. An official of the bank was heard to remark facetiously that he trusted the Tube would not bore into the strong-room aforesaid—a new possibility and grievance to be duly noted.

Directly underneath Brompton Road goes London's latest Tube, passing "Harrod's," the most palatial General Store in the metropolis, if not in the world. It originated some years ago in a narrow little shop, where good tea, excellent butter, and, rumour says, jam made by Mr. Harrod's mother, were the chief articles sold to the customers, the bulk of whom were of the working-class.

Now Knightsbridge is reached, in olden times called Kingsbridge, when it was represented by a bridge only (on the site of the modern Albert Gate), built by Edward the Confessor over a brook, or bourn, rising, like the Tybourn and the Oldbourn, in the Hampstead Hills, and flowing thence to the Thames.

No part of London has so completely changed in appearance as this; lofty modern buildings having taken the place of small old-fashioned houses. These improvements culminate at Sloane Street, where anyone approaching town by way of Kensington, meets the first of the numerous metropolitan "rond-points," surrounded by mansions and shops so tall as to put into the shade the French Embassy and the houses at Albert Gate, which for many years were considered the highest in town. At the equestrian statue of Field-Marshal Lord Strathnairn, four thoroughfares converge—Kensington Road, Brompton Road, Sloane Street, and St. George's Place—pouring around it a continual stream of traffic day and night. Three of these thoroughfares are perfect paradises to ladies who delight in such alluring shops as Harrod's, Harvey Nichols and Co., and Woolland Brothers, whose prolonged and magnificent frontages are unequalled in Modern Babylon.

A few doors from the "rond-point" in Brompton Road is a Tube station; and the workmen, as they bore close to the triangular grass-covered enclosure in front of Tattersall's, are probably unaware that a comparatively slight deviation would take them through a pit beneath the enclosure, which, tradition avers, was used, during the Great Plague of London, for the dead. It is likely enough; for centuries ago there existed, a little to the east of Albert Gate, a hospital belonging to the Dean and Chapter of Westminster, which in 1665 was given up for the use of infected patients; and as this little piece of ground has never been disturbed, it probably was originally the burying-place attached to the hospital, and was converted into a plague-pit.

A house close to Hyde Park Court was once occupied by Charles Reade, the novelist. At a house close by (long since pulled down), Horace Smith, joint-author of *Rejected Addresses*, lived from 1810 to 1818, and drove himself daily to and from the City—he was then a stockbroker—in a vehicle called a "whisky." A little farther on, where the London and County Bank is dwarfed by the late Sir Herbert Naylor Leyland's great mansion, used to stand the "Fox and Bull," a quaint old tavern dating back to Queen Elizabeth's time, and a favourite resort of Sir Joshua Reynolds, George Morland, and other painters. Holy Trinity Chapel, St. George's Place, no longer wedged in between two public-houses, replaces an old church where the celebrated Prime Minister—then plain Robert Walpole—was married in 1700 to a Lord Mayor's daughter, who became the mother of Sir Horace Walpole. In St. George's Place, where it faces the Park—surely one of the most desirable of situations, the first intimation that we are approaching "Green pastures and Piccadilly"—is the Hyde Park Corner Station of the new railway, next door to No. 8, conspicuous as the residence of the Baden-Powell family, on the site of which house, in an old-fashioned tenement, lived for many years John Liston, the comedian identified with the character of "Paul Pry." Being freehold—a unique feature in the neighbourhood—this small plot of ground has cost the Company dear. It had to pay £30,750 for its acquisition.

It is hard to believe that at this point London once terminated, Lanesborough House, where St. George's Hospital stands, being described in Pennant's days as a "country mansion," and thus it remained until little more than a century ago. While in the time of Charles the Second, near Hamilton Place was an inn, bearing the sign of the "Hercules Pillars," signifying that, like the "First and Last House" at Land's End, no habitation existed beyond it.

All sorts and conditions of people, mostly distinguished, live, and have lived, along this part of the route, which has its Tube stations at Down Street and Dover Street. There is Apsley House, and next to it Baron Rothschild's mansion. At No. 1 Hamilton

Place lived the great Lord Chancellor Eldon. From 139, Piccadilly (Lord Glenesk's) Lady Byron, after one of her quarrels with the poet, fled with her infant daughter. At Nos. 138 and 139, formerly one building,

FIG. 14. THE WESTERN APPROACH TO PICCADILLY.

the Marquis of Queensbury (the notorious "Old Q.") used, when an octogenarian, to sit at a certain window for hours, and ogle the passing fair sex. Gloucester House adjoining, is the residence of the Duke of Cambridge, occupied, when it was Elgin House, by the Earl of Elgin, who brought over to England the famous marbles that bear his name. Nearly opposite Down Street, on the park side of Piccadilly, stands a curious reminder that once upon a time, parcels and packages of all kinds had to be conveyed all over London, not by train or by Carter Paterson's speedy vans, but on the shoulders of stalwart porters. It is a "bulk," replacing an old timber one. A "bulk," it may be explained, is a kind of shelf supported by two posts at a convenient height for the bearers of burdens to temporarily dispose of them and rest awhile. On the site of No. 106 (the St. James's Club) was formerly the "Greyhound," a very old inn, which, with the "White Horse" close by, and the "Half Moon," a little further on, was a favourite pulling-up place for the numerous carriers, tranters, and market-gardeners who were incessantly coming from the country to town; for Piccadilly was one of London's great highways westward. In a house (now a club) at the corner of White Horse Street, Sir Walter Scott sometimes stayed when in town. Cambridge House (the Naval and Military Club) recalls Lord Palmerston and the notable political receptions of his accomplished wife. At the corner of Clarges Street, where lived Edmund Kean and also Lady Hamilton, is the Turf Club, and at No. 84 the Imperial Service Club, the last of Piccadilly's line of clubs that, commencing with The Bachelors', at the corner of Hamilton Place, forms a kind of approach to the real club-land of St. James's Street and Pall Mall. Bath House, at the corner of Bolton Street, was the residence of the late millionaire, Baron Hirsch. No. 80, Piccadilly, and No. 1, Stratton Street together form the town house of the Baroness Burdett-Coutts, and it was from No. 80 that her father, Sir Francis Burdett, M.P., was, in 1810, amidst serious rioting, taken to the Tower for having made use of bad language in the House of Commons. From the roof can be obtained a splendid view of the Westminster and Pimlico district, across the Park, rightly called "Green," with its beautiful stretches of turf and graceful trees, and far away to the Surrey Hills and the Crystal Palace.

Devonshire House, seen through its fine old iron gates—brought here from Chiswick—is plain enough externally, but its saloons are very handsome, and here the lovely Georgiana, Duchess of Devonshire, reigned as Queen of Fashion long ago. Arlington Street reminds us of the Marquis of Salisbury, of Earl Nelson, who lodged here, and of Sir Horace Walpole and his father. In Albemarle Street, Percy Bysshe Shelley once had quarters at Cooke's Hotel.

The Tube now carries its passengers ninety feet below the beautiful Piccadilly shops, past St. James's Street and Bond Street, the Burlington Arcade and Burlington House, past the Egyptian Hall, past Fortnum and Mason's—so universally associated with hampers, long-necked bottles, and race-meetings; past the Albany, where lived Byron, Lytton, and Lord Macaulay; past the Prince's Restaurant, and its neighbour, St. James's Church, where there are some splendid specimens of Grinling Gibbons' wood-carving, and where, in 1762, occurred a singular thing. In some unexplained manner the vaults caught fire, and two hundred coffins with their inmates underwent an uncontemplated process of cremation; past St. James's Hall opposite (eventually to be enlarged and converted to purposes other than harmony only). And now Piccadilly Circus, where six roads meet, and where, next to Spiers and Pond's Restaurant, is the Piccadilly Circus Station of this, the longest

Tube. Subways should certainly be arranged for access to this station, to avoid the very dangerous crossings from each of the six roads. Why does not the London County Council, emulating the City Fathers and their Mansion House subterranean passages, undertake this beneficent work in the West End?

We are now in the region of music-halls, theatres, cafés, dining-places, and Scott's, the famous shell-fish shop.

"What is the origin of the name *Piccadilly?*" is a question asked again and again. It is difficult to decide. Was it from the ruffs called "peckadils" (from the Spanish *pica*), whose stiffened points were like diminutive spear-heads, worn by the mashers or dudes of the early Carolean period, who gathered here at a gaming-house, Piccadilly Hall? Or was it, as Pennant thought, from the "piccadills" (cakes) which may have been sold in the surrounding fields? Who in the year 1903 can decide?

Here I pause. The rest of the new Tube's route to Stamford Hill is useful but prosaic, and none of the remaining ten stations, except Cranbourn Street, Covent Garden, and Holborn are surrounded with any remarkably interesting associations, either historical or modern.

From South Kensington to Piccadilly this railway is certainly an aristocratic one. Daintily-clad ladies will, doubtless, use it largely for shopping and paying visits. The rank and fashion of London will patronise it. Countesses, marchionesses, even duchesses, may condescend to travel by it; nay, royalty may even give it a trial! Nobody would be surprised to see its booking-office æsthetically designed; the officials well-groomed and decorous as bank clerks; the lifts luxuriously upholstered with seats for all; the *cars-de-luxe* (for which an extra charge would be made) beautifully decorated, warmed in winter and delightfully cooled during summer heats, with fresh flowers provided, and perfumes sprayed at intervals to remove the least trace of bad smell; copies of the *Court Guide* and the most fashionable magazines at the disposal of the passengers; umbrella and parasol stands; special and comfortable quarters for pet dogs; the smoking-cars models of elegance and comfort; and the guards' uniform scarlet and gold.

Seriously, however, is there or is there not, "one little rift within the lute"? Will the size of the tunnels—11½ feet in diameter—suffice for maintaining an equable and pure atmosphere throughout the year? Doubtless it will; for special attention has been given to this matter by the distinguished consulting engineer, and inlets for fresh, and up-cast shafts for foul air, together with fans worked by machinery, will be liberally provided.

CHAPTER XI

ELECTRIC TRAMWAYS GENERALLY

"And I have taken away your horses."—AMOS iv. 10.

HISTORY OF TRAMWAYS

NEARLY fifty years ago there arrived in this country an enterprising citizen of the United States bearing the name of George Francis Train, with whom will always be associated the first attempt to introduce tramways into Great Britain.

Like many other innovators, Train was ahead of his time, and after vainly struggling against indifference, and, in London, against the strongest opposition voiced by the Chief Commissioner of Works, he returned home a wiser and a sadder man, having failed to launch his great enterprise.

Not unreasonably he complained that his system had not been given a fair trial, and that his nationality was against him, pointing out that in Ireland he had, on the contrary, received sympathy and encouragement from the fact that he was an American.

The truth was, his ideas were immature, and his tram-lines utterly unsuited to the street traffic of great cities.

His first attempt was at Birkenhead, in 1860; and three years later he laid down a line, four miles long, from Hanley to Burslem, in Staffordshire, and also a short one at Darlington. In the year 1861 he constructed a line from the Marble Arch along the Uxbridge Road, and another from Westminster Bridge to Kennington Park. The track was ballasted, not paved, and the macadam very soon "rutted" on each side of the rail; but the worst feature was that the tread of the rail being an inch below the road surface, the wheels of vehicles were seriously injured and sometimes wrenched clean off as they endeavoured to leave the lines.

A tremendous agitation ensued against the tramway system. Train's rails were compulsorily taken up, and his ideas were dismissed as impracticable.

Yet the bread had been cast upon the waters, destined to be found much later on, but not by George Francis Train. For ten years after the Birkenhead line was laid down, tramways remained in a very primitive condition. the sole aim being to obtain a smooth track, and so lessen the wear and tear caused by the uneven macadam. The rolling-stock was crude in the extreme, and the rails were fastened down to longitudinal sleepers, so that the spikes invariably worked up, but this defect was remedied when steel girders came into use. The trams were, of course, drawn by horses, for until 1880 no better means of traction appears to have been thought of. Nobody was a bit interested in the tramways, and carriage-folk detested them, so they were banished to the outskirts of the City and "over the water."

The West End recognised them not, except to sign petitions against their introduction. The "poor man's street railway," it affirmed, must keep its proper place in the south, the far north, and the far east of London.

It was left to private enterprise to run the lines, and practically four companies—the North Metropolitan, the London Street Tramways, the South London Company, and the London Tramways Company—monopolised the business, there being no enterprising London County Council to compete with.

VARIOUS METHODS OF HAULAGE

For a decade—up to 1890—all kinds of improved methods of haulage were tried: compressed air, coiled springs, underground cables (a well-known example of which was the Highgate line, which was always breaking down), and, lastly, gas traction and steam traction.

To all these methods there are serious objections. Horse traction is expensive, besides being distressingly trying to the animals themselves. It is necessary to keep up a large stud for each car, and the horses when idle are eating their heads off. Their fullest speed with the heavy cars is necessarily low. Starting is a slow process, and at the best the rate of progress (including stoppages) does not exceed four miles an hour.

Compressed air and coiled springs may both be consigned to pigeon-holes, labelled respectively "doubtful" and "impossible," there being of the former scarcely half a dozen examples in Great Britain, though in America it is said to have worked well and on an extensive scale.

Cable traction has many advantages, and for a long time was successfully adopted in America, but is now abandoned. With the funicular system, in vogue in Edinburgh, Birmingham, Paris, and Melbourne, travellers have long been familiar. Where a large number of cars are employed, it has the advantage of cheapness in working, and the machinery does not easily get out of order. But the initial cost is very heavy, and it is not suitable for complicated lines, or for tramways with several branches; and therefore extensions, unless straight, are almost impracticable, though it is superior to all others, save that of electricity, for very severe gradients. As the cable moves at a uniform rate, a car can neither vary its speed nor reverse its course. Then there is a difficulty in dealing with the gas and water-pipes during construction (that is, if they are near the surface), and the conduit forms a receptacle for street refuse, and becomes insanitary. But the chief defect is that three-fourths of the total power required to haul the cars is absorbed in driving the cable.

On a small scale, and with but little success, gas traction has been recently tried. There is a difficulty in starting the engines, therefore they have to work continuously, which causes the unpleasant noise familiarised to us by petrol-driven motor-cars when standing still. There is a decided smell from the "exhaust" of the engine; the vibration is considerable; and, as at present designed, the cars cannot mount a moderately steep hill.

Steam traction has been in use for some time, but has not improved, and is not popular. Great wear and tear of the track is caused by the weight of the locomotive, and the public object to the long intervals of service, consequent upon the necessity, for economical reasons, of using large cars. Steam involves sulphurous gases and general dirtiness, besides the apprehension, fanciful or real, of an occasional "blow up."

VARIOUS METHODS OF ELECTRIC TRAMWAY TRACTION

Dismissing all these systems, we turn to electricity, as admittedly the best agent for tramway traction, and, until some marvellous discovery displaces it as a force, likely to remain and to become universally adopted.

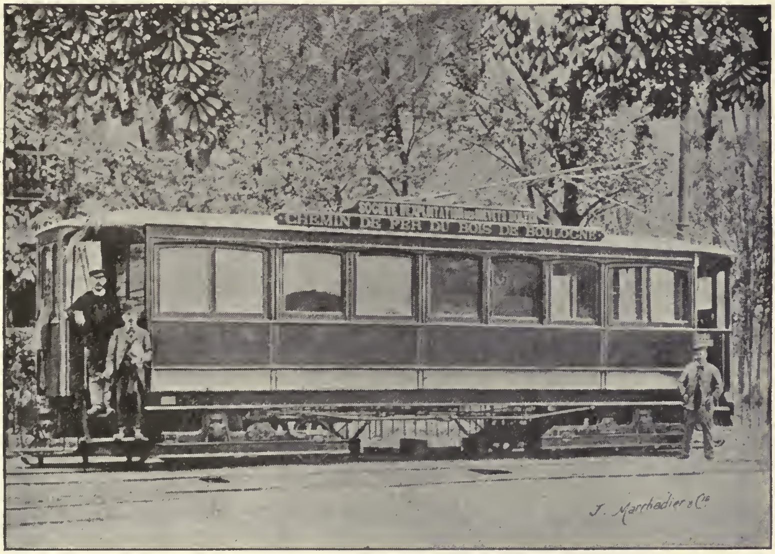
Blackpool was first in the field with an electric tramway in 1883. Several other provincial districts followed suit, including Bristol and Stockton-on-Tees. London, in 1900, welcomed the completion of Mr. J. Clifton Robinson's great scheme for electrifying that portion of the London United Tramways running between Hammersmith and Kew.

The year 1903 sees metropolitan and suburban electric trams in every direction; while in the provinces they will soon cover the face of the land, so extraordinarily rapid has been their acceptance. On every hand signs are evinced of the direct influence upon the general prosperity, comfort, and pleasure of all classes of people by a cheap and rapid electric tramway service.

The electric system admits of an easy extension of routes, and is of all systems the simplest to work. The cars can be readily backed or diverted in any direction. They are roomy, clean, well lighted and ventilated, and, if necessary, can be heated; the seats are comfortable; and the speed is double that of horses, while, without any fuss, gradients of 1 in 8 can be tackled. Of its popularity none can doubt, especially in hot weather, when exhausted town-dwellers swarm on the roof of the cars for a breath of fresh air as they travel merrily along at the rate of twelve miles an hour.

Existing tramways can be adapted to this system with rapidity, and all experts bear testimony to the fact that electric haulage is comparatively so cheap, and the development of traffic on its adoption so great, that horse traction has no chance against it.

There are four kinds of electric-tramway traction which, though apparently rather puzzling, are readily explained. These are the Conduit; the Surface Contact; the Overhead (or trolley); in each of which the current is conveyed to the line—as in an electric railway—from a power house; and the Accumulator, or Self-contained Car, the motive power being obtained from storage batteries carried on the car itself, and these supply the current direct to the motor on the car.



By permission of the *Dolter Electric Traction Co., Ltd., London*

FIG. 15. TRAM-CAR IN PARIS EQUIPPED FOR COMBINED OVERHEAD TROLLEY AND SURFACE CONTACT SYSTEM

In the conduit system the main conductors (or feed-wire), always in this country placed underground, are carried in a conduit or tube under the track, which has a narrow longitudinal slit on its upper surface level with the road. Through this slit passes a bracket carried by the car in such a manner as to make contact with the two conduit-conductors. The objections to this system are the heavy cost of construction, its liability to derangement from floods, the expense of cleaning the conduits, and its tendency to accumulate filth.

The closed conduit, or surface contact system, consists of a series of plates or studs placed along the track a few feet apart and flush with the road, and insulated from each other. Under ordinary circumstances these are disconnected with the conductor, which is laid entirely below the surface, but when a car passes over them they become, by means of switches, automatically connected with it, so that the current can be conveyed through them to the car motors. In other words, the studs are "alive" while the car is over them, and "dead" as soon as it has passed. This is a very practicable method, and in certain cases is preferable to the open conduit. Defects, however, there are, but the Dolter apparatus claims to have overcome them, and it is greatly in its favour that the system has been successfully worked in Paris for more than two years. It has the merit of readily lending itself to a combination with the overhead trolley system.

Of all systems, by far the best known to the public is that of "overhead," recognised immediately by the tall iron poles inseparable from its adoption. Ninety-five per cent. of the world's electric tramways are worked on the overhead principle. The distribution of electric energy is by means of a wire, called the trolley wire, upheld by insulated brackets on poles twenty feet above the ground, along the entire track, which is divided into sections, each section taking its current from the main conductor-wire, which is laid underground, through the iron poles. Should any one section of the trolley wires meet with mishap, only the cars working on that section are stopped; those on the remaining divisions, having an independent source of current, continue to run with-

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FIG. 16. CROSS LANE JUNCTION, SALFORD. THE LARGEST AND MOST COMPLICATED OVERHEAD TROLLEY CROSSING IN THE KINGDOM

out interruption. At the upper end is a small deeply grooved wheel which, by means of springs at the base of the trolley pole, is pressed against the under side of the trolley wire overhead, and in that position remains as the car proceeds. From the wire the electric current passes through the grooved wheel and down the trolley pole to the motors, of which there is one at each end of the car.

In all three systems the motor itself is suspended from the axle, which it turns; and the armature of the motor is parallel to the axle and nearest to the centre of the car. On the end of the armature is a small cogwheel which gears into the teeth of a larger wheel keyed to the axle, and this turns round the wheels of the car. A coiled spring supports the field-magnet of the motor, and when the driver turns the lever on to the top of the controller (which is a high box in front of each platform containing a series of wires connected with the motor), and switches on the current, the motor is lifted up on the first revolution of the armature, the coiled spring takes up the motion of the motor, and prevents the car starting with a jerk. The current, when done with, returns to the source of supply by the ordinary tram rails, which are specially connected at the joints for this purpose. It is maintained that for cheapness of construction, simplicity of operation, reliability in action, and flexibility in adaptation, this method is superior to all others.

There was at one time a certain objection to it on æsthetic grounds. The earlier examples, when clumsy wooden posts and festoons of wire obstructed the view and seemed to choke up the street, undoubtedly justified the protest against the "overhead"; but now that slender iron poles, ornamental rather than otherwise, and, in some cases, rosettes attached to the houses, are used for the suspension of the trolley wire, people have become reconciled to the appearance of the thoroughfares, and no longer object to the apparatus.

One more system, an ideal one, remains to be considered. It is that of the "Self-contained Car," which carries a battery of secondary cells, whence the current for working the motors is taken as required. But, for the present, there are serious obstacles against its general application. The great weight of the accumulators leads to a disproportionate consumption of power, and involves heavy expenditure on the permanent way and in rolling-stock. The batteries must be recharged at frequent intervals, and must either be removed from the car—a troublesome process—or the car must be kept idle while the cells are revivified. Accumulators as a rule do not live long, and have to be renewed.

Thus the working expenses are so heavy that, ideal as the system is, and delightful the smooth running of the cars, it does not pay commercially to adopt it, and we must wait patiently in the hope that one day a perfect and practical secondary battery will appear on the scenes. Great improvements in lightness and durability are in the air.

Tramcars have become luxurious compared with the makeshifts that did duty in George Francis Train's day, and each new line endeavours to make its rolling-stock superior to the others. Some cars are double-decked, *i.e.* have seats outside; some are single-decked, *i.e.* have no outside seats. They are roomy and comfortably upholstered, and the windows are curtained, or provided with louvre shutters to keep the sun out. Those of the London United Tramways are models of comfort, and people who recollect only the early examples, mostly of foreign construction, would be surprised at the advance made. They seat thirty inside and thirty-nine outside passengers, have spring cushions covered with plush moquette, and ceilings panelled in bird's-eye maple. There are electric push-buttons for signalling the motor-man; electric light is provided, and ventilators extend the whole length of the car, ensuring an abundant supply of fresh air.

No cars, however, in Great Britain have reached the pitch of perfection attained in America by the palace and parlour tramcars; the former fitted up like a Pullman, with little tables and easy-chairs, and windows prettily curtained. Of this type, perhaps the most superb is in Buenos Ayres. Decorated in early French style, it is beautifully finished; while inside it resembles a drawing-room, with windows separated by carved pilasters and draperies of white silk and gold damask. A fine Wilton carpet covers the parquetry floor, whereon stand woven cane fauteuils with gold plush seats. At each end of the car is a buffet, and one of the platforms is provided with an ice chest, while an electric heater produces tea and coffee when required.

I cannot close this chapter introducing the subject of tramways, without reference to the "Rush for the Trams" that attracted so much attention last year. The rushes in the Blackfriars Bridge Road began shortly after five o'clock and continued until seven p.m., and were described in the daily journals as follows: "South London, thanks to the L.C.C., rejoices in an excellent tram service. There are many trams going everywhere within a reasonable distance — Streatham, Greenwich, Tooting, New Cross. Now, however hard or however fast you rush at a tram, it is not to be bullied into holding more than a certain number. If, however, you rush sufficiently fiercely and with sufficient violence, you may either knock or frighten out of the way a girl who has been waiting longer than you. Some genius discovered this and rushed; others, not to be beaten, rushed also. The result is that every evening the Blackfriars Road is the scene of a savage fight for the incoming trams, where men and women meet in unequal strife. . . . All notions of chivalry, of 'ladies first,' are thrown to the winds, apparently, on these occasions, with the result that many young girls, weak women and children, rather than share in the unequal strife, are content to walk all the way home. . . . Long before the trams arrive at the starting-point, they are boarded at either end, and a jovial crowd, knocking off one another's hats, poking out one another's eyes, swarms on to them. As an entertainment, this is not without merit; as an exhibition of the passions, it is undoubtedly interesting. But if you happen to be weak or a woman and want to get on one of these cars, it is possible you will fail to consider these things. Only a day or two ago a fatal accident occurred in the rush for the trams. Such a serious case is, no doubt, rare, but small injuries must be of frequent occurrence, torn clothes and bruises part of the daily round, the common talk of those who struggle for the trams. It is unpleasantly common to see women knocked off their feet and dragged in the road. Nor is the Blackfriars terminus the only battlefield. The Westminster Bridge Road is no whit better, and there, with a roadway somewhat narrower and a somewhat larger quantity of quick traffic, the danger is even greater."

The remedy for this state of affairs was thus significantly pointed out:—

"When electricity is fully adopted the service will be able to deal with a larger traffic, for, although the same number of cars will be running, they will run faster, and each will carry 50 per cent. more passengers, so that the carrying capacity of the line will be much increased. Till then there is no hope of improvement. It is impossible with horse traction to run more cars, or run them faster."

CHAPTER XII

LONDON'S TRAMWAYS

"When all is done, the help of good counsel is that which setteth business straight."—BACON.

THE L.C.C. AND LONDON'S TRAFFIC

ALL tramways within the boundaries of the County of London—an area of some 16½ by 12 miles—will eventually be controlled and worked by the London County Council, who, under the Tramways Act of 1870, have the power of purchasing, either compulsorily at the expiration of twenty-one years from the passing of the Act, or by agreement, any tramway undertaking within their official territory. A heavy responsibility truly; but whether for good or for evil, municipal trading has come to stay, and the principle as applied to tramways seems to be particularly appropriate in this, our great metropolis, with whose locomotive system none but a very powerful and experienced governing body can ever hope to successfully cope.

Mr. J. Allen-Baker, the vice-chairman of the L.C.C.'s Highways Committee, reporting on the subject of our congested highways, said: "Even though there should be no future increase in street traffic, I believe it to be the imperative duty of the Council to seek a remedy, and how much more when we feel assured that London will keep growing, and that within the next thirty years both a water and locomotive service will have to be provided for an estimated population (in Greater London) of probably not less than ten or twelve million people; and whatever the growth *outwards* may be, the best system of rapid transit for the central districts will always become more and more essential. If, therefore, we are to cope with either our present or our future requirements, and prevent our streets from becoming really impassable, it is, in my judgment, our duty to take up the subject at once, and seek from His Majesty's Government those additional powers and amendments to existing Acts of Parliament that will enable the Council, as the central authority, to carry out these improvements in the interests of the whole metropolis."

I doubt if anybody realises the gigantic scale of Greater London's street traffic, so much of it being hidden away. It is estimated that in one year travellers by cabs and omnibuses number 580,000,000, and by tramways 400,000,000. By Underground, Tube, and suburban railways 890,000,000 travel; and should the metropolis increase at the rate expected by Mr. J. Allen-Baker, in thirty years' time there will be something like 4,000,000,000, or 11,000,000 human beings per diem, moving about on wheels or on foot.

All these facts will doubtless be carefully considered, and, if possible, the problem of London's traffic solved, by the Royal Commission—Sir David Miller Barbour, K.C.S.I., K.C.M.G., in the chair—appointed in February last to deal with the subject. (*vide* Chapter IX.). It is authorised to report:—

(1) As to the measures which they deem most effectual for the improvement of the same (the street traffic) by the development and interconnection of railways and tramways on or below the surface, by increasing the

facilities for other forms of mechanical locomotion, by better provision for the organisation and regulation of vehicular and pedestrian traffic or otherwise; and

(2) As to the desirability of establishing some authority or tribunal to which all schemes of railway or tramway construction of a local character should be referred, and the powers which it would be advisable to confer upon such a body.

THE L.C.C. AND REHOUSING

The tramway policy of the L.C.C. is so connected with the housing, or, rather, with the rehousing question, that although this book is purely on the subject of electrical traction, I cannot avoid making some reference to it.

For fifteen years, since, under the Local Government Act of 1888, the Council was constituted, it has slowly been winning the confidence of Londoners. Aggressive at first, it has relinquished the altruistic theories of youth, and it now realises the fact that it is a body of trustees acting not for one class only, but that it must administer its heritage in the interests of the community at large. Jealousy of its powers is dying out, and by comprehensive and energetic action it justifies itself as the one central privileged body able to deal with the highway, and with the housing problem of Modern Babylon.

One of its provinces, in fact its statutory obligation, is to provide new accommodation—not necessarily in the same locality—in place of all houses destroyed as unfit for human habitation. It also takes upon itself voluntarily (where no such legal obligation exists) in certain instances to provide for rehousing, and, wherever possible, this is effected in the same districts. But this cannot as a rule be done when rehousing is compulsory, and to meet the difficulty, estates have been acquired, and blocks of houses and cottages erected at Croydon, Wood Green, Brixton Hill, Holloway, Hammersmith, and other more or less suburban spots. The Model Dwellings built on the site of Millbank Prison, and inspected by the King and Queen on February 18th last, accommodate 4,500 men, women, and children. At Tooting, the L.C.C. scheme provides for 8,600 people; at Norbury, for 5,800; while at Tottenham there will be quite a new town of 40,000 artisan inhabitants.

Encouragement is given by the Council to the idea that working-men and women—since they cannot, in so many cases, live chock-a-block with their employment—should be provided with homes upon, or a little beyond, the Council's boundaries, and be brought backwards and forwards by train, for the popular 1*d.* Being practical men, the Councillors know that any transference on a large scale of London factories to the country, however desirable, cannot be effected yet awhile. And even if they could acquire sites in the centres of industry, and erect gigantic lodging-houses, the cost would be prohibitive. They have to deal with the present necessity. Their ideal is probably the workshop as it exists in London, with the heads of firms at Belsize Park, Bayswater, and Dulwich, the clerks at Wandsworth, Chelsea, and Fulham, and the workmen at Tottenham, Wood Green, and Hammersmith.

On the other hand, figures quoted by Mr. Troupe, of the Home Office,[1] show to what a large extent it might be possible to relieve congestion by the removal of factories to the country. He said that there were

[1] Report of Parliamentary Committee on Housing of the Poor, 1902.

748 factories in London classified, in the following proportions, viz. 50 for machine-making, 30 for bread and biscuit-baking, 14 for cabinet-making, 11 for turning out fruit preserves, 16 breweries, 47 book-binding establishments, 72 printing houses (not including newspapers), and 19 saw-mills. In these 748 factories close upon 200,000 people were employed, representing with their families some 600,000 human beings, and if, following the recent example of the largest cabinet-makers in London, the bulk of these removed into the country, which they might do if suitable railway arrangements could be made, a considerable number of the 600,000 men, women, and children would be rehoused amidst "fresh woods and pastures new," greatly to their benefit.

This is a dream at present, as factories cannot without great loss be summarily transferred from suitable urban quarters where water-frontages and locomotive facilities exist. They have grown up with, and in many cases created the district in which they are situated. Bermondsey has for years been the home of the leather trade, Lambeth of the pottery industry, and although Mr. Justice Grantham instances Doulton's as an awful example of an uneconomical delinquent London manufactory—their clay in Dorsetshire, their coal in the Midlands, their salt in Cheshire, and their works on the banks of the Thames—it is no light matter to break with long business ties and take up with fresh ones, not so easy to leave the old love and take up with the new.

It will be granted, however, that Mr. William L. Magden was right when he maintained that "no manufacturer about to commence business at the present day would fix upon London as a suitable position. He would choose rather a district in which land was cheap, and in which he could obtain cheap power for his machinery and transport for his goods. He should not in future be limited to the colliery districts or to the main lines of railway. Light railways serving as feeders to the main lines, and the supply of electrical energy over large areas from main power stations, could provide for both these requirements, giving the manufacturer ample assurance that his works could be run cheaply, and that the raw material and manufactured products could be efficiently handled. By such means electrical science is capable of opening up thousands of square miles in England for manufacturing purposes, the native population of which has been languishing under the chronic complaint of agricultural depression."

THE L.C.C.'S TRAMWAY SYSTEM

Whether, as regards tramways, the L.C.C. will be the central authority recommended by the Royal Commissioners, time will show; but meanwhile it has already established its tramway system, which can be seen at work in our midst. In order to understand it the more easily, it should be assumed that all the lines, including those of the London United Tramways Company, are in the hands of the Council, that they are more or less linked together, that powers for new lines have been granted, and that electrical traction in some form has been adopted throughout.

On studying a tramway map, one is struck by the fact that, starting from the central area of London, all the tram-lines meander towards the Council's boundaries, where they will eventually no doubt join and interchange through traffic with the vast light railway or rural tramway systems of various companies in the direction of north and south, north-east, south-east, north-west, and south-west; but that "through" (or cross-country) communication from west to east, practically does not exist.

In the north-west there are huge areas of brick and mortar as destitute of tram-lines as Central Australia, so that anyone living in the Regent's Park districts has to "train" it eastward, or, if he be bent on "tramming" it, has to go by an inconvenient and awkward route to Hackney or Bow.

Another notable feature of the map is that, although there are almost as many tramways on the south as on the north side of the river, there is no access from one to the other, the bridges being looked upon as sacred thoroughfares, along which tramcars—certainly not as unæsthetic as omnibuses, or waggons laden with vegetables —may not pass, although Westminster is the widest bridge in the world, 85 feet; Blackfriars, 80 feet; and Vauxhall and Lambeth will be equally wide, and broad enough to accommodate the trams without inconvenience.

At present the lines are painfully disunited, without starting-point or terminus. The gaps in the lines require to be filled up, and where this is impracticable, shallow underground tracks should be made use of. The great defect, however, would at once disappear if the lines could cross the Thames at Westminster and Blackfriars; but if this be persistently refused, light bridges or tubes ought to be specially provided at convenient points with four tracks for the use of tramways only.

The history of the London County Council's work towards the improvement of metropolitan highways dates back to the early nineties, when the Council began to acquire tramway companies. A most important step was taken in 1897, when the whole of the lines and depôts belonging to the North Metropolitan and London Street Tramways Companies in the County of London were purchased, the purchase-money being £800,000. In 1899 the Council acquired the South London Tramways at a cost of £882,043, and still more recently the control of the South Eastern Metropolitan Tramways Company and the South London Company has been effected. Negotiations for other acquisitions are pending, and, as a matter of fact, there are now not a dozen miles of tramway lines within the county which the Council has not already purchased.

The North Metropolitan lines have been leased by the Council to the Company for fourteen years from 1896. The South London lines are worked directly by the Council, and in the year 1901-2 no fewer than 119,880,559 passengers were carried over the system, 53,639,489 being at halfpenny fares and 50,913,036 at penny ones. The traffic receipts for the year amounted to over £439,000, and the mileage run was over 10,000,000. About 4,500,000 workmen's tickets were issued during the year.

Thus our metropolitan Councillors have, after due deliberation and much searching of hearts, launched a prodigious undertaking. Whether it will or will not prove too costly is another matter. Dr. Alexander B. W. Kennedy, their consulting engineer, in his report, said: "I hope, therefore, that the Committee will find themselves able to believe that the enterprise in which they are about to embark is one which will not only be for the benefit of Londoners generally, but one also which will pay its way, and on which, therefore, there would seem to be no reason for grudging such expenditure as to make the whole scheme one of a kind suitable for and worthy of the greatest city in the world."

Not long ago the Council decided to adopt electrical traction on all their lines, involving an ultimate cost of

£9,000,000, which will include the necessary generating stations, rolling-stock, purchase of smaller undertakings, and extensions. The result attained will be a splendid system, equivalent in length to two hundred miles of single track, though not larger than that of some big provincial cities. Wherever possible the system will be that of the conduit underground; more expensive than the trolley method, but in the crowded streets of London—where every inch of space is valuable—advantageous, and from a severely æsthetic point of view, preferable, because it dispenses with poles and wires. But on lines acquired by the Council where already exists the overhead principle, there will be no difficulty in arranging the cars so that they can be run from one system to the other, either with no stopping at all at the point of change, or with a delay of but a second or two. The cars, except the trucks, will be made in England by British firms, and are to be double-decked, double-bogied, and thirty-two feet long; they are to hold twenty-eight passengers inside, and forty-two on the roof, and will be in two compartments. They will resemble the Liverpool cars, described in Chapter XIII, and will be painted a chocolate colour. The speed will be a maximum of twelve miles an hour, with an average of about seven.

Supposing, therefore, that all the L.C.C. parliamentary Bills are carried through, and that all the disunited lines are properly and harmoniously linked together, and through communication established in every direction, it will be feasible to take some such day's business journey within the Council's boundaries as that of Benjamin Short which I am about to relate. But before doing so I think the very important decision of the Lord Chancellor in an appeal case, November 27th, 1902, on the subject of the maintenance of tramway tracks should be recorded :—

THE MAINTENANCE OF TRAMWAY TRACKS

On March 4th, 1900, Mr. Fitzgerald was driving a horse and Ralli car in Grafton Street, Dublin, when the horse stumbled and fell, and the respondent was flung out of the cart and sustained serious injuries. On the ground that the surface of the paving at the place where he was driving was unsafe for horses and in a condition which was a danger and annoyance to the ordinary traffic, he brought an action against the tramway company, and was awarded £1,000 damages, the jury holding that the part of the roadway for which the company was responsible was at the time slippery and unsafe, and that this was the cause of the horse falling. They, at the same time, found that the misfortune was not caused by the fabric of the pavement being improperly constructed or maintained.

The Lord Chancellor, at the conclusion of the arguments, moved that the appeal should be dismissed. The tramway company had been permitted the use of the public highway subject to certain obligations, which practically meant that while they were to use it they must take care that the safety and convenience of the public were consulted. They were not to have a monopoly of the highway, and it was their duty to take care of the public convenience in respect to that part of the roadway over which they were permitted to exercise a kind of subordinate dominion. It was not denied that the surface of the roadway became, in certain states of the weather, a danger and a nuisance to the public, and it was a strong contention to say that, having received instructions from the road authority to do that which would have prevented the accident, there should be no liability upon them. The obligation, as he read the statute, was to keep the pavement in a fit and proper condition for public traffic. How that was to be done was a question of mechanical engineering, and neither the Legislature nor the Court was called upon to enter into the question as to how it could best be done. All the judges without exception seemed to agree that the best and most proper mode of doing it was to do what the road authority directed them to do, and that they had deliberately disobeyed.

A BUSINESS JOURNEY BY L.C.C. TRAMS

Benjamin Short was born and brought up in London and if any man living knew its ins and outs he did. He was a jovial-looking little man, always called Ben, for, said his father, "We christened him Benjamin for long, but as he grew so slowly, we called him Ben for short; for *short* he is, and short he always will be—except of cash!"

Short the elder was a small tobacconist in the days when the fragrant weed was first put up and sold in packets—a paying idea, as he soon discovered—and to effectually put it into practice, he used a fast-trotting mare and a roomy, comfortable trap.

Ben, as he grew up, was allowed to accompany his father on these journeys, and having abundant powers of observation and natural quickness, he came to know more about Greater London than most men of double his age. He was cut out for a commercial traveller's career, and a traveller, in due course, he became, inheriting from his father a snug bit of capital.

At the time of which I am writing, Ben lived at

Stamford Hill, close to the London County Council boundary, in a well-built house with a bit of land at the back, in which he had invested his inheritance. He called it "The Watchmaker's Rest," and it faced the tramway line. Its front garden was the envy and admiration of the neighbours. There appeared in their season the choicest bulbous flowers, lovely annuals, herbaceous plants, chrysanthemums, and asters, all of irreproachable quality, for Short, being a sober and steady man, devoted his spare time to horticulture, at which he was an adept.

Ben Short travelled for a large wholesale firm of watchmakers and jewellers in Clerkenwell, whose warehouse was not far from the junction of Goswell Road and Old Street. Thither Short went to business every day at eight o'clock from Stamford Hill, not by a Tube ("Toob" he called it), but by the tram which passed his door. He was a first-rate salesman, working on salary and commission, as active and enduring as a bee, but as no travelling expenses within the London district were allowed him, he had to get about as cheaply as possible.

Hitherto he had been in the habit of working a single section of town until it was exhausted, and then taking up another. But one July morning the head of the firm asked him if he could vary the plan and take the pick of several districts in one day as an experiment. This was done to test Short's capacity as against that of an English-speaking German traveller, a protégé of his partner, who had already tried his best by train and 'bus to cover a large area in one day, but had blundered over the job. Ben Short, who had noticed a "foreigner" hanging about the place a good deal, drew his own conclusions therefrom, and promptly acquiesced in the proposition, and replied that he was quite willing to show how much could be done in twelve hours by one who knew his London well and how best to make use of its locomotive facilities. Ben intended to make a record!

To save time he took home with him from the sample-room his bag, an inconspicuous, well-worn old companion. It was easily carried, as the contents, though valuable, were light. Next morning at 7.30 to the minute he was at breakfast, clean as a new pin, thoroughly well groomed, a man of peace, but if you had put your hand into the side pocket of his coat you would have found a smooth ivory handle, suspiciously like that of a neat six-shooter—in case of accidents! At eight o'clock he was in a comfortable electric tram bound on his first stage to far-off Hammersmith.

The route was *viâ* Stamford Hill, High Street, Stoke Newington Road, and Kingsland Road, and, branching off at Hackney Road, by way of Old Street and Clerkenwell Road, to the western end of Theobald's Road. Thence, a long stretch by way of Hart Street, Bloomsbury, along part of New Oxford Street, into Oxford Street, past the Marble Arch, along the Uxbridge Road, past Notting Hill Gate, and down the beautifully paved, broad incline towards Shepherd's Bush, then to the left through Brook Green, and so to the Broadway, Hammersmith—one of the most interesting rides in London, and but recently added to the London County Council system, after tremendous agitation and opposition on the part of the "Tube" and others, but absolutely necessary to complete the linking of other and disjointed sections.

Here, at Hammersmith, Ben Short transacted some very satisfactory business in King Street. It was early;

his "clients" had just finished their breakfasts, their shops had been but a few minutes opened, and they had leisure to attend to his persuasive arguments. He was a favourite wherever he went, and as he carried exactly the kind of goods to attract, he quickly booked orders and was free to proceed.

On board once more, at good speed Ben was rolled along Fulham Road, leaving on the right the big convent jealously guarded by high walls, which made Ben fall to wondering how any sane young woman could voluntarily cut herself off from a world about which she probably knew practically nothing. On went the tram, past the big buildings of the Fulham Workhouse, past the entrance to Fulham Palace and the Bishop's Park, along the widened High Street of Fulham, over Putney Bridge, and by way of Putney Bridge Road and West Hill, Wandsworth (a new route), to Lower Tooting—altogether a pleasant trip at that time of the year, for gardens, at which he critically and eagerly gazed, greeted Ben in every direction.

Wasting no time, Short called upon all the most likely customers, and again he was in luck, for whether they wanted watches and jewellery or not, orders were booked.

Now the energetic little man had to get to the "Elephant and Castle." Along the Balham Hill Road, with its pleasant shops and lively pedestrians, was plain sailing enough, past umbrageous Clapham Common on the left, edged with sedate and comfortable mansions recalling the old days when prosperous Evangelicism dwelt exclusively in Clapham; then by way of Clapham Road and Kennington Park Road to the far-famed "Elephant and Castle." Here a less sharp-witted man than Short might well be bewildered by the wonderful concentration of tram lines converging from Walworth Road, New Kent Road, Newington Causeway, London Road, St. George's Road, and the road he had come by. Here, if anywhere, as at the Mansion House, well-arranged passenger subways are needed.

Our "commercial" did much business round about, for it was one of his best districts for cheap goods, and then he thought it was time to refresh the inner man. In a neighbouring cool, clean little crib—"a close borough of his own," he called it—he rested, and made intimate acquaintance with a noble piece of silver-side, some crisp lettuces, and any amount of piccalilli—he was a lover of cold meat and pickles—but, in accordance with a rule he never broke in business hours, he restricted himself to coffee as a beverage.

Short, braced up by his luncheon, was now ready to set out for the wilds of Plumstead—a somewhat long journey. He started by train from the "Elephant and Castle" *viâ* the New and the Old Kent Roads, New Cross Road, Greenwich Road, Trafalgar Road, Greenwich and Woolwich Lower Roads to Woolwich, and by the Plumstead Road to Plumstead itself. He worked the two districts together, but his luck had deserted him, and orders were fewer and farther between than he altogether liked; but he was not going to "chuck the thing up" yet. He would do a bit of the East End, and thus complete the circuit of London.

He took the same route back from Plumstead as far as Blackwall Lane, then *viâ* the Blackwall Tunnel to East India Dock Road, Burdett Road, and Mile End Road to its junction with Cambridge Road. In this neighbourhood he did his only extensive bit of walking. The district, though poor, was large, and he did a fair amount of business, but as time was getting on he decided to return home; so by Cambridge Road, along Cambridge Heath, Mare Street, Lower and Upper Clapton Roads, he got back to Stamford Hill, and was put down almost at his own house.

He had travelled by electric tramway some fifty miles at a cost of about 2*s.* 1*d.* (or a halfpenny a mile). He had done a lot of business, and had been absent just twelve hours!

In the bosom of his family he found ample compensation for his exertions. A hearty welcome and a savoury supper, accompanied by something that was *not* coffee, awaited him, and the following day the firm received him with acclamation. The Teuton was not "in it," and Ben Short reigned supreme as its chief and highly appreciated traveller.

LONDON UNITED TRAMWAYS COMPANY

Want of space forbids more than the mere mention of the South Metropolitan and the London Southern, the Woolwich and South Eastern, the West Ham, and the Northern Middlesex Tramways. But this chapter would be incomplete without some reference to the useful and popular organisation, the London United Tramways Company, that takes up the running at the London County Council's boundary.

Forty million passengers were conveyed last year over its original route of twenty-two miles, extending from Shepherd's Bush and Hammersmith to Southall, Hounslow, and Twickenham. In one week alone over a million were carried.

Last April an important extension was inaugurated from Twickenham, which brought the trams through Teddington and Hampton Wick right to the gates of

By permission of T. and T. Vicars, *Earlstown, Lancashire*

FIG. 17. BOILER-ROOM, LONDON UNITED TRAMWAYS CO.'S POWER HOUSE AT CHISWICK, FITTED WITH VICARS' AUTOMATIC STOKERS

Hampton Court Palace, and from Richmond Bridge to Hampton Court. In the near future these extensions will be connected with new lines running to Uxbridge, Thames Ditton, Surbiton, Hook, Kingston, New Malden, Wimbledon, and Tooting; while eventually these western and southern tracks will, by the system of tubes, rejuvenated underground railways, and the L.C.C.'s electric tramways, be joined to those of northern and eastern London. In three years' time, when its extensions are completed, the London United will have 100 miles of tram lines in operation.

The gauge is the standard 4 feet 8½ inches. Throughout the route the overhead trolley system has been adopted. At Chiswick is the power house, and the mains convey the electricity to sub-stations, six miles apart, where rotary converters change the alternating into direct current, and transform down the high voltage of 5,000 into the Board of Trade limit of 500. In the fine boiler-room T. and T. Vicars' automatic stokers are used, and very interesting it is to watch the machines continually pushing small charges of coal into the furnaces without any direct human agency.

Mounted on two four-wheeled bogie trucks, with two 25 horse-power motors, the handsome cars seat thirty-nine passengers outside and thirty inside. On the Sunday after the opening of the extension no fewer than 200,000 people journeyed from Hammersmith, Shepherd's Bush, and Richmond, to Kew, Twickenham, Teddington, and Hampton Court; and on Whit Monday, 1903, the number reached 400,000, thus establishing a record. So great was the rush during some part of those days that a two minutes' service of cars had to be provided.

The extension from Twickenham to Hampton Court was opened by Mr. C. T. Yerkes, the Chairman, and author of the happy alliance of train, tube, and tram, which may possibly enable many toilers in the East End to live in the country. At the least, it will give them the chance, when possessed of a little leisure and a few pence, to quickly exchange their sordid environment

By permission of the *London United Tramways Co., Ltd.*

FIG. 18. A LONDON UNITED TRAMWAYS COMPANY TRAM-CAR

for one of the numerous sylvan spots which surround London, especially in the west.

Alluding to this, Mr. C. T. Yerkes, at the inauguration, significantly remarked that it was a strange fact that London was particularly behind in transportation, being the most backward of all cities. Though during the last twenty years in London, 900 miles of streets had been made, and 340,000 houses had been built, it was only within the past few years that intramural transportation had been even spoken of. The London United Tramway Company, he said, expected to join very intimately with the Metropolitan District, forming a continuous line to Hampton Court from the City; and they anticipated connecting with the Great Northern, Brompton, and Piccadilly Circus Railway. People would be carried very cheaply, and when the District was electrified the mileage rates would be abolished in favour of uniform fares, which were far the best. Poor people who were living in an unenviable condition should have the chance of getting into the country.

On the much-debated question of American capital and American enterprise in Great Britain,[1] Mr. Speyer spoke no less to the point. He said that those who undertook to provide the metropolis with an up-to-date system of locomotion should be encouraged, for they performed a task that should have been done twenty years ago. English capital had had every opportunity of investment in underground lines, and if only half of the five millions had been subscribed in this country it was not the fault of the promoters. They would have preferred that the Underground Company should have English shareholders only, but unfortunately they had had to allot half of the shares of the Company to Americans and foreigners. One would have thought, he said, that there would have been more keenness in London to build its own underground railways, which would so materially add to the well-being of the masses. If either of the proposed lines were situated in South Africa, Australia, or Klondyke, London investors would have been tumbling over each other to subscribe. But the fault of these lines

[1] *vide* Chapter V.

was that they were at our own doors. It was a fact, incredible though it might seem, that the richest city in the world did not appear able or willing to provide the funds for what was really a public necessity—*quicker transit*. So let them hear nothing more of American invasion, if people here stood with folded arms and allowed others to do the work which they ought to have done themselves; for while they persisted in this *non possumus* attitude, no one could blame the Company if they went elsewhere.

CHAPTER XIII

PROVINCIAL TRAMWAYS

"They shall measure to their cities round about."—DEUTERONOMY xxi. 2.

THE LIGHT RAILWAYS ACT OF 1896

IN the year 1896 an Act of Parliament was passed which, it is no exaggeration to say, revolutionised tramway locomotion, and was destined to produce consequences undreamt of by the promoters of the measure.

Under the Tramways Act of 1870, Municipal Corporations had been exercising their powers of buying up existing tramways, working them in the interests of the ratepayers, and of generally entering into the business of providing a cheap and efficient means of traversing the area within their boundaries. They used the new Light Railways Act of 1896 occasionally, but only for the promotion (by two or more combined local authorities) of certain lines running through several districts.

Prior to 1870, tramways, like railways and canals, had to be promoted by special Bills, and the Tramways Act of that year was intended to facilitate their construction, and to cheapen and simplify the method of obtaining parliamentary powers, either by Bill or by the alternative of an application to the Board of Trade for a Provisional Order authorising the construction of the tramway, the said Order being subsequently confirmed by an Act of Parliament introduced by the Board.

The Act of 1870 provided that no tram line should be sanctioned without the consent of the district local authority, and that the local authority might buy up the undertaking at the end of twenty-one years at its then value—practically only the worth of the rolling-stock and plant, without any allowance for the goodwill of a going concern.

In either case (that of a private Bill in Parliament or a Board of Trade Provisional Order), if a tramway was planned to run through two or more districts, the consent of the local authorities having jurisdiction over two-thirds of the length of the line was sufficient. But this condition gave the local authorities owning just over a third of the route, power to veto the whole scheme.

Under the same Act, land, otherwise than by mutual agreement, could not be acquired by tramway promoters.

Up to 1896, electric tramway schemes had remained in abeyance, but though the Light Railways Act removed many obstacles to their increase, and made electric traction commercially possible, it did not bestow perfect liberty of action. But the fresh legislation on the subject, anticipated during this year's session of Parliament, will doubtless result in such amendment of the Act as will abolish all ground of complaint on the part of the advocates of the industry.

At the time the 1896 measure became law, hardly any Tramway Company in Great Britain, whether horse-drawn or steam-propelled, paid its way, except in a few large centres. The companies knew that the time was drawing near when they could be bought out by corporations; so they had no inducement to make expensive reforms; and only by charging high fares, and by avoiding every possible form of capital-expenditure, could they keep their heads above water. Their undertakings, one and all, sank into a state of inefficiency, and a strong public feeling arose in favour of their being reformed, and worked with improved cars and at popular tariffs by local authorities. So, one by one, these bodies absorbed the private companies, placed new rolling-stock on the lines, and adopted electrical traction, to the advantage of the public, and in one notable instance—that of Glasgow—it is claimed, at great pecuniary benefit to the ratepayers also.

MUNICIPAL TRAMWAY UNDERTAKINGS

Throughout the British Isles these municipal tramway undertakings now flourish and increase in number. Take a map, and we shall see that the coast line from the North Foreland to Plymouth is dotted with towns provided with electric trams, while inland, Camborne, a Cornish tin-mining centre, marks their western English limit. Then round Land's End along the Bristol Channel it is the same. South and North Wales show a blank until Llandudno is reached. Then up-to-date towns provided with electric traction thicken on the Lancashire coast as far as Fleetwood. In the Isle of Man there are no fewer than four electric tramways. Except at Glasgow and district, the west of Scotland is bare of any kind of tram, and continues so round the North Cape and the East Coast until we come to Aberdeen, Dundee, and Kirkcaldy. Next are clusters reaching from North Shields to Middlesbrough. After this, electric trams are to be found at Hull, Great Grimsby, and Yarmouth.

Inland are three great centres—Liverpool, Manchester, and Birmingham—around which "electrified" towns gather thickly. Isolated Guernsey and the Isle of Wight each possess an electric tram, the latter being on Ryde pier.

In Ireland there is a wide stretch of country, empty and desolate from an electric tramway point of view, *i.e.* from the Giant's Causeway to Cork, except at Newry, Dundalk, Lurgan, and Dublin. By far the greater number of these British and Irish tramways are on the overhead trolley system.

The 1896 Act provided for the establishment of a Light Railways Commission of three members, whose special work was to facilitate the construction and working of tramways or light railways in Great Britain and Ireland, the Commissioners being appointed by the Board of Trade.

Application for a Light Railway Order may be made for a county, borough, or district council by any individual, corporation, or company, or jointly by councils, individuals, corporations, or companies. Applications have to be referred to the Commissioners in the first instance, and, if approved of, are placed before the Board of Trade for confirmation. Provision is made by the Act for the purchase of land under certain conditions specified in the Lands Clauses Act. Provision is also made for enabling local authorities to acquire any undertaking whose route passes through their district, the time and terms of purchase being arranged by agreement between the promoters and the municipalities, the terms of sale, usually thirty-five years' purchase, being settled on the basis of a fair market value of the line in full work, but with no allowance for compulsory acquisition.

Local authorities, landowners, and adjacent railway companies have the right to object to proposed lines. The local authorities, however, possess no power of veto, but generally the Commissioners refuse applications from promoters if their schemes are strongly protested against by the municipalities concerned.

To what extent this Act has been taken advantage of may be judged by the fact that last year no fewer than forty-seven municipalities were stated to have disbursed, or to have decided to disburse, eleven millions sterling in their electric tramways. In several instances the municipality owns the tramways and leases them on certain conditions to large companies or syndicates, a kind of compromise between absolute urban control and unrestricted private enterprise.

How it works in the provinces can be understood by taking as examples four of the largest cities in Great Britain, viz., Glasgow, Liverpool, Manchester, and Birmingham.

THE GLASGOW TRAMWAYS

Glasgow, with a population of some seven hundred thousand, possesses the most successful and lucrative system of municipal tramways in the world, the working for the year ending May, 1902, on a capital expenditure of nearly two millions, showing a gross revenue of £614,413, with a gross balance of £200,371; and so large was the reserve fund in consequence, that it was applied to the writing off of all expenditure on the old horse-traction plant and equipment, so that the capital account included only the expenditure relating to the new (electrical) system of locomotion. In the language of the bookmakers, the city of Glasgow's tramways stood, financially, on velvet. In 1894 the Corporation began the service of tramways (heretofore leased by it to a private company) with everything new—buildings, horses, and cars—their policy being a very frequent service at low fares. Not satisfied with horses, they soon began to search about for some better method of traction, and in 1899 resolved to substitute electricity on the overhead trolley system, and accordingly the change was effected; new lines were from time to time constructed, until at the present moment Glasgow possesses, including leased lines, 140 miles of single track and nearly six hundred double and single-deck cars.

Unlike the somewhat haphazard fashion of London, the Glasgow tramway lines have been planned in a skilful manner and on a definite system, to give means of transit from the north and south and east and west of the city. It is divided into five separate and independent areas, each supplied with current from its own sub-station, but these areas can be interconnected if necessary.

On a convenient side of the Clyde, with ample facilities for obtaining coal and water, is the main generating station, built with a steel framing clothed with Glasgow plastic clay, two great chimney-shafts, 263 feet high, towering above it. In this fine building is contained a mighty specimen of what is called the three-phase distribution of electrical energy, the system being to create the power at one centre and distribute it over a wide area; that is, electricity is produced in the form of three-phase alternating current at a pressure of 6,500 volts, and sent on to five outlying sub-stations, where it is transformed to a potential of 310 volts, and then converted from alternating into continuous current at 500 volts, for working the cars. The total capacity of the main station is:—

Three-phase plant, 10,000 kilowatts.
Direct-current plant, 1,200 kilowatts.

The engines used to produce this are of 16,000 h.p. capacity, while each of the generators is of the great weight of ninety tons, almost the largest in existence for traction work.

Altogether, the tramway enterprise of Glasgow is in its magnitude and its good management almost unique. The size of its power-house will be surpassed by that which supplies the Electrified Metropolitan District Railway; but the wise and economical arrangement of its traffic can hardly be beaten, and is a model to other large cities and towns contemplating the adoption of electric tramway traction.

THE LIVERPOOL TRAMWAYS

On a large scale are the Liverpool Corporation Tramways, the total mileage being 127 of single track, the rolling-stock 451 cars, and the capital a little over a million.

When the Corporation acquired the Liverpool United Tramways and Omnibus Company's undertaking, in 1897, they at once decided to use electricity on the overhead trolley system, instead of horses. Singularly graceful centre and bracket poles with arched arms and scrollwork were adopted in the wide thoroughfares, and in the narrow streets the overhead conductor-wire was upheld by rosettes attached to buildings on each side.

The new cars are remarkably fine and comfortable, and include the Continental single-deck, with a side entrance, and the double-deck, about 27 feet long, with doors at the ends, and with three large, well-curtained plate-glass windows on each side. A special kind of staircase is fitted to these double-deckers to enable people, the aged and infirm in particular, to descend in safety even when the cars are in motion. They are also fitted with useful revolving route-indicators, which, being illuminated, light up the upper deck as well. No one can grumble at the fares charged, which are at the rate of one penny per stage of two miles. That these tramways are a great boon is shown by the enormous number of passengers—nearly 100,000,000—carried last year.

At Pumpfields, near the Exchange and Waterloo Goods Stations, and at Lister, near Newsham Park, are the power stations, each housing plant of 15,000 horse-power (up to 7,500 kilowatt capacity). The energy is distributed to sub-stations, and thence to the cars at the safe orthodox pressure of 500 volts.

The Liverpool tramway routes necessitate many twistings and turnings. The junction of lines at the intersection of the London Road and Lime Street is a sight worth seeing, there being at that place special trackwork with sixteen points.

THE MANCHESTER TRAMWAYS

Manchester—fifth largest city in the empire—has a wide district to serve, as the Corporation works certain tramways in such districts as Stockport, Heaton-Norris, etc. Thus its track consists of 150 miles of single line, and its rolling-stock of 600 cars, worked on the overhead trolley system.

These cars are of three sizes, and carry respectively 67, 43, and 20 passengers, the smallest cars being single-deck. The larger ones have six nicely-draped plate-glass windows on each side, and the upholstery, fittings, and lighting are excellent.

The estimated capital expenditure is the same as at Glasgow, two millions sterling. A speciality of the Manchester Tramways undertaking is its splendid car depôt, the site covering three acres, two and a half of which is roofed over. The façade to Boyle Street is 700 feet long, and reminds one of some large and picturesque public school, a tramway-car depôt being the last thing one would take it to be. It is claimed to be the largest car-shed area in Europe, and the covered-in portion is the most extensive in the world. In this and three other similar sheds and a few smaller ones elsewhere all the cars are stabled. Formerly they were concentrated in one place.

By permission of the Manchester Corporation Tramways.

FIG. 19. FAÇADE OF QUEEN'S ROAD CAR-SHED, MANCHESTER CORPORATION TRAMWAYS

The cars are of the British Thomson-Houston Company type, double-motored, and are fine examples of elegance and solidity combined, and fitted with all the latest improvements for the comfort of travellers.

THE BIRMINGHAM TRAMWAYS

Birmingham, as regards tramways, stands in a peculiar position. Its city area is restricted; it has only short lengths of tram lines, and these require to be linked up with outlying districts. The lines were leased to the City of Birmingham Tramways Company, but whether the Corporation will or will not take them over now, has not yet been decided. However, by a majority of fourteen votes it has sanctioned the substitution of electricity on the overhead method, and this is being proceeded with; and when the transformation is complete Birmingham and district will have an electric tramway system of nearly a hundred and ten miles. Its tramways have always been popular, and at a charge of a penny for a three-mile ride—a record for cheapness—56,000 passengers made use of them on Mafeking Day, no small proportion of a city of 522,182 inhabitants!

Before quitting the subject of tramways, it will be interesting to note the fares charged in different parts of the world. In London they begin at a halfpenny. On the Continent they vary; for example, in Berlin the fare is $1\frac{1}{4}$*d.* for two miles, and a halfpenny for each additional mile; in Paris it is 3d. inside, with transfer ticket, and $1\frac{1}{2}$*d.* on the platforms, or outside the car; in St. Petersburg $1\frac{1}{4}$*d.* and $1\frac{1}{2}$*d.* is the fare; in Stockholm it is the curious sum of $1\frac{3}{8}$*d.*; in Florence it is 1*d.* from the suburbs to the city, and $1\frac{1}{2}$*d.* across the city; in Cape Town it is 3*d.* for three miles; and in Canada the fare averages $2\frac{1}{2}$*d.*, and 5*d.* after midnight.

PROVINCIAL RURAL TRAMWAYS

The memorable question once put to the House of Commons, "What is a pound?" to this day has not met with a strictly accurate reply. The same may be said of the frequent inquiry, "What constitutes a Light Railway?"

Under the Act of 1896 a Tube should officially be described as a Light Railway. So should a Shallow Underground, an Urban Tramway, and a Rural Tramway. So, too, should a Brighton Beach Line, or any short train running along a pier. So also should any railway line for the carrying of minerals, worked by heavy sixty-ton locomotives, and hauling five or six hundred tons of ore at a time! *Reductio ad absurdum.*

The originators of the Act did not define what a Light Railway really is, but they evidently had in their minds, *inter alia*, that railways, unrestricted by Board of Trade regulations as to fencing, sidings, gradients, and permanent stations, should be permitted to run along the high roads, acting as feeders to the existing lines, to the benefit of the small towns, villages, and farms near which they passed. Thus a pleasing vision unfolded itself of revived agricultural prosperity, of handy little trams peacefully steaming along the highways, stopping, when hailed, at some convenient corner, where the farmers' waggons would be in waiting with produce to be taken away to market in exchange for goods delivered to them.

It was a promising idea, for the cost of construction per mile would necessarily bear no comparison with that of ordinary heavy railways. But in this form Light Railways were not developed. Agriculturists abandoned the hope of any immediate relief, and it came to be recognised that the Act meant a development, not of goods, but of passenger traffic, and that, so far as extra-urban districts were concerned, Light Railways meant Tramways, just as they did in town or city.

It may be asked, "Do not local railways answer all requirements of the ever-increasing population and already congested districts? Whereabouts are these country tramways that we hear so much about? and in what respects are they so useful and necessary?"

For goods the network of local railways covering the country is no doubt fairly sufficient, and eventually, when well-organised services of electric-motor waggons aid in feeding them with merchandise collected and delivered at the very doors of consignor and consignee, they will fully answer their purpose; but for linking together city, town, village, and hamlet in the interests of working-men—in many districts the chief customers—they are almost useless. For this class, wishing to get about quickly—going to and from their daily toil, paying visits to their sporting pals, attending dog shows, football matches, etc., taking their wives and children shopping, and on holidays going some distance afield—a local railway, even if close by, is of little use, with its rigid time-table, its fixed stopping-places, its high fares, and its general formality. What they wanted, and what, until the introduction of electric traction, they waited patiently for, was a service of comfortable cars, that would pass their houses every few minutes, and would take them long stages for, at the utmost, a twopenny fare.

To meet this want, in various parts of rural England, more especially in Staffordshire, horse and steam tramways were tried, but the latter method, from mechanical reasons, proved to be a failure. The rails weighed but 45 lbs. to the yard; they were set in iron chairs and laid on wooden sleepers, and the engines were of the locomotive vertical boiler type. Soon it was found that the weight of the water damaged the locomotive, and the incessant vibration and pounding shook the track so much as to necessitate constant renewal, and the expenditure became so great that many private Steam Tram Companies either wound up, were reconstructed, or were taken over by the local authorities.

Unattractive was the appearance of these old-style tramcars—great cumbersome, top-heavy, two-storied structures, drawn by what looked like a big iron box with a black funnel poking through its lid. They were dirty, they smelt, the service was irregular and slow, and the fares were too high.

MANUFACTURING CENTRES—GREAT BRITAIN

Studying an up-to-date map of Great Britain, one is struck by the fact that in the distribution of cities, towns, and villages it resembles the stellar system, with London as the governing central body, while lesser planets, each surrounded by groups of satellites (not very bright ones, it is true), varying in size and importance, represent subordinate star centres. These have grown, and still grow bigger and bigger, the suburbs of a large town reaching out farther and farther until they touch the outskirts of the next town, so that in some districts an overgrowth of houses and factories covers many a square mile.

In the quiet old days that are gone, a working-man, particularly if a weaver, could labour far away in the country in some miniature workshop or in his own little room at home. But for years past he has been compelled to trudge backwards and forwards to some big factory or mill, where steam-power was concentrated, and run upon so economical a principle, that outside of it the individual workman had no chance of gaining even the barest livelihood. With the advent of steam the villages in certain parts of England were abandoned for the town, where clusters of great workshops had sprung up. A new order of things arose, and operatives, if they could, lived within the town boundaries. But as rates, taxes, and rent increased, they concentrated in outlying hamlets, within walking dis-

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FIG. 20. VIEW NEAR DUDLEY STATION, SOUTH STAFFORDSHIRE, SHOWING A STEAM TRAM-CAR

tance of their work. Thus these hamlets gradually became townlets, and eventually towns, which in their turn developed into centres of industries—lesser lights revolving round the greater.

All over the kingdom manufacturing industries have a natural tendency to settle down in particular localities favoured by the proximity of the raw material, and by railway or water facilities. Thus Dundee, Aberdeen, and the North of Ireland are associated with linen and strong textiles; the Eastern counties and Lincolnshire with agriculture; Warwickshire and Yorkshire with machinery; Burton-on-Trent with beer; Coventry and Nottingham with cycles; and so on. Any intelligent schoolboy could reel off a list of such towns and their products.

Swansea, with its great works for smelting copper and tin ore—the former brought from South Australia, Chili, and Cornwall; the latter from the Straits Settlements and Cornwall—and its manufactories of tin plates, bolts, and zinc goods, is the centre for neighbouring towns associated with its industries, such as Porth, Pontypridd, and Penarth, which, together with the Mumbles, are partially linked together by tramways.

Glasgow, where shipbuilding, armour-plate rolling, and locomotive constructing flourish, has around it the towns of Gourock, Greenock, Rothesay, Coatbridge, and Bridge of Allan, all more or less commercially interested in the great northern city.

Newcastle-on-Tyne and Sunderland, headquarters of England's shipbuilding, are surrounded by places connected with or engaged in kindred industries, as Tynemouth, Stockton, the Hartlepools, Gateshead, Jarrow, and North and South Shields—the last four practically suburbs of Newcastle—a fine field for electric tramways.

Then in Yorkshire we have such centres of the linen and woollen interests as Leeds, Bradford, Huddersfield, Halifax, etc., begirt with townlets which are in process of being interconnected; and further south, in South Lancashire, Burnley, Oldham, Ashton, Blackburn, Preston, Rochdale, Bolton, Manchester, and Liverpool, together with endless smaller places—every one of them engaged in our gigantic cotton trade—cover large thickly populated areas, supplied with tramway means of intercommunication.

THE BLACK COUNTRY AND THE POTTERIES

A remarkable instance of the localisation of special industries, and of a city begirt with good-sized towns, is to be found in the South Staffordshire Black Country, its central sun being the city of Birmingham. While in the Potteries are a number of small towns almost touching one another—star clusters, destined maybe eventually to coalesce into a single planet of the first magnitude. Here humanity swarms.

Alighting from a train at any wayside station in the South or West of England, if one walks along the main road, and avoids the villages, one may go for miles without meeting a soul. The Londoner, whose nerves have been unstrung and jarred by incessant contact and friction with his fellow-citizens for months at a stretch, has only to journey a few miles, say to Chertsey, Ewell, Epsom, or anywhere in Herts or Surrey, and in a few moments he finds a peaceful solitude not likely to be disturbed save by passing cycles or motor-cars. But in the Midlands, and for that matter anywhere in the North, it is different. There the bulk of Britain's population is concentrated. One cannot go for a stroll without coming across individuals of all ages, who, although accustomed to see many people, stare at every stranger after a fashion unknown in the home counties, as if he or she were a wanderer from another planet. And should it be a child whose curiosity is thus aroused, he will probably follow the stranger for miles, gaping at nothing!

In the past, the manners and customs of the Black Country folk were decidedly rough, based on the principle of a blow first and an explanation afterwards. But this little trait has, under the modern influence of inter-communication with the outer world, been considerably modified. They work hard and "play" hard, and are given to week-end excursions and an annual "outing" to Blackpool, Southport, Lytham, or other favourite seaside resort. They earn good wages and, if steady, quickly save money and live in comfortable houses of their own; but if otherwise, their "good pay" only accelerates the wretchedness of their surroundings. Lavish with their cash, they are hospitable in the extreme; great consumers of plain beef and mutton, sweets and kickshaws they relegate to the women and children; but they no longer—as was affirmed of puddlers and miners during the boom of many years ago—drink champagne and feed their bull-pups on loin-chops and rump-steak. They are keen on dogs, pigeons, and singing-birds. Dog-fights are a thing of the past, of course, but it is whispered that suspiciously high-bred gamecocks are still to be seen sub-rosa throughout the district!

Altogether they are not half as black as they are painted; neither is the aspect of their country, though except in the neighbourhood of Birmingham it can hardly be called picturesque. They represent the sturdy old Midland English, independent and brusque, whose confidence once gained will not be betrayed.

Here, then, in the country called "Black," is a concentration of industrial centres, each possessing great natural wealth of coal and iron, and turning out in enormous quantities cutlery, anvils, bolts, buttons, ironwork of all kinds, guns, hinges, locomotives, nails, pens, pins, rails, rifles, screws, tin and zinc-lined goods, tools, tubes, etc.

In its eighty-square-mile area, between Wolverhampton and the headquarters of "Chamberlainism" on the one side, and Stourbridge and Walsall on the other, dwell over a million people, distributed among some twenty-one towns ranging in size and population from Quarry Bank (8,000 inhabitants) to Wolverhampton (94,000), and including such familiar places as Handsworth (38,000), Stourbridge (17,000), Tipton (33,000), Wednesbury (29,000), and West Bromwich (68,000), all busily engaged in the industries before mentioned.

Such in a few words is the Black Country district, which the adjoining Potteries closely resembles. A more promising field for tramway enterprise could hardly exist. No wonder that George Francis Train in 1860 selected North Staffordshire for one of his earliest, though unsuccessful, ventures—a two-mile tramway from Hartley to Burslem, in the very heart of the Potteries.

THE NEW ORDER OF RURAL TRAMWAYS

Subsequently tramway companies came on the scene, with horses and steam traction, and—in one instance—with electricity. There were five distinct enterprises: the South Staffordshire Tramways Company, the Birmingham and Midland Tramways Company, the Dudley and Wolverhampton Tramways Company, the Wolverhampton Tramways Company, and the Dudley, Stourbridge, and District Electric Traction Company (a short line of about four miles).

Not only were these lines entirely separated and disconnected, involving tedious changing of cars, but two of the five were actually of different gauge from the rest, making through communication impossible. It was no system, merely a conglomeration of *disjecta membra*. The tramway condition of the district became thoroughly unsatisfactory, utterly inadequate to the needs of the travelling public. Matters gradually went from bad to worse, and a financial Lord Kitchener was urgently needed to remodel everything.

He appeared in the form of a powerful organisation, the British Electric Traction Company, with a share capital of £4,000,000, which entered into negotiations with the various companies and with the local authorities controlling no fewer than twenty-two districts, into which the Black Country area is divided. The proposition was to combine all the Black Country tramways into one great system to be worked by electricity in the most up-to-date manner, to give frequent service, to ensure rapid and comfortable communication between all parts, to straighten things out well, and to adopt this motto, "One management, one method, one gauge," provided the local authorities would for some years suspend their rights under the Acts of 1870 and 1896 to buy the tramways for practically the worth of old iron.

Some of the local authorities thought well of it. Others did not, contending that they, and not the Company, ought to undertake the reform; while the rest saddled their adherence to the scheme with such impossible conditions, that the negotiations dragged wearily on, and it was some time before the great scheme was finally carried through at the cost of much trouble with the local authorities in the matter of routes selected for the requisite extensions. In one instance the line, instead

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FIG. 21. VIEW AT CASTLE HILL, DUDLEY, SOUTH STAFFORDSHIRE. SHOWING AN ELECTRIC TRAM-CAR

of being carried in the natural way direct to the urban boundaries of a large town, was compelled by the authorities of the area involved to turn off at an angle and to gain access to the town in an utterly roundabout fashion, much as if in London, one was obliged in approaching St. Paul's by Ludgate Hill to deflect up the Old Bailey, and to reach the cathedral by way of Newgate Street.

One thing only is still wanted to make this Light Railway scheme (typical of other similar ones) perfect, and this is that its cars should have running powers right into Birmingham and other large towns, and it is to be hoped that before this book is published they will be granted. Travellers do not want to change cars when they arrive at the municipal boundary. They want to move from one centre of population to the other, to get in at the Birmingham starting-point, and to get out in the centre of Walsall, West Bromwich, or Wolverhampton, as the case may be, or even to go without changing as far as Kinver, on the edge of the Black Country, a favourite holiday resort hitherto inaccessible to the manufacturing population.

In the North Staffordshire Potteries the British Electric Traction Company has pursued the same policy as in the Black Country with excellent result, as may be judged by the number of passengers in 1901. In the Potteries and the Black Country many millions made use of the tramways, the system throughout being that of the overhead trolley, and the combined length of track about 75 miles.

LOCAL AUTHORITIES AND RURAL TRAMWAYS

The whole question of local authority in its relation to rural tramways needs settling on a sound common-

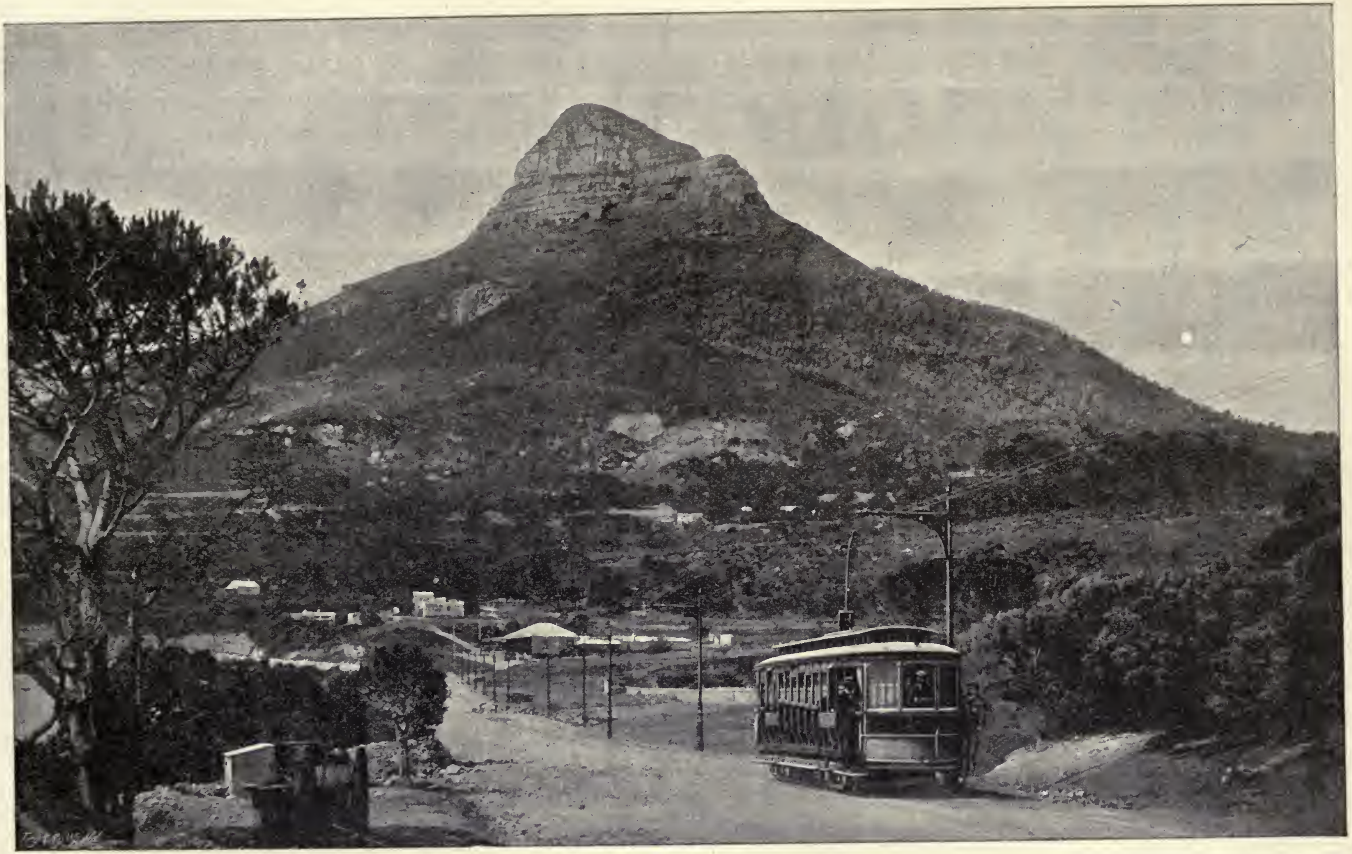

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FIG. 22. CAMPS BAY, CAPE TOWN, AND SEAPOINT TRAMWAYS

sense basis, making the requirements of travellers the dominating object to the exclusion of petty differences and local aspirations and jealousy.[1]

If Great Britain is to be networked with these handy means of transport, and the interspaces of town and village bridged over with cobweb lines of trams, an Act of Parliament should settle a universal gauge, and on equitable terms provide for free running powers, whether in town or country, and encourage an interchange of traffic.

It is constantly urged that it is better for cities and great towns to create tramway lines of their own, and work them within their own boundaries, and that the task of dealing with the rural interspaces should be left to the small towns and areas, and not to private enterprise. The opponents of this principle argue that one great objection to municipal trams is that they are compelled to work within artificial local boundaries, and that there are grave drawbacks to municipal trading in any form. As to the interspaces, to work them by themselves would never pay, and any interspaced tramway system would be almost useless without intimate connection with urban centres as feeders, which is only obtainable by the uniform control afforded under joint stock enterprise. Besides—say the objectors to municipal or rural council control—if private working is the most economical way of running tramways in interspaces, it should be still more economical in towns.

[1] One of the largest tramway schemes ever promoted is contained in the Nottinghamshire and Derbyshire Tramways Bill, which came before Parliament in March last. The routes have a total length of 80 miles, and pass through a district with a population of close upon three-quarters of a million. The idea is to connect, by means of electric tramways, the towns of Nottingham, Long Eaton, Derby, Ilkeston, Ripley, Alfreton, Sutton-in-Ashfield, Pleasley, Mansfield, Eastwood, Bulwell, and Hucknall Torkard.

Surely, therefore, there would be no hardship in restricting the development of urban and rural tramways to local authorities wielding power over areas of a certain size and importance, and the loss to small communities of the power of objection or veto to large schemes ought not to be felt by them. They and the landowners should take warning from the history of railways, and encourage in every way the introduction and extension of tramways, which in remote districts would vastly relieve the tedium of existence, enabling labourers and others to temporarily exchange some dull little village for the comparatively lively market town at a nominal cost. Whereas, in many instances, instead of welcoming this herald of a brighter and less monotonous life, too often is repeated the scene immortalised in *Punch* some years ago. A brickfield: "Bill, who's that chap?" "Do'ant know. A stranger, I should think." "Then heave 'arf a brick at his 'ed."

Capitalists should be encouraged to embark in tramway enterprises that are bound to be beneficial to everybody, and in which they would be entitled to a fair return of interest; for truly the labourer is worthy of his reward.

CHAPTER XIV

THE SHALLOW UNDERGROUND SYSTEM

> "Through the faithless excavated soil
> See the unweary'd Briton delves his way."
>
> BLACKMORE.

IN LONDON

HITHERTO we have been considering Metropolitan Electric Railways constructed at considerable depths below the surface, or lifted up on high, as at the Liverpool Docks.

There is another system, however, and one that is strongly advocated by the London County Council, at present chiefly as a means of linking together existing tram lines by taking the cars underground through congested areas and bringing them to the surface again where the traffic is less dense.

In its ever-increasing congested condition, London reminds us of a patient afflicted with dropsy of long standing, susceptible to occasional alleviation, but hopelessly incurable. In Tudor, Stuart, and Hanoverian days the town gave no signs of this malady; but with Queen Victoria's reign the germs of it became evident, and now the giant city lies prostrate in a state of helplessness that has baffled the most skilful engineering physicians, whose remedies, trains and trams and tubes, have been successful only in giving temporary relief to the sufferer, who forthwith resumes and even increases his original bulk.

For ages the ocean, without breaking its bounds, has absorbed the rivers and streams running into it; but imagine the process reversed, and the English and Irish Channels and the North Sea unrestrictedly pouring their torrents into the Thames, the Forth, or the Liffey! Only one result could ensue. The channels thus gorged with water, their currents would cease to flow. A similar fate threatens London, into whose narrow and inelastic fairways an Atlantic of traffic is ever pouring. One day the current will be unable to flow, and there will be a permanent condition of "block." Then, and only then, perhaps, will a partial migration of town to country bring about a more natural state of things, and save this colossal city from utter collapse.

These shallow tramways of the London County Council are a novelty in England, but on a large scale have been successfully adopted in Paris, Buda-Pesth, Boston, and New York. At present the shallow subway which the Council has been authorised to construct at a total cost of £279,000, commences at Theobald's Road, Holborn, where it forms a junction with an existing surface tramway, the property of the Council. Thence the line falls in level, until, in Southampton Row, it runs beneath the street, whence, in a trench of inconsiderable depth, it passes along the new thoroughfare, Kingsway, from Southampton Row to the new Strand crescent, Aldwych. There it turns towards the Embankment, on gaining which near Waterloo Bridge it again comes out to the surface. In its total length of about five-eighths of a mile it has four stations. Its motive power is electricity on the underground conduit third rail system. The cars, running singly, and at frequent intervals, are single-decked. It claims for its principle that the station platforms are readily accessible, so that instead of having to descend a great number of steps, or to enter a lift to reach the cars, passengers arrive there by means of a short well-lighted stairway; that the ventilation of the tunnels is perfect, and the speed of the cars equal to that of the trains, and as they run singly and close together, long waits are avoided, and thus they are specially suited for short-distance travelling. It also claims a general immunity from vibration.

To thoroughly understand how a complete system of shallow underground works we must go abroad to Paris, Buda-Pesth, Boston, and New York. I may remark that in describing this system a certain amount of repetition is inevitable.

PARIS

Paris has its "Twopenny Tube," or rather its equivalent. On July 30th, 1900, Londoners for the first time travelled by a deep-level line from the City to Shepherd's Bush, a distance of 5·77 miles; and a few days earlier, on the 19th of the same month, the Electrical Chemin de Fer Métropolitain de Paris—the main channel of an elaborate system that links together every district of the capital—was opened for traffic. This chief artery connects at the fortifications, the Porte Maillot with the Porte de Vincennes, a distance of 6·6 miles. In other words, it crosses Paris diagonally from north-west to south-east; from a point at the north of the Bois de Boulogne to another at the north of the Bois de Vincennes; the eighteen stations (including terminals) on the main line being Porte Maillot, Rue D'Obligado, Place de L'Etoile (Arc de Triomphe), Avenue de L'Alma, Rue Marbœuf, Champs Elyseés, Place de la Concorde, Tuileries, Palais Royal, Louvre, Châtelet, Hotel de Ville, St. Paul, Place de la Bastille, Gare de Lyons, Rue de Reuilly, Place de la Nation, and Porte de Vincennes.

On the Métropolitain there is a three-minutes' service of trains during the day, and a six-minutes' service at night. On the London Tube the intervals vary from two-and-a-half to three-and-a-half minutes in the day, while at night they are the same as in Paris, both railways being open for some twenty hours out of the twenty-four.

In Paris two classes of passengers are provided for: first and second. The former are called upon to pay 2½*d.*, the latter 1½*d.*, for any length of journey. Up to nine a.m., second-class, or workmen's tickets, are issued for 2*d.*, the return half being available for the remainder of the day.

Thus, as regards date of opening, length of line, service of trains, and average fares, there is a close similarity between the English and French lines; but the system is widely different. In London we burrow deep; in Paris they go just beneath the surface, the authorities after much hesitation having adopted the shallow underground system. Our Tube trains are shot through huge iron pipes penetrating the subsoil at depths varying from sixty to a hundred feet, and to get at the rail level, passengers must take a perpendicular journey in a big lift. But their Parisian counterparts trip down a few steps and along a brightly-lighted, white-tiled tunnel, so beautifully ventilated and smokeless—electricity being the motive power—that an enthusiastic expert declares its atmosphere to be "perfectly clean and sweet." The tunnels are as near the surface as possible, and on the greater part of the line the keystones of the masonry arches are only about 3 feet 6 inches below the street level. The excavations were at first attempted by means of shields, as in "tubular" work; but this had to be abandoned in favour of the time-honoured "cut and cover" plan employed in the construction of our early underground railway.

When the great Parisian scheme is completed upon a twentieth-century model, much more finished and convenient in many ways than any of ours in London, it will comprise a total length of 38·86 miles of track, seven-tenths being laid in shallow covered trenches, the remainder in open cuttings or on viaducts, the entire cost being estimated at twelve million sterling. An interesting feature of the scheme is that each section is self-contained and ends in loops, so that shunting is obviated. No trains run from any one distant strip of line into another, but where there are crossings, or where the termini touch, there are stations to facilitate changing. This arrangement ensures a rapid service, maintained with regularity and punctuality on each section. Like our "Tube," the success of the Parisian Métropolitain was from the first immense, and at the end of ten months showed a return of over forty million passengers.

BUDA-PESTH

Along the Boulevard Andrassy at Buda-Pesth there is a shallow electric tramway built upon similar principles, a few feet under the main thoroughfare, which is by no means a failure, financially or otherwise.

BOSTON

Now let us cross the Atlantic, and note what has been effected at Boston and New York.

The former—the picturesque old-world capital of the State of Massachusetts, with its population of over a million—is familiarised to every schoolboy who knows anything of history and the War of Independence, with the city where the tea was thrown into the harbour by Colonials disguised as Mohawks, an incident that indirectly brought about the creation of the United States. It is a city also sacred to literati as being the home of Nathaniel Hawthorne, and is so old-fashioned—or so excessively up-to-date, whichever you please—that, until recently, neither cabs, omnibuses, tubes, or underground railways were to be found within its boundaries What with the uneven surface and the labyrinth of the streets, Boston is picturesque in spite of itself, and its old buildings emphasize this. There are the two New England meeting-houses. The "Old South" has been proudly preserved in its ancient state, although the ground on which it stands is almost as valuable as that in the City of London. Architecturally, it is a brick barn, with a pretentiously ugly steeple. "Old North" has an equally plain body, but from its steeple, as a tablet affixed to it sets forth, "the signal lantern of Paul Revere warned the country of the march of the British troops to Lexington and Concord." King's Chapel, another ecclesiastical antiquity of Boston, was, for a quarter of a century after 1749, the place of worship of the official British colony, and accordingly became an eyesore to the earnest puritanical Bostonians.

But Boston cannot, like Charlestown, South Carolina, boast of a St. Michael's Church, famous for its beautiful steeple, so greatly resembling that of St. Martin's-in-the-Fields as to suggest that probably they were both designed by the same architect, Gibbs, one of Wren's pupils.

In the Act passed by the State Legislature authorising the construction of the Boston subway, it was stipulated that its length should be some five miles, and its total cost not more than one and a half million pounds sterling.

The construction of the subway was begun at the Public Gardens, where an incline, a hundred yards long, carries the surface lines into the tunnel, passing under the edge of Boston Common to Tremont Street. It is joined by a branch subway from Pleasant Street, where another incline leads to the surface. From this junction the subway proceeds beneath the Tremont Street side of the Common to Park Street, which is the central point of the system. Thence it is carried directly beneath Tremont Street to Scollay Square, and by means of a bifurcation under Hanover Street on the one hand and Cornhill on the other to a junction under Washington Street. The tunnel continues under Washington Street to Haymarket Square, and immediately rises by an incline to Causeway Street, where it connects with both the surface and the elevated lines. Wherever possible, the subway was carried out by open excavations, and, as in the Paris Métropolitain, by the old-fashioned "cut and cover" method. The roof of the tunnel is generally about three feet below the surface, though in some places considerably lower. At and near the stations the subway sides are lined with white glazed bricks, whitewash being used elsewhere.

There are five stations in the Boston shallow underground, viz. at Boylston Street, Park Street, Adams Square, Scollay Square, and Haymarket Square. These are approached by short stairways, protected from the weather by neat clock-surmounted kiosks, or small iron structures, in shape resembling our cab shelters, and placed at convenient points, either on the sidewalks or—where there is sufficient width—in the centre of the

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FIG. 23. BOSTON SUBWAY, SHOWING ENTRANCE AT THE PUBLIC GARDENS

O

roadway. Passengers can thus, by about twenty-five steps, go to and from the platforms in a few seconds. The ticket-offices are at the bottom of the stairways. The passenger returns at Park Street (the busiest station) are among the largest in the world, being 28,000,000 per annum.

The Boston surface street cars adopt the overhead trolley principle of electric traction, and the elevated railway-cars the third rail system, both these systems being continued throughout the subway.

The subway is illuminated electrically, but a considerable amount of natural light is also obtained, especially at the stations; and Captain Piper, deputy of the New York Police, when on a visit to London last February, discussing the question of ventilation in tube railways, gave it as his opinion that the freshest air he had "struck" in an underground railway was at Boston. "The air," he said, "is excellent."

The subway is, of course, perfectly clean, smokeless, and comparatively quiet; neither in the streets can any noise be heard from the cars that are continually passing close beneath. By an extension of the subway under Boston harbour, the surface lines in the district of East Boston are connected with the main system, thus making the entire length eight miles of single track.

NEW YORK

In New York, after much careful consideration of the advantages and disadvantages of deep tunnels (tubes) and shallow railways, the Rapid Transit Commissioners decided upon the latter as being likely to give the best facilities for quick travelling. On account of its peculiar peninsular shape, admitting of extension in one direction

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FIG. 24. NEW YORK SUBWAY IN COURSE OF CONSTRUCTION. CAR TRAFFIC MAINTAINED

only, the problem of transportation in the Empire City is comparatively easy, the routes being straight, and no necessity existing for intercommunication as in London. But, on the other hand, the number of persons to be carried morning and evening is greater.

Instead of the arched roof and masonry side-walks of the ordinary underground, there is a rectangular structure with a framework of steel beams riveted together, concrete enclosing the erection completely at the top and sides, and forming the bottom, rows of steel columns helping to support the roof between the tracks—in other words, a kind of Britannia Bridge let into the surface of the earth. The line has four tracks, the two centre ones being reserved for an express service (30 miles an hour), with stations $1\frac{1}{2}$ miles apart. On the other tracks the stations are closer together, about four to the mile. So that there are two kinds of stations; one with platforms on the outside of the outer (or slow) track (at which only local trains stop), and another with platforms for fast trains only, and island platforms for either local or express trains. At the former stations the subway is sufficiently deep to allow of a bridge over the entire four tracks, with staircases leading to the various platforms. By means of loops, and, in places, by the lowering of the express track beneath the local tracks, crossings and switchings at the termini are, as in the Paris Métropolitain, eliminated, and the cars run continuously without any shunting whatever.

Its general scheme is as follows. Starting with a loop round the General Post Office, a four-track route is taken direct to the Grand Central Station in 42nd Street. It then turns west along 42nd Street to Broadway, and proceeds under Broadway to 104th Street, a distance of seven miles. Here the four tracks divide, a

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FIG. 25. NEW YORK SUBWAY, SHOWING HOW IT WAS BUILT

double track continuing along Broadway to Kingsbridge, and another double track going in an easterly direction under the Harlem river to the Bronx district. Each of these branches is seven miles long, making a total length, for the whole system, of twenty-one miles, seven being for four track and fourteen for double track. The northerly ends of the double-track line are on the surface for a combined distance of about five miles, the remainder being shallow underground. At convenient points inclines lead to the surface from the subway, and are linked to street trams and elevated railroads. Electricity is exclusively used for traction and lighting, and the cost of the entire scheme was originally estimated at £7,000,000.

Now, what is the conclusion to be come to as to the adaptability of the shallow underground system to our vast metropolis, whose station at Liverpool Street is the busiest in the world, with its "turnover" of forty-five millions of passengers per annum; St. Lazare, at Paris, coming next with forty-three millions?

In newly-constructed thoroughfares provision for shallow subways, and for sewers, pipes, cables, etc., can be easily made; but in old-established streets the difficulty and expense in making them would be formidable, as vaults and cellars used for business purposes frequently extend right across the narrow carriageways, and a perfect network of conduits would have to be displaced and moved either below or alongside the subway.

Some idea of the cost of interfering with sewers may be gathered by the fact that in constructing the New York subway an entirely new outfall sewer, over six feet in diameter, had to be built one mile in length! On the other hand, labour is cheaper in this country than in America, and in London there is no rock to be removed as in New York.

In conclusion, I would quote from the report of Lieutenant-Colonel Yorke, who was sent over to Paris two or three years ago by the Board of Trade to inspect the Métropolitain. He thinks that as regards convenience for passengers and economy of working, the balance of advantage lies with the shallow tunnel or subway as compared with the deep-level tube. But he hesitates a little when confronted with the thought of what would happen to London while its roadways were in process of being undermined. The difficulties in the way of adopting the subway would, he says, be great, though he does not emphatically declare that he considers them prohibitive; and he approves of the attempt made to introduce the system in the manner adopted by the London County Council beneath the new street between Holborn and the Strand.

CHAPTER XV

HORSELESS VEHICLES—ELECTRICAL AND OTHERWISE

"Cars without horses will go."—MOTHER SHIPTON.

PRIVATE MOTOR-CARS

THE above prediction, constantly quoted at the advent of railways, is being realised with the utmost exactness. Except the late craze for cycling, nothing is more remarkable than the boom in the motor-car.

Prior to the passing of the "Locomotives on Highways Act" in 1896, motoring was an impossibility. Even then its advance was slow, and until about three years ago motor-cars were decidedly unpopular. The London street boys—miniature representatives of public opinion—derided them, and, with their usual fiendish lack of sympathy, rejoiced when they came to grief; while 'bus-drivers and cabmen ironically likened all automobiles to traction engines, cherishing the delusion that they continually broke down, cost a small fortune to maintain, and, worse than all, dislocated every bone in their occupants' bodies.

This contempt reached a climax when certain lemon-coloured electric cabs were seen plying for hire, ugly to look at and limited in speed; while simultaneously a line of steam omnibuses, so cumbersome and weighty

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FIG. 26. ELECTRIC CARRIAGE ENTIRELY OF BRITISH CONSTRUCTION

as to really merit comparison with traction engines, began to run to Victoria Station.

But an extraordinary and rapid change has come over popular taste, and nothing is needed to bring motor-cars into universal use, save a lowering of their cost; for even the cheapest are rather beyond the means of people with moderate incomes. This may be one reason why they are so fashionable, though the King's marked predilection for travelling by them has done much to make "motoring" the correct thing; and His Majesty has recently consented to become a patron of the Automobile Club.

Before the advent of the motor-car, Society, though tired of "biking" and craving for a novelty, could not tolerate the notion of being seen in any other than a well-horsed vehicle. Society now thinks differently, as evidenced by a stroll in the Park during the season. There, in the midst of graceful landaus and other equipages drawn by the most splendid horses in the world, may be seen endless electric and steam barouches, broughams, victorias, and cars, all perfectly noiseless, and magnificent petrol motor-cars (*not* noiseless!), resplendent with brass and oxidised silver fittings and upholstered in morocco, whose fair occupants are smartly dressed in tailor-made motoring gowns or, on warm days, in ordinary carriage toilettes.

Some of the fashionable hotels own big cars and run them in lieu of coaches for their customers' benefit to various places near London; while, to the vexation of omnibus companies, motor waggonettes, duly authorised by Scotland Yard, ply to and from Putney and Piccadilly Circus, always "full up" with people, no longer the butt (as they used to be), but the envy, of pedestrians. And these public cars, though not perfect, are an advance upon omnibuses, and do not break down more frequently than horsed conveyances.

In the country motor-cars have become indispensable, more especially to landed proprietors, with houses always full of visitors who, with their luggage, have to be conveyed to and from the station. They are much used for race-meetings and for conveying shooting parties to the covert side, stubble, or moor, in comfort, golfers to the links, and fishermen to the riverbank; picnics would be failures without them; and delightful excursions to all kinds of outlying places are arranged by the host, proud of "motoring" his guests, who thus are made acquainted with bits of beautiful scenery they would otherwise have remained ignorant of; as in the case of the King's and Queen's visit to Chatsworth last January, when a feature of the programme was a series of motor-car tours in North and West Derbyshire. In fact, the motor is a most important factor in English country life, and the art of managing it is gradually superseding that of riding, driving, and four-in-hand coaching. Eheu!

Horseless vehicles are not actual novelties. They have merely been in abeyance while the perfecting of our iron roads has proceeded. The earliest practical specimen emanated from an inventor named Guyniot a hundred and thirty years ago, but nothing commercially serious came of it, and the idea slept. In 1786 William Symington produced his steam-engine, to run upon an ordinary road. It had the condenser and the ratchet-motion used in his steamboat, an invention of which he was the originator. The boiler and funnel were in the front, a coach on C-springs between them, and the steering gear, with a kind of bicycle handle-bar, at the rear. The machine, it was said, worked well.

Then, in 1821, a steam-coach by Griffiths attracted much attention, being the first self-propelled vehicle to ply for passengers on British roads. It had a boiler with water-tubes as now used in the Serpollet and Belleville systems for motor-cars. In appearance it somewhat resembled the Symington, but carried a double coach mounted on railway springs.

Walter Hancock's three-wheeled steam-coach of 1828 looked like a tricycle with a big funnel, and was propelled by a pair of oscillating cylinders working the double-cranked axle of the steering-wheel.

In 1859 the Marquis of Stafford had a steam-coach built that weighed less than a ton. With its chain-action it anticipated the modern bicycle: in front it had a kind of bath-chair seat facing the steering gear. In this vehicle Lord Stafford and party of three made trips at from nine to twelve miles an hour over heavy roads without any difficulty, it being easy to guide and remarkably steady. In these steam coaches the funnels appear to have been placed in the rear.

All these ideas, though from one point of view crude, undoubtedly represented

> " . . . such refraction of events
> As often rises ere they rise."

The motor-car industry in Great Britain is flourishing, and it is estimated that out of a total of some ten thousand horseless carriages in the country one-tenth are of home manufacture (the remainder being French or American), a small proportion, truly, but a great increase upon the number built in 1890; and at the Reliability Trials of the Automobile Club last September (1902), thirty-five of British make took part in the contest, and only twenty-six of Continental or American origin, a most satisfactory feature to those who are eager to see British makers second to none in motor-car construction, especially as the aim of the competition was to encourage the building of machines that would be thoroughly dependable in all conditions of road and weather.

At the last Crystal Palace Automobile Show, national vanity was certainly gratified. Not only was the exhibition the largest ever held in the country, but

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FIG. 27. A "CROWDUS" ELECTRIC CARRIAGE

was a concrete example of the remarkable progress of an industry which, so far as these islands are concerned, started lamentably late in the day. There were brought together at the Crystal Palace about seven hundred and fifty motor-propelled vehicles of every class, ranging from the powerful steam lorry, capable of transporting a load of 7½ tons, to the latest "flier," light and elegant of construction, and costing anything up to some £3,000. Motor tricycles and bicylces formed a strong section. The cosmopolitan character of the exhibition is shown by the fact that among the two hundred or so exhibitors were the leading English, French, Dutch, Italian, and German firms.

By general consent the show was regarded to have made plain the fact that in efficiency and reliability the English maker has drawn at least level with his foreign rival, while, so far as the production of motors for *commercial* purposes is concerned, he still stands far ahead.

Automobiles are of all sizes up to magnificent 40- or 60-horse-power racers. For town use there are broughams, victorias, landaus, and landaulettes (open or closable for country work), the phaeton with four seats, placed two by two, looking forward, and the tonneau—a kind of small omnibus with a movable back—with the two rear seats in the corners.

Sometimes cars are run with six seats arranged in three pairs, with plenty of room both for the driver and the coveted box-seats. Most cars of either pattern have a glass front screen, while some have a fixed roof as well. The greater number are driven by the use of petrol, the machinery being in front under what is called the "bonnet," and the ease with which the oil can be obtained has great advantages for a touring expedition.

Steam is also employed for motor-cars, and is practically noiseless, but there are obvious objections to its use, however skilfully the working parts are constructed.

In London, electromobiles are extremely popular, and no wonder, for there is no smell, no vibration, and no noise; the speed attainable is great, and they are under perfect control, advantages involving the use of storage batteries, the recharging of which is a lengthy operation, seldom taking less than five hours. But, as Mr. Llewellyn Preece observed about twelve months

By permission of the *Electric Power Storage Co., Ltd., London* ago, "this condition of affairs is gradually disappearing; private electric carriages are now to be seen in London, and their number is increasing. Cars can be obtained capable of running to Brighton, Portsmouth, and other places within seventy or eighty miles of the metropolis." (*i.e.* on one charge. They may be called "short-tour cars.")

Electric town-cars are generally of the landaulette type—for theatre-going, and for paying visits in such inaccessible suburbs as Stoke Newington, Balham, and Hampstead. They carry from two to four passengers, can attain a speed of fourteen miles an hour, and will run forty miles without recharging.

A long-distance electric car, to compete with petrol, has yet to be made, but it will shortly be possible to obtain one of moderate weight at a reasonable price that will cover one hundred and twenty miles on a single charge; and, as a matter of fact, tours of more than a thousand miles (from London to Glasgow and back) have been satisfactorily accomplished.

PUBLIC CONVEYANCES

The perfect motor-omnibus, and, for that matter, the perfect 'bus of any kind, has yet to arise, and is suggestive of Darwinism in the length of time required for its evolution. But can London and the long-suffering traveller wait ten million years or so—putting up meanwhile with the inconvenience of existing vehicles—until the omnibus companies wake up, or are superseded by more enterprising business adventurers?

Why, for instance, should all omnibuses be stuffy? There was a reason for it when their floors were covered with straw and they were shut in with doors. But now there are no doors, and there is nothing to harbour damp; yet even when the passengers sitting at the entrance of the omnibus are assailed by icy blasts, those at the far end are in an atmosphere of mustiness strongly suggestive of stables. Then, on days when the roads are greasy, these vehicles crawl along, often taking an hour and a half to travel from Fulham to Liverpool Street (a distance of about six miles). Upon such minor nuisances and annoyances as the exiguous space (about 2 feet 6 inches) between the seats, ticket-giving and ticket-examining, the jarring of brakes, the rattling of loose coach-bolts, the lurching of the top-heavy structure, the windows that will not open, the glare and dust in summer, the Cimmerian darkness in winter and at night, the stout people who take up too much room, the wet umbrellas and odoriferous waterproof cloaks, the exasperating and often unnecessary stopping every few hundred yards to the distress of the poor animals, it is needless to dilate. We experience them every day of our lives.

But better times are in store for the horses, and better times for our children (perhaps even for ourselves), who will see in London's streets electric omnibuses in which it will be a delight to travel.

Between Oxford Circus and Cricklewood (not far from Hendon) are now running improved motor-omnibuses built in Scotland for a London syndicate, to the requirements of the Chief Commissioner of Police. It will be remembered that some years ago a very large Thorneycroft steam 'bus plied for custom. It carried thirty-six passengers, but, turning the scale at three tons, it was of illegal weight as a vehicle, and should have come under the definition of a traction engine with speed limited to four miles an hour, and preceded by a man with a red flag. So it was ultimately withdrawn.

But the new "Stirling" steam omnibuses are only 32 cwt. when empty. The engine is of 12 horse-power, and is geared for three forward speeds of $4\frac{1}{2}$, 9, and 14 miles per hour, with one slow reversing speed, while by a clever contrivance the driving machinery ceases to act if 14·2 miles be exceeded, both steering gear and brakes being under perfect control. Handsomely fitted up, with large windows that can be taken bodily out in hot weather, and with comfortable leather-covered spring seats, the new 'buses are a decided step in the right direction.

At the last meeting of the London General Omnibus Company the deputy-chairman stated that there was no kind of motor traction that would pay the company to take up. If anything was done in that direction it would be in the use of petrol. Steam was of no use, because of the great vibration, and he doubted if the Government would permit 15,000 such omnibuses to run over the streets. In his opinion the time to take up motor omnibuses had not yet arrived.

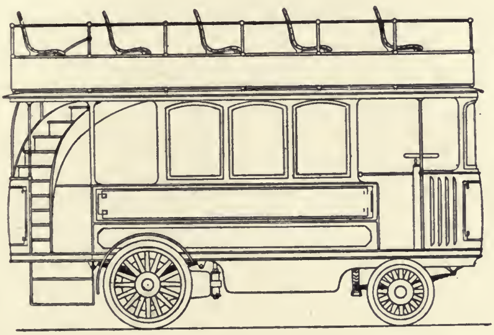
But the London Road Car Company has taken a different and more far-sighted view of the situation, and a combination of petrol and electricity is now to be tested by it.

Cars of the Fischer combination pattern have arrived from America. Each has a 10 horse-power petrol engine which drives a dynamo, the current from which is used to work a motor acting directly on the wheels.

This may, perhaps, seem a needless complication, but there is much method in it. A 10 horse-power engine is not sufficiently powerful to drive a fully-laden 'bus up a hill at any reasonable pace, but there are many places where a 'bus will run by its own weight, and needs no engine. The new car is provided with accumulators.

When little or no power is required by the motor, the current is switched on to the accumulators, so as to store up a reserve for hill-climbing. So when necessary, the car draws on the reserve in the accumulators, and with them and the dynamo develops not 10 but 20 horse-power, enough to take it up and over any hill that 'buses climb.

The manager of the Road Car Company is of opinion that the new vehicles will carry from twelve to twenty



By permission of the Fischer Motor Vehicle Syndicate, Ltd., London

FIG. 29. A "FISCHER" COMBINATION OMNIBUS

Capacity fifteen passengers; weight, 2 tons 13 cwt.; speed, 12 miles an hour

passengers. Owing to the greater speed of the motors, however, the passenger accommodation provided by, say, half a dozen such cars would be greater than that of a similar number of omnibuses, for the service would be more frequent. Not much increase of speed can be hoped for in congested areas, but outside these the motor should be able to run half as fast again as the horsed 'bus.

There exists, however, no reason why a still more improved and refined omnibus service should not be started, electricity alone being adopted, instead of steam, petrol, or a combination. Runs of seventy and eighty miles without recharging are perfectly feasible by using standard long-distance batteries, and would suffice for the daily journeys of the omnibus, while the recharging could be effected with little or no trouble after working-hours.

Motor-omnibuses, besides working on the regular routes, can be run on the tramway time-table system on tramway sections where there is little traffic; while for developing scantily-populated districts and accustoming people to travel, automobile public conveyances are perfect agencies, the very fact that they can choose their own route accentuating this great advantage; and on special occasions, for instance when exhibitions are held in places inaccessible by tramways, they will be a source of considerable profit.

Our provincial towns (take Eastbourne and Hastings for example) are beginning to wake up on the subject, and many of them have adopted or contemplated the starting of some form of horseless omnibus, in several cases the motive power being electricity. Across the Atlantic automobile 'buses are run by the Fifth Avenue Stage Company of New York City down Fifth Avenue, and have proved most popular; while in Chicago there are three lines of electric omnibuses successfully competing with the street cars for patronage. They are double-decked, seating forty passengers, and when they are "full-up" express speed is put on, and there are no more stoppages until the down-town district is reached.

As to four-wheeled cabs, they are hopelessly behind the times, though excellent ones may be evolved out of the landaulette type of electromobiles. During sixty-two years of sullen toleration on the part of the public, the growler has improved but little, and it remains a mystery why in the streets of the world's metropolis comfortable and comely private vehicles cannot be hailed for hire, as in other cities.

New and improved cabs, such as the "Brougham," the "Clarence," and the "Chesterfield," from time to time appear in our streets, and inspire hope that a general reformation is about to take place, and that neat little coupés will be universal. But in some unaccountable manner, after a brief season they disappear from public view—as did the lemon-coloured electric broughams of a few years ago—relegated to some mysterious region where vehicular failures find employment when banished from Modern Babylon.

CHAPTER XVI

HORSELESS VEHICLES, ELECTRICAL AND OTHERWISE (*continued*)

MOTOR-CARS IN WARFARE

THE question of mechanical traction in war is of the gravest importance, the increasing size of armies and the large area they cover when in action, necessitating the employment of some form of haulage other than that of railways or horses.

For bringing up guns and their ammunition at a critical moment automobiles are of the greatest value. At the Motor-car Reliability Trials last autumn there was present a military officer of considerable experience who was much impressed with the possibilities of the motor in battle. If, he argued, sixty cars could run down from London to the South Coast easily in three hours carrying an average of four passengers each, the same number of horseless vehicles could convey sixty machine-guns to Brighton in a similar time. A corps of these might, he said, have proved extremely handy in the late South African campaign. To illustrate this, he pointed out that quick-firing guns carried on automobiles might possibly have ended the Boer War after the action of Poplar Grove. He was present on that occasion, and could speak with authority. All the enemy had been routed out of their far-reaching trenches and were in full flight. Then was the time to push home the attack, but cavalry and infantry were thoroughly done up by the great flanking movement and were unable to follow up their advantage. In full sight of our army, the Boers scuttled away along the plain with only a few desultory shells fired after them. "Now," said the officer, "if we had only possessed a few automobiles with guns on that occasion we should have scored very heavily. The veldt was level enough for the purpose. A big victory at that critical moment might have thoroughly demoralised the Boers, already much disheartened by Cronje's defeat a short time before at Paardeberg, and so caused them to surrender without much ado."

No doubt the gallant soldier took rather a sanguine view of the situation; but of one thing he might have been certain, viz., that at that time neither an unenterprising War Office, nor a Colonial Department capable of requisitioning ordinary infantry from Australia to act against the wily mounted Boer, would for one moment have thought of sending motor-cars out for the purpose he suggests!

Not only for light artillery, but for heavy guns, motors can now be used in warfare, and Lord Roberts had a road-train constructed for South Africa sufficiently armoured to withstand rifle-fire, and powerful enough to draw a couple of heavy guns with their crews and ammunition, the motive power being steam.

In the prosaic work of conveying stores, motor-tractors with lorries are fast becoming integral parts of our complicated war-system, and the report of the trials held at Aldershot in December, 1901, is decidedly in favour of their employment on a large scale. The tests were severe, and included two days' running (with full loads) of thirty miles a day, and a march of 197 miles (also with full loads) in six consecutive days on roads both hard and soft, and even over boggy ground, the gradients being various, and in places very stiff. The first prize was awarded to the Thorneycroft Steam Waggon Company, but although the committee believed that these steam lorries were serviceable and useful for the present, they were much struck with the great possibilities of machines burning heavy oil. Their observations were as follows :—

"Compared with horse-draught, these trials have shown that self-propelled lorries can transport five tons of stores at about six miles an hour over very considerable distances on hilly, average English roads under winter conditions. The load transported by each single lorry (five tons) if carried in horse-waggons of service pattern would overload three G.S. waggons, requiring twelve draught horses, besides riding horses, whose pace would not ordinarily exceed three miles an hour. Moreover, the marching of 197 miles in six consecutive days would not have been accomplished by horses even at that speed without the assistance of spare horses."

To this report appeared the following appendix of considerable importance :—

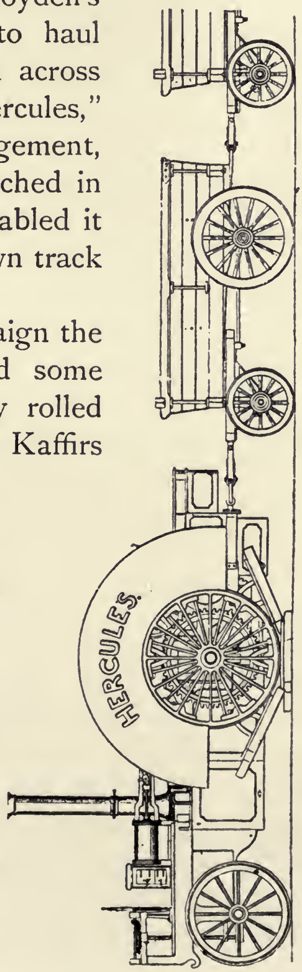
"The committee, in carrying out the tests, travelled in motor-cars, and as a result of their experience they remark, 'The committee desire to bring to special notice the incidental demonstration afforded by these trials of the great possibilities for staff work, and for work in connection with the command of long transport trains, of the motor-car. No vehicles drawn by horses could have possibly covered the distances or kept up the speeds required; portions of the roads, sometimes miles in length, had to be traversed and retraversed several times, and at speeds beyond the capabilities of horse-flesh. Riding horses would have been knocked up to an extent necessitating large relays. The staff officer, moreover, instead of being fatigued, is always comparatively fresh at the end of the day.'"

No wonder that the Army, from the Commander-in-Chief downwards, is quickly becoming devoted to motoring. The quantity of work that can be got through by means of the automobile is a revelation to those who have been used to travelling by means of horses.

During the Crimean War, Boydell's traction machine was used to haul open trucks on the road and across country. Its engine, the "Hercules," was fitted with a curious arrangement, which, by means of rails attached in six sections to the wheels, enabled it to lay down and take up its own track as it went along.

In the South African campaign the military traction engines did some excellent work, and, as they rolled over the plains, startled the Kaffirs out of their senses at the unwonted sight of what they probably thought was some new and monstrous form of rhinoceros.

It has yet to be decided what is the best motive power for lorry cars in warfare, both oil and steam motors having, as compared with those driven by electricity, the disadvantage that the machinery moves by a series of shocks. Doubtless



By permission of Sampson Low, Marston, & Co., London

FIG. 30. THE "HERCULES" TRACTION ENGINE, AS USED DURING THE CRIMEAN WAR

the ideal power would be one that acted evenly. The electric motor is superior to all others in the regularity of its action, and its steering is most readily effected. All that is wanted to adapt electric traction to military purposes is a perfected storage battery, and the day may not be far distant when extensive use will be made of light accumulators capable of being safely carried and of being recharged as readily as a steam engine can be supplied with fuel.

MOTORS IN AGRICULTURE

In England the use of steam for agricultural machinery has hitherto been confined to the purpose of ploughing and threshing. But coal in some districts is dear, and farmers are beginning to find that oil engines are more economical, there being no loss of fuel in the sudden stopping of work during wet weather; but petrol has a nasty trick of not vaporising readily when it is frosty, and here electricity steps in with an admirable *force-motif.*

With a dependable electro-motor, the farmer may work his self-binder all day long in the harvest-field, and at night send it up to market with produce. Moreover, the motor may help to plough and harrow in the winter, and when there is no work to be done it costs nothing, having—unlike the horse—no stomach to fill.

In fact, the successful adaptation of the motor to farming may solve the ever-present labour problem, and do much to resuscitate the agricultural industry, while fruit and vegetable growers may find it invaluable, making them independent of high railway rates and bad train service. But, although the application of the automobile to agriculture is only in the experimental stage, it cannot be doubted that, in some shape or other, it will come to the cornfield, the orchard, and the market garden, while the modern farmer will welcome it gladly.

Probably it will begin, as was suggested by Mr. Rider Haggard before the Norfolk Chamber of Agriculture at Norwich, in the shape of an agricultural post. His

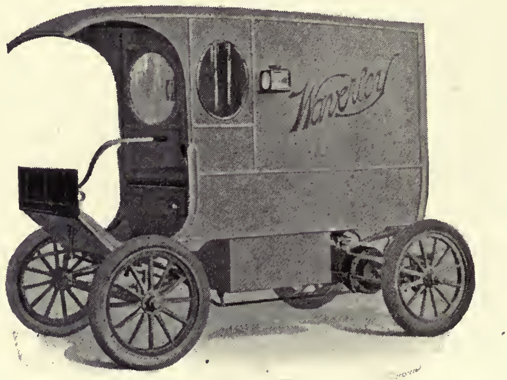
By permission of the Anglo-American Motor Car Co., Ltd., London

FIG. 31. A TEN-TON ELECTRIC TROLLEY

plan was to enlarge the present system of parcel-post so that one hundred packages, each of 100 lbs. in weight, should be carried in the same way as parcels of only 10 lbs., and that produce of any sort, such as a crate of apples, the carcase of a sheep, a basket of flowers, etc., should be delivered the next morning to whatever part of England the goods were consigned.

MERCANTILE MOTORS

The prosaic use of motors is increasing rapidly. In our streets are frequently seen steam or petrol lorries for the heavy goods of brewers, stone-merchants, builders, contractors, engineers, asphalt-paving companies, etc.; substantial vans for wholesale manufacturing houses and great establishments, such as Bryant and May's, Maple's, Harrod's, Whiteley's, and Barker's; lighter vehicles for smaller tradesmen, carts for county council and borough council work; a few fire-engines



By permission of the Automobile Co. of Great Britain, London

FIG. 32. AN ELECTRIC TRADESMAN'S-VAN

and ambulance waggons; while in the country any number of motors are used by shopkeepers to deliver their goods for miles around.

In fact, the mercantile use of motors has grown so much, that before long we may even see "Black Maria" delivering and picking up its daily quantum of *détenus* through the medium of stored-up electricity.

We must just glance at the subject of motor-bicycles, driven by petrol and "sparked" by electricity. They are beginning to be much used for getting about quickly, for trailers, and as sporting machines for "breaking the record." In September last year, at the Crystal Palace, some extraordinary results were obtained by them in the matter of speed, one of them covering no less than fifty miles in an hour and eight minutes!

Sir Martin Conway's opinion, humorously delivered this year to the Society of Arts, respecting "stupid cyclists" and motor-cycles, is worth recording. He said that the first thing on which he desired knowledge concerning motor-cycles was how he was to fall off, as he fell off every machine on wheels some time or other; next, how long it would take a man to understand the parts in a motor-cycle, or whether they were hopelessly removed from the range of the ordinary stupid person; then, how the thing vibrated; and, finally, which of them did not break down. He said that he had been told that the pleasure with a motor-car was considerable when it went, and the annoyance even more considerable when it did not go.

Motors are everywhere, and are used for every purpose. There are motors in the Equatorial Free States of the Congo, where there is no energetic policeman, stop-watch in hand, to time the "driver" and summon him; and one day—who knows?—there may be motor-cars in use at the North Pole.

The motor has even been the indirect cause of political upheavings, for it is said that the revolution in Morocco came to a head because the fanatical tribal allies of the Pretender resisted, amongst other European articles, the introduction of automobiles into the country, and opposed their use by the enlightened emperor, as too progressive, and not in accordance with the Mussulman faith.

Meals are sent out in motor-vans by the London Distributing Kitchen Company from its well-equipped premises near the Army and Navy Stores, the breakfasts, luncheons, and dinners being placed in air-tight baskets in aluminium receptacles. In Manchester, for some time past, "meals by motor" have been an accom-

By permission of the *Fischer Motor Vehicle Syndicate, London*

FIG. 33. ANOTHER TYPE OF THE "FISCHER" COMBINATION OMNIBUS

plished fact, and most popular and lucrative the scheme has proved.

Motoring has its romantic side. For instance, in France—the birthplace of the automobile—abduction by motor has been initiated, and our lively neighbours may possibly contemplate the revival of that mediæval custom of wedlock by force. This young lady, however, seems to have been a not unwilling party to the transaction.

Going to school by motor has also been made practicable across the Channel. For some months the Ecole Lacordaire, in Paris, has been running a Serpollet steam omnibus, which collects the pupils and conveys them to and from the school. The day's run gives a total of sixty miles. Monsieur Serpollet has lately carried out an interesting test with the vehicle. He made a run of sixty miles with twelve passengers, and the cost for petrol was 1*s.* 2*d.* per passenger, or rather more than four miles for a penny. The omnibus averaged eighteen miles an hour.[1]

[1] In England the motor-car is beginning to play an important part in country parliamentary elections. Motor-cars are used by commercial travellers, and are being tried for the official work of the police about the metropolis. The General Post Office is also giving motor carriers a trial for letters and parcels ; and motors are utilised for dust-carts.

CHAPTER XVII

HORSELESS VEHICLES, ELECTRICAL AND OTHERWISE (*continued*)

SPEED OF MOTOR-CARS

TO motorists the pressing question of the day is *speed*. In England the motor-car was in its infancy when the present law came into force. Before its birth, no mechanically propelled carriage could travel along the highway faster than four miles an hour; but six years ago a determined attempt was made to adapt the law to the exigencies of modern traffic. Fourteen miles an hour was decided upon as the maximum speed, and the Local Government Board subsequently reduced the limit to twelve miles. But these regulations are now out of date.

A few years ago there was a great outcry against cycle speeds. That has died out, not because cyclists ride more slowly, but because the public has come to realise that, with a readily controllable vehicle like the bicycle, the greater speeds are not dangerous. Similarly the public is now much exercised in mind concerning speeds of twenty to twenty-five miles an hour by motor-cars. It will not be long before they realise that these velocities are quite safe under certain conditions, and that the motor-car might almost under any circumstances be allowed to travel twice as fast as a horse, indeed even faster. It is said that this year the speed of the motor-car is expected to approach a hundred miles an hour. The Hon. C. S. Rolls came very near to attaining it at Welbeck last February, when he made an attempt on the flying kilomètre record. The best of four runs gave the time of 27 seconds, which is a speed of 82$\frac{4}{5}$ miles per hour, and 1$\frac{1}{5}$ seconds better than Mr. Jarrott's run over this course last year. Whether it will rank as a world's record is not certain, as the road in the Duke of Portland's park has a slight favouring gradient. The French official record on the Dourdan road is twenty-nine seconds, a speed of seventy-seven miles per hour, accomplished by both Fournier and Augières. Mr. Rolls drove an 80 horse-power Mors, which he entered for the Paris-Madrid race.

Estimates of speed differ in the most extraordinary degree, and the Hon. J. Scott-Montagu gave to the *Car* the following humorous table, the result of an inquiry at a police court:—

	Miles.
"Private opinion of mechanic in charge	12
His opinion when talking to his friends . . .	20
His opinion when in court	8
Policeman's private opinion	14
Policeman's opinion in court	28
Farmer's opinion when a pony was frightened .	50
Maker's guaranteed speed	16
Actual speed	10"

Motorists are evidently assumed to be made of money, if we may judge by the following statement made by a correspondent of *Motoring Illustrated* this year. He says, "One curious result of a car case, in which I was fined £10 for 'scorching,' is that in less than a week I have received upwards of seventy begging letters from charitable societies or individual beggars. Motor owner and millionaire are apparently one and the same thing in the popular mind."

Mr. Leopold de Rothschild, who is entitled to speak with authority on the subject, frankly admits that there is much justification for the irritation in the public mind against motor-cars. He strongly condemns rash driving, but, at the same time, maintains that when motor-car owners obey the law and observe the courtesy of the road, they ought not to be looked upon by coachmen, cyclists, and pedestrians, as the enemies of mankind.[1] Nevertheless, he firmly believes that the dislike of motor-cars will die away in due time, just as did the dislike of cycles. The utmost caution ought, he concedes, to be exercised by drivers in the crowded thoroughfares of large towns.

On the question of their importance generally in relation to British industry Mr. Leopold de Rothschild says, "We should foster them by every means in our power. At the beginning not a single one was produced in this country, but at the present moment some of the machines turned out in English workshops rival those of the very best French make. In recent contests on the Continent, too, English cars have more than held their own. It is sometimes complained that the machines make a great noise. That defect is being gradually cured. Then it is urged that they raise a tremendous dust as they speed along. That evil is also being remedied, and will disappear altogether if the experiment

[1] A very curious and, to the superstitious, significant coincidence was recently reported from Ireland.

Last year, when permission was asked to repair the road between Newcastle and Kilcoole, a member of the rural council opposed, declaring that it was good enough for farmers, and they did not want to encourage "galoots in motor-cars" and "go-boys on bicyles" in their neighbourhood. This councillor was, not long since, killed through the wheel of his cart catching in one of the ruts complained of!

of pouring petroleum on the roadways should prove successful. Where the motor-car is extremely useful, I consider, is in enabling people to go across country to attend hunt meets and visit distant golf links. Then, again, see what encouragement is given to wayside inns. When in Scotland the other day I visited a friend who lived twenty-five miles off, and did it comfortably between luncheon and dinner, and that, too, without endangering the life of myself or anybody else. I regard the motor-car as a source of intense enjoyment. Allow the owners greater freedom, but take care that in return they loyally observe the regulations which are framed by competent authorities for the safety of the public."

MOTOR-CARS AND PUBLIC HIGHWAYS

Who can place a limit to the development of motors! The time may arrive when tram lines will disappear, the roads themselves being of steel and forming a broad rail upon which self-propelled coaches, omnibuses, cabs, and cars will ply in every direction, and far and wide into the suburbs. This is the idea of Mr. A. A. C. Swinton, who also thinks that eventually motor-cars will drive tram-cars out, because, as he says, "Tramways are merely a smooth place on a rough road, with a groove to keep the wheel in a smooth place," and as one day the whole road will be smooth the tram-rails will disappear.

Something similar, I take it, was in Mr. Balfour's mind when, in 1901, writing to the Warden of the Browning Settlement in Camberwell on the subject of homes for the workers, he said :—

"What I am anxious people should bear in mind is that trams, railways, and 'tubes' by no means exhaust the catalogue of possible improvements in transit; indeed, I am not sure that they are the means of communication for relatively short distances which some years hence will find most favour. What I should like to see carefully thought out by competent authorities would be a system of radiating thoroughfares, confined to rapid (say, fifteen miles an hour or over) traffic (that is absolutely essential), and with a surface designed, not for carts or horses, but for some form of auto-car propulsion. If the local authority which designed and carried out such a system chose to run public auto-cars along them, well and good. But this would not be necessary, and private enterprise would probably in time do all that was wanted. In such a thoroughfare there would be none of the monopoly inseparable from trams, the number of people carried could be much larger, the speed much greater, the power of taking them from door to door unique, while there would be none of the friction now caused when the owners of the tram lines break up the public streets. It may be urged—and, perhaps, with truth—that at present the auto-car industry has not devised an absolutely satisfactory vehicle; but we are, I believe, so near it that the delay ought not to be material."

"It is, of course, obvious," he continued, "that the present difficulty of locomotion in our streets is almost entirely due to want of differentiation in the traffic. We act as the owners of a railway would act if they allowed luggage trains, express trains, and horse-drawn trams to run upon one pair of rails. The radiating causeways, as I conceive them, would be entirely free from this difficulty. Neither the traffic of cross streets, nor foot passengers, nor slow-going carts and vehicles would be permitted to interfere with the equable running of fast cars. There would be no danger and no block; and as the causeway would be connected at intervals with the ordinary road and street system of the district, and would melt into that system at either end, every village in which there were enough residents who had to be in London at a fixed hour every day could have a motor of its own. It might be well worth a manufacturer's while, I should suppose, to lodge his workpeople out of London, and to run them to and from his works."

No electrician living can predict with certainty what the motor-car may *not* result in.

One thing only is probable—that our metropolitan streets will soon be congested with vehicles to such an extent as to leave no space for horses. And then will come the complete victory of the automobile.

CHAPTER XVIII

ELECTRICITY APPLIED TO NAVIGATION (A FORECAST)

"And knowledge shall be increased."—DANIEL xii. 4.

DEVELOPMENT IN SIZE OF SHIPS AND STEAMERS

"DON'T give yourself away," shrewdly remarked an eminent engineer, as I discussed with him the outline of this work, and the probability that in the near future, gigantic ships, as long as the Crystal Palace, and propelled solely by electricity, would traverse the seas. "I have not yet come across any form of accumulator that could be adapted to such a purpose, though I admit that the next quarter of a century may produce some startling results. Still, I would not, if I were you, write about it."

My friend, like many scientists, was cautious, and did not like to commit himself; but I am not professionally restricted, and may freely indulge in a dream containing many elements of reality, and "take the wings of fancy," nay, may also "take the wings of foresight," and try to describe a mail-packet of the future.

But before entering into particulars of that phenomenon, the *Princess Ida*, and to prepare ourselves for the contemplation of her large proportions, we should note the evolutionary process which has gone on steadily for the last seventy years, and rapidly during the close of the Victorian Era, in regard to the size and tonnage of ocean steamers.

To go far back for the purpose of comparison—*i.e.* to the days when Britain as a maritime nation was in her infancy, or even to Tudor and Stuart times, when the *Great Harry* floated proudly in English waters, and Elizabeth's *Ark Royal* defied the Spanish Armada, or when Phineas Pett reconstructed Charles the Second's navy and planned those famous men-of-war, the *Royal Sovereign*, *Royal Charles*, and *Royal Prince*—is misleading, because up to Nelson's time the practice of building ships with an extravagant amount of "sheer" (the forecastle and stern towering upwards to protect the fighting men, and producing the outline of a doubled-up old shoe), together with the pronounced "tumbling in" of the ship's sides, rendered it difficult to arrive at any correct estimate of length and beam. Approximately, 1,500 tons might represent the *Great Harry's* measurement, and 150 feet her length, the Carolean *Royal* being about the same.

This method of shipbuilding began to be modified while Pepys was at the Admiralty, but it was very gradually abandoned, and had almost disappeared at the beginning of the century, the *Victory*, slightly over 2,000 tons, and some 152 feet in length, showing but a slight trace of it in her high poop.

In 1834 a merchantman of 1,000 tons was considered a big craft, the largest on Lloyd's register for that year being 1,500 tons, upon which there was not much advance until the "fifties" and "sixties," when all the adventurous of England's manhood were irresistibly attracted to the goldfields of Australia, and vessels of large tonnage began to be laid down on the stocks. Of such were the *British Empire*, 2,676 tons; the *Donald*

McKay, 2,636 tons; *Red Jacket*, 2,000 tons; and many others of from 1,000 to 1,800 tons registered tonnage. These in their turn gave place to iron "sailers" of immense capacity, the tendency being to build them bigger and still bigger—"five-masters" of from 3,000 to 4,000 tons—it having been found that they are worked more economically than smaller craft, and are able to compete with the larger vessels of other countries, and with the syndicates that threaten to monopolise the nation's carrying trade. Foreign examples are *La France*, 3,624 tons, and the *Preussen* (biggest in the world), 4,700 tons.

In steamers the development of size has been great, and astonishingly so since the universal adoption of the screw-propeller. For instance, the paddle-wheel *William Fawcett*, that pioneered the P. and O. Company, built in 1829, was but 74 feet long; the Cunard *Britannia*, that took Charles Dickens to Boston, was a paddle-boat of 1,154 tons, and 207 feet long; the *Great Britain* (1843) was 3,400 tons register, and regarded as phenomenal.

Presently the shipping world arrived at the awakening period of its history, when steamers of from 350 to 500 feet long, and of from 4,000 to 7,000 tons, began to be common; but old stagers shook their heads, and asked where and when this enlargement was going to stop. Time went on, and splendid mail boats, such as the Cunard *Scotia* and *Persia*, in their day considered perfect, were looked upon as obsolete, and even their successors, the *Servia*, 7,392 tons and 515 feet long, the *Etruria*, 7,718 tons and 502 feet long, and others of similar dimensions, soon ceased to be wondered at. This was eighteen years ago. Then, by leaps and bounds, so great was the competition between the different Atlantic liners, and so strong the demand for speed, that 10,000 tons was soon reached in the White Star Company's *Majestic* and *Teutonic*, and exceeded by the Cunarders, *Campania* and *Lucania* (1893), of 13,000 tons each, 620 feet in length, and over 65 feet in beam.

But Harland and Wolff, of Belfast, who had been building 12,000 ton boats, metaphorically without "turning a hair," were determined not to be beaten, and produced their new *Oceanic* (1899), 704 feet by 68 feet, *i.e.* nearly as long as the Haymarket, and about as broad as one portion of Piccadilly. In her, it was thought, finality had been reached; but last year Belfast witnessed the launch of a still bigger vessel, the *Cedric*, 21,000 tons gross register, 700 feet long, and 75 feet wide—the largest steamer afloat! Even she is destined to take second place, as ere long two ships belonging to the Cunard Line will dispossess the *Cedric* of her premier position. These wonderful creations will be 750 feet by 76 feet, with an estimated sea-speed of 25 knots.

Thus we clearly see how enormously the dimensions of steamers have increased; for instance, the *Britannia* (1840) was 1,154 tons, and 207 feet long, and had accommodation for 115 cabin passengers, no "steerage" being carried. But the *Cedric* is nearly 3½ times longer, and carries 3,000 people across the Atlantic, besides her crew of 350 hands. In the same ratio of progression, ships (they will not be called *steamers*, but *electrofers*) 2,500 feet long, with comfortable quarters for 75,000 human beings, will be the order of the day!

I have not referred to the poor old *Great Eastern*—or *Leviathan* as she was originally named—680 feet long, and of 16,000 tons register. She was before her time, and, like other big steamers of that day, far too heavy in her plating to be driven economically at even moderate speed.

Great dimensions and swiftness have been rendered possible by improved engines, but chiefly by the employment of steel in their construction, which so materially reduces the *vis inertia*, that in the case of the *Pennsylvania*, built by Harland and Wolff for the Hamburg-American Line, although a mighty carrack of something like 585 feet, and 62 feet by 42 feet, her actual dead-weight is only 8,000 tons. Still more remarkable will be the reduction—about one-half—when aluminium with some form of alloy—copper, perhaps—comes into general use. Torpedo-boats have been built with this metal, and have run with great smoothness. It exists in every clay and shale formation, and is scattered throughout the world in immense profusion, our London clay consisting principally of silicate of alumina. Electricity is used in manufacturing this beautiful metal, that requires no paint to defend it from rusting; and, although it has hitherto been a costly article, the time is not far off—so it is said—when the price will come down to £19 a ton, or less.

A recent and novel application of aluminium to building purposes is to be seen at Chicago, where a house sixteen stories high is fronted on both sides with it, instead of bricks or terra-cotta.

Berthing the monstrous ships of the future is a problem met by a radical and world-wide alteration in the dimensions of docks, supplemented by quays running out into deep water, which in London would extend on both sides of the Thames, on the north from Tilbury to the Albert Docks, thus converting the old river, like the Clyde, into a long water-street lined by sea-walls, and kept constantly dredged, and connected with London by special lines of railway.

But what is to be the propelling power of the future leviathans? Not steam; but electricity, applied to the machinery from storage batteries. Why not?

ELECTRIC STORAGE AS A MOTIVE POWER

Sceptics in the past argued that it was manifestly impossible that vehicles would ever be horseless, or that communications would one day be transmitted by telegraph, not to speak of the time when even the wires for that purpose would be dispensed with; while the suggestion that artificial light would be obtained through any other agency than candles or oil-lamps, and that sail-less ships would be propelled against wind and tide, seemed savouring of Bedlam!

Yet all these seeming impossibilities, and many more, have become realities. So, too, will electrical marine propulsion, and, although we live in a more enlightened era than our ancestors, few persons even now perhaps realise that ships will be navigated without either sail or steam power.

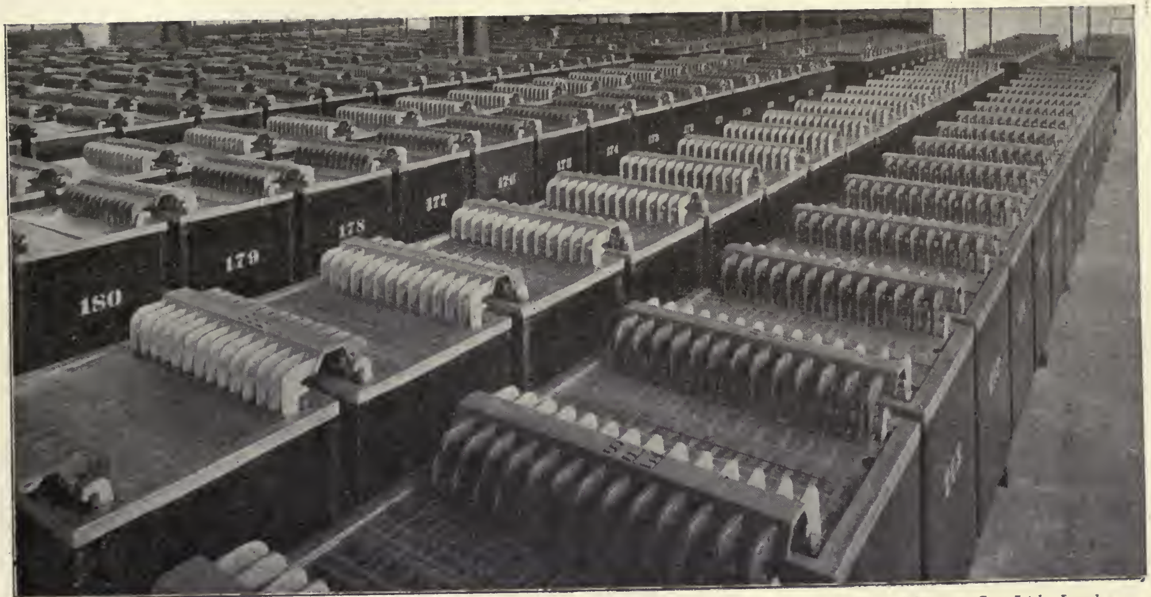
By this time, however, the public have become so familiarised with scientific marvels, that they have ceased to wonder at anything. For instance, there is nothing really more marvellous than that hundreds, or even thousands, of horse-power should be borne by a copper wire, or a moderate cable, and despatched to a distant point with the speed of lightning for traction purposes; but, without knowing what the nature of the force is, we cease to be astonished at it. In point of fact, it is not more occult than heat or light, the attraction of gravity or cohesion.

Therefore when it was announced last year that Edison had solved the problem of how to store electrical force effectually, everybody took it for granted that he had been, or would eventually be, as successful in this direction as in multiplying electric light and applying it to a thousand new purposes.

The "Wizard of Llewellyn Park" is necessarily a sanguine inventor, but he has taken the right and only satisfactory way to determine the question—that of varied and long-continued experiment. Electricity differs from all other forms of power in two respects—it can be stored, and transmitted to a distance. The task of transmission has been, and is being, rapidly achieved. The far greater object of light and efficient storage, the most momentous problem awaiting solution in the whole range of practical physics, may very shortly be solved.

In brief, Edison's storage battery cells are composed of tiny bricks of specially-prepared iron and nickel. In charging and discharging, oxygen is driven from one metal to the other and back again through the action of a potash solution, and without corrosion or waste. Renewal of the water supply is all that is needed to keep the cells in good condition, and a process of recharging has been improved, so that less time is consumed than for the recharging of other batteries. No wonder he believes that the application of storage batteries will ultimately be extended to trains, and especially to ships.

The claim of the Edison Accumulator is that it will occupy about the same space as the present battery, and that it will weigh only about seventy per cent. as much, and will be more durable. Men conversant with the theory of electrical science are not so thoroughly impressed with the work accomplished as is Mr. Edison. The tests that have been made have been more than duplicated, it is said, by the batteries now on the market. We may assume, then, that either Edison's or somebody else's method of storing up electricity for the propulsion of sea-going vessels will be perfected.



By permission of the *Electric Power Storage Co., Ltd., London*

FIG. 34. ELECTRIC STORAGE BATTERIES

THE "PRINCESS IDA" IN THE YEAR A.D. 19—

Early one morning in the spring of 19— a small party of ladies and gentlemen, anxious to avoid the east wind fiend by flying from their native shores to milder regions, travelled by the electric railway towards the mouth of the Thames, and, branching off at a point near Barking Junction, traversed the new line, running for miles alongside the splendid quays recently completed between Galleon's Reach and Tilbury, where special berths were reserved for the leviathan liners that had begun running from the port of London to Cape Town.

Long before the station was reached inquiring glances had been cast riverwards for the first glimpse of the giantess *Princess Ida*.

"That cannot be the *Princess Ida*," said an unbelieving and short-sighted member of the party to his sharp-eyed friend, who was pointing to something which in the distance looked like a couple of White Star *Cedrics* linked together and towering above the roofs of the warehouses that commanded the quays.

"Well, you will see for yourself presently," he retorted. "Seeing is believing, isn't it?" And as the train got nearer and nearer, wonder and admiration increased, and when a break in the line of warehouses gave them a clear view of the great vessel, her beautiful proportions, her polished hull gleaming in the sunlight, and her exquisite cleanliness, their excitement and enthusiasm rendered them speechless.

The *Princess* was berthed close alongside the river wall, and through a great sliding port in her side over a short, stout gangway like a drawbridge, neat motor-cars laden with luggage, and with passengers who had made the run direct from their London homes, passed in continually, emerging later from a corresponding port-hole some distance away. Of cargo there was none, the only resemblance to it being mails, sufficient in quantity, however, to fully load an ordinary small steamer. As these were not timed to arrive alongside from the General Post Office until two o'clock, the party had plenty of leisure to look around, and from what they had read about this wonderful ship, supplemented by much information supplied by a courteous and communicative official detailed as cicerone, they were able to give the following history and particulars of that interesting up-to-date creation of shipbuilding—the fair giantess *Princess Ida.*

She was constructed by the Thames Ironworks Company, a flourishing concern that worthily represented the marked revival of the shipbuilding industry in the world's metropolis. The material used throughout, except for the lower masts, machinery, propellers, and rigging, was aluminium alloyed with copper. Her dimensions were as follows: length over all, 1,600 feet; breadth amidships, 164 feet; depth from upper deck, 110 feet; estimated gross registered tonnage, 33,500; but her lines were so perfect and graceful as to mask these enormous measurements.[1] She had an "entrance" forward like a clipper ship, and a "clearance" aft of the utmost fineness, the stem being rounded off in most beautiful curves. Her floor in the midship sections was flat, and resembled the letter U, and deep bilge keels helped to keep her steady, and enabled her to settle down upon her shore cradle without risk of canting or

[1] Both Brunel and Scott Russell, the eminent shipbuilder, argued that from scientific theory and actual experience there need be no limit to the size of a ship when constructed on the tubular principle, except that which the quality of the material imposed.

straining. Her horizontal outline revealed to nautical eyes just that amount of "sheer," and no more, necessary for strength, rising almost imperceptibly to a graceful overhanging bow, from which pointed a tapering bowsprit, apparently short, but in reality a single massive spar of Oregon pine.

This style had been adopted by the owners because, as they argued, it added considerably to the beauty of the great ship, and as she probably would never enter a dock—using a shore cradle when it was necessary to cleanse the hull—a few score feet added to her length would make but little difference in the room she took up at the quays. The figure-head, of oxidised silver, was a beautiful half-draped representation of Tennyson's fair Princess—

> "All beauty compass'd in a female form."

Five magnificent pole-masts, set up with thick wire shrouds and backstays, rose aloft from her deck, their lower part of steel, the upper section of polished and varnished American fir, terminating in gilded globes, one of them being specially set apart for the wireless telegraph apparatus. These masts, with a graceful "rake," could not have been much less than three hundred feet high, but were in accurate proportion to the length of the *Princess Ida*, giving her the appearance of a Brobdingnagian five-masted fore-and-aft schooner. In an emergency, sails could be put up from them to keep the ship's head to the wind and sea. No ventilators showed their unsightly mouths above the very broad teak top-rail, for they were not needed; but more than the regulation number of boats—about eighty, all hoisted electrically—hung from massive davits, some being electric launches. No great forty-feet wide funnels to hold the wind; no top-hampering superstructures broke the deck area, save the deck stairway houses and the wide bridge, with its chart-room, captain's sanctum, and binnacle house, in which a wheel that a child could turn operated the steering-gear, consisting of a great toothed pinion wheel keyed to the enormous rudder, and worked by two electric motors used alternately.

From end to end was a double striped and fringed awning. The *Princess* carried a search-light of enormous range and power on her foremast, and her side-lights were disposed without any disfiguring effect on her starboard and port bows, and not in miniature Eddystones. Her anchor gear, worked by electricity, was the heaviest ever made, and resembled that of the largest battleship.

Over all floated the red merchant flag of Great Britain, 40 feet by 24 feet, the flag of the South African Commonwealth, the Blue Peter at the fore, and above the taffrail the beautiful blue ensign of the Royal Naval Reserve, while in honour of this her maiden voyage she was dressed rainbow-fashion with innumerable pennons.

The hull was built on the cellular principle, divided into water-tight compartments up to above the water-line, the decks or floors being ten in number. The mighty hold, and the space where bunkers would have been in an ordinary steamer, were filled with storage batteries; so that an immense area was at disposal for electric power, renewed daily by a wonderful chemical process, the weight of the batteries—in this case an advantage—taking the place of ballast, keeping the *Princess Ida* at an almost unvarying draught.

Relatively the machinery of the *Princess Ida* was simplicity itself. She had three propellers that *looked* inadequate to move so vast a bulk. There were no quadruple expansion-balanced engines with cylinders of 28, 41, 58, and 84 inches in diameter, and no bewildering gathering of cranks, pistons, rods, and levers, but the shafts were coupled direct to enormous electric motors which turned them with resistless force, without the loss involved in the use of a long propeller-shaft. There was no escaping steam, no heat, no stuffy stokehold and fierce boilers, no smell of oil and waste, and the ventilation was almost as perfect as on deck.

Going on board by the central gangway reserved for foot-passengers, one entered a splendid hall fifty feet high and a hundred feet square, resembling the lounge saloon of a big hotel, with glass dome-shaped skylight above—a winter garden with beds of flowers and groups of sea-loving palms at the side, kept-renewed throughout the voyage; seductive easy-chairs and couches scattered about; tables here and there, covered with periodicals and writing material; while at one end of a platform, used by the ship's band, and forming a miniature stage, was a grand piano backed by a handsome curtain of peacock-blue plush, and, facing it, a fine organ, both instruments strictly reserved for public entertainments, theatrical and otherwise. The walls of this beautiful saloon were of polished New Zealand woods, Kauri pine predominating, than which a lighter and more elegant wainscot can hardly be imagined. Fireplaces with ornate overmantels burnt logs of wood—a sacrifice to conventionality and sentiment, as they were not required for warmth, the ship being lighted and heated throughout by electricity.

In general arrangement the interior of the ship reminded one of a modern hotel, and the illusion was heightened by the port-holes on the main or second deck being so arranged as to resemble plate-glass windows set in frames of great strength, and when the vessel began to move on the waters it was as if a section of the Cecil Hotel had floated off into the river. But, though beautifully furnished, the ship was not overdone with meaningless decoration. Mirrors were restricted in number, and there was but little gilding. Rare paintings of ships, birds, and flowers were on the walls, while wood-carvings in the style of Grinling Gibbons and delicate French bronzes beautified unsightly corners. All the decks were covered with india-rubber laid over fireproof planking, reducing noise to a minimum, those below the upper deck being carpeted; and as all the doors were sliding and shut noiselessly, the general effect of quietude was delightful, even the electric gongs being subdued in tone.

The style of upholstery throughout was that of the latest Victorian Era, modified to meet the requirements of life at sea. There was, of course, a very grand dining-saloon, and smaller ones for private parties; also a principal drawing-room, boudoirs, tea-rooms, and in the transoms (*i.e.* the aftermost part of the ship) one small and purely ornamental parlour in imitation of Princess Ida's in her college—

> "\. . . . a court
> Compact of lucid marbles, boss'd with lengths
> Of classic frieze with ample awnings gay
> Betwixt the pillars, and with great urns of flowers"—

where a statue of that divinity, seated on a throne, with a couple of tame leopards on each side, was placed as a kind of tutelary genius, to which the sentimental ladies on board made weekly offerings of the choicest flowers they could get.

Then there had been skilfully provided in this wonderful ship a small oratory for the use of Roman Catholic passengers, several libraries, reading and lecture rooms, a music-room, a cardroom, smoking saloons of course, a billiard-room, (available in very fine weather), swimming or rather plunge baths, and electric and ordinary baths in abundance made of aluminium ; besides massage-rooms, coiffeurs' and barbers' saloons, a shooting-gallery, a post and telegraph office, a gymnasium, a skating-rink, a bowling-alley, a photographic room, an amateur's workshop, an apartment specially set apart for ping-pong and similar games, American bars, and a miniature café for the pleasure of those who would make believe they were still ashore ; a tennis-court, a miniature golf-link, a small running, walking, and cycle track (quoits, cricket, hockey, and even football could always be enjoyed on the upper deck), an aviary (parrots prohibited), a natural history room, an aquarium, a servants' hall, a nursery (a remote locality) with tracks for perambulators; small shops for confectionery, millinery, hosiery, and tobacco; also a printing-press, a dispensary, and a hospital; a cell for insubordinates, and, alas! a mortuary.[1]

On the upper deck—so great was the distance from stem to stern, twice up and down being more than a mile—small electric trolley-chairs were at the disposal of the old or infirm to enable them to take open-air exercise. A wide shelter-promenade ran round the ship's sides between two of the decks, looking out on the sea through spacious port-holes, and when wind and rain were too pronounced there were the roomy stairway houses on deck wherein to take refuge.

[1] The Hamburg-American Line's luxurious yacht *Prinzessin Victoria Luise* has a splendidly-equipped gymnasium, where the passengers can indulge in horse-riding, cycling, and rowing, on the various apparatus installed. On one of the decks is a first-class "cricket-pitch," a tennis-court, and an archery ground.

On every floor there were lifts for those who cared to use them. The telegraph and telephone made inter-communication easy, and at every corner of the ship, with its maze of corridors and staircases, direction-tablets indicated one's whereabouts.

Families were accommodated with furnished suites of private rooms, which could be rented or even leased. Here they could bring their own servants, and be boarded independently of the other travellers. These suites varied in size from a modest sitting-room and bed-room for solitary couples, to flats suitable for a large number. There were bedrooms (not cabins) for spinsters and bachelors, and double-bedded rooms. The familiar two, four, and six open-berthed staterooms were conspicuous by their absence.

Of regulations there were few, and these were framed for the general good and were strictly enforced. No dogs or cats were allowed in any part of the ship; the playing upon any instrument, except in the music-room, was prohibited, and this applied even to the private suites; small children and babies were kept absolutely separate from the adults, and smoking was forbidden except in saloons set apart for that purpose and in private rooms.

All cookery was done by electricity,[1] supplemented by charcoal, and the scale of provisions that had to be dealt with, apart from the ship's stores for the crew, was Gargantuan, while fresh fruit, fish, etc., were always

[1] A heater devised by Mr. E. G. Rivers, chief electrical engineer to the Office of Works, brings the problem of electric heating for domestic purposes well within the bounds of practical utility. It renders possible the employment of electricity for heating buildings, for cooking, and for other uses in a manner hitherto impossible. Mr. Rivers is engaged in developing his invention in the direction of applying it to cooking-ranges, and expects very shortly to adapt it to that use.

obtained in addition at the various stopping places. For the round voyage, with allowance for accidents, say forty-two days in all, there had to be put on board for the passengers: of fish, 36,000 lbs.; fresh meat (beef, mutton, lamb, veal, and pork), 367,700 lbs.; fowls and chickens, 16,000; ducks, 1,800; geese, 950; turkeys, 1,500; partridges, grouse, etc., 3,600 brace; 260 tons of potatoes; 560 hampers of vegetables; 4,000 quarts of ice-cream; 18,000 quarts of milk; 215,000 eggs; also canned goods, butter, flour, and groceries in proportion. Of champagne, 18,000 bottles; 15,000 of claret; 110,000 of ale; 45,000 of stout; 87,000 of mineral waters; and 10,000 bottles of various spirits. All these, except the stimulants, were preserved in chilled rooms, the ice being made on board.

At a pinch the *Princess Ida* could accommodate—besides her crew of four hundred, a small army of servants, the stewards, and stewardesses (there were no stokers or firemen)—six thousand souls; but to ensure comfort, only 3,500 passengers were as a rule booked, necessarily at high rates. All were of one class, the only difference, as in an hotel, being in the price paid for position.

The officers were comfortably quartered in the forward part of the ship in a manner equal to the first class of many a steamer; the crew beneath, in the so-called forecastle, palatial in comparison with the old-fashioned sailing ship.

By the time the handy-man had taken these notes H.M.'s mails arrived alongside, and were put on board by electric trolleys through the central side port. There was no stupefying, deafening escape of steam, and no maddening ringing of great bells. The Blue Peter—some fifteen feet square—fluttered down from the foremast, and a megaphone in sonorous tones announced that the hour of departure had arrived, and that visitors must leave for the shore.

The *Ida* began to show that she could move, and majestically and slowly shifted her position, until her bow pointed seaward, a mighty cheer going up from quay and ship. An unseen orchestra gave forth "Auld Lang Syne," and in the fading light the *Princess Ida*, glowing with incandescents, her syren sounding at intervals, disappeared in the river fog on her maiden voyage.

Going down channel at an easy fifteen knots, it was immediately noticeable how remarkably steady the great ship was in the choppy sea. There was an entire absence of vibration, partly attributable to the metal of which she was constructed, and to the perfect balancing of her machinery and nice adjustment of weight throughout her holds. Even in the Bay of Biscay, which was wavelessly heavy in long, sullen rollers after a mighty storm from the west had died away, the *Princess* behaved like a real sea-lady, yielding slowly, but steadily, to the *force majeur* of the Atlantic; and no one dreamt of being sea-sick except one very bilious-looking gentleman, a heavy eater, hailing from Brazil.

In short, she proved herself to be a splendid sea-boat. Not a drop of water could reach her upper decks; pitch she hardly could, as her great length enabled her to ride quietly across the valleys between oncoming waves.

A few hours' detention at beautiful Madeira, and shortly afterwards Teneriffe was reached, where it began to be warm; but the ship was so spacious, and was kept so cool by means of refrigerators, electric fans, and—when necessary—punkahs, that no one felt in the least inconvenienced by the heat. There were no smuts, no smoke, and, better still, no smell of oil or paint (neither of these being used on the ship), no cockroaches, mosquitoes, flies, or rats!

Here she began to put on speed, working up to eighteen knots an hour, her maximum (very great speed being no special consideration), and it was then observed

By permission of the *Immisch Electric Launch Co., Ltd., London*

FIG. 35. ELECTRIC LAUNCH ON THE THAMES

that so smooth and tapering were her lines, that she slipped through the water raising but little bow wave, and almost as frictionless as a swift ocean-fish.

An hour or so at lonely Ascension, and the same at St. Helena—in each case to deliver and receive mails, and to keep up telegraphic communication with London—a voyage altogether of wondrous beauty and enjoyment, nights of solemn loveliness, and days that broke in perfect splendour, cloudless, save for little patches of white here and there, and the ocean a dazzling radiance of deep blue.

Cape Town—six thousand miles in sixteen days out from Tilbury — and, greeted by thousands who had flocked from far and near to witness the sight, the *Princess Ida* glided to her berth inside the great breakwater.

And there for the present I must leave her.

I think I have demonstrated that, theoretically at least, the tiny electric launches, put on the Thames in 1889 by the Immisch Company, one of which, the *Lammda*, took the then Prince of Wales through Boulter's Lock, was the forerunner of the ocean steamer of the twentieth century.

But there is no absolute novelty under the sun ; for it is stated that in 1838 a distinguished Roman scientist, Jacobi, invented an electric motor which drove a small boat on the Neva at two miles an hour.

CHAPTER XIX

SOME ELECTRIC LOCOMOTION DRAWBACKS

"Perfection is attained by slow degrees; she requires the hand of time."—VOLTAIRE.

THE DEVIL'S ADVOCATE

LITTLE more need be said as to the advantages of the new order of things, for however technical opinions may differ about the relative advantages of steam or electricity, there cannot be any doubt that the public fully recognise the immense superiority of the latter in details of cleanliness and general comfort.

Tube railways are intensely disliked by some people, and as heartily appreciated by millions of others. That they are an advantage in many ways is unquestionable, though they are not yet without defects. Motor-cars (electric or petrol), to those who use them, appear to be the safest and most delightful of vehicles, but here again perfection has not been reached.

With these four well-known forms of traction I must now deal, and not eulogistically. In the old days when some recluse renowned for his holiness—which he had instanced by living unwashed for years in a hair shirt until it fell to pieces—died, his admirers frequently put in a claim for his canonisation. This necessitated the appointment of an individual called the *Advocatus Diaboli*, a leader of the opposition, whose duty it was to raise all kinds of objections to the granting of the sacred honour, and to recall everything possible to the detriment of the candidate. Not a pleasant task, certainly, but not altogether unnecessary.

After this fashion it is fair to bring up some sort of a case against electric traction.

ELECTRIC RAILWAY ACCIDENTS AND BREAKDOWNS

As regards electric railway accidents and blockings of tubes, the *Advocatus Diaboli* is able to quote rather too many examples. Commencing with the United States, where in July, 1902, a car, descending the mountain on the Mountain and Lake Electric Railway, near Gloversville, where the grade is a thousand feet in four miles, became uncontrollable, and, acquiring frightful velocity, collided with another car which was ascending the slope. Both cars rushed down several feet, and then ran off the rails. Each car contained seventy passengers, and of these fifteen were killed and injured. Ten bodies, mangled beyond recognition, were taken from the wreckage. Most of the victims were women.

At home there is the disastrous Liverpool Electric Overhead Railway fire of December 23rd, 1901. The trains are run on the multiple control principle, a motor at each end, and the accident was due to a defect in the rear one. But as it is a typical case, I will quote in full the cause of the accident, as assigned by Lieutenant-Colonel H. A. Yorke, the Board of Trade Inspector. He says: "A gale of wind was blowing from the west, that is, from the mouth of the tunnel towards the station, which caused the fire to spread from carriage to carriage until the whole train was enveloped in flames. It is estimated that the train was well alight about twelve minutes after the stoppage. There were twenty-nine passengers, who, when the train first came to a stand, were urged by the driver and guard to keep their seats, as there was no danger. The driver and guard seem to have made some futile attempts to put out the fire; but it soon became apparent that the fire had obtained the mastery, and the passengers found it necessary to alight. They had only eighty yards to walk in order to reach the station, and the majority of them appear to have gone to their homes without any delay, and to have suffered no ill-effects from the fire. It appears, however, from the evidence that a few remained behind, presumably to watch the progress of the conflagration and the result of the effort to control it."

The inspector went on to say that in his opinion it would have been productive of no serious danger had only the driver acted with a moderate degree of prudence. When this man discovered that his rear motor had failed his duty was to disconnect his rear motor by means of the plug provided for the purpose in his apartment. He should then have run into the station with one motor, as is often done. For some reason or other, which cannot be conjectured, the driver, instead of disconnecting the defective motor, and in disregard of the warning of the guard, made repeated efforts to bring it into use, the result being that before long the woodwork of the rear carriage was ignited by the flashes produced by the electric arc when the current was switched on to the defective motor. While the driver was so employed both he and the guard appear to have told the passengers to keep their seats, as there was no danger. Both these men and the station foreman seem to have exhibited a lamentable lack of judgment in this respect. It is impossible not to feel that the sacrifice of life might have been easily avoided. If the passengers had been hurried out of the train as soon as it became evident that it had broken down, and if none of them had been permitted to loiter about the station, their safety would have been secured. And if the train men and station foreman, who deserve credit for their efforts to prevent the fire from spreading, had only realised sooner that the train was doomed, they too had ample time to escape. The cutting off of the current did no good, but, by putting the place in darkness, rather increased the difficulties and danger of the situation.

The lesson of the disaster is, that all woodwork should be removed as far as possible from the electric machinery of the railway carriages, and that for the purpose of insulation material should be employed which is uninflammable.

Of blocks or stoppages on tube railways the following are examples.

Serious inconvenience was caused on December 30th, 1901, by a mishap on the Central London Railway. It appeared that just before five o'clock in the morning a motor was being shunted into the Bank Station to take the first train to Shepherd's Bush, when, though going dead slow, some of the gear apparently fouled the current rail, and it jumped the points just where the two tunnels join, and effectually prevented any train entering or leaving either. The nearest "cross-over," by which trains could be shunted from one to the other, was at the British Museum Station, but even timely notice did not make the walk through the wet any the more attractive to business men, the rain having caused all the omnibuses to be filled long before they got to the station gates. When the line was constructed it was proposed to make a second siding at the Bank as at Shepherd's Bush, and had this been done there would have been no dislocation of traffic, but fears for the effects of vibration on buildings above vetoed the proposal. On an ordinary railway a powerful crane would probably have been run alongside, but the space in the tube is so circumscribed that it was with the utmost difficulty that the engine, which weighed forty-four tons, and was resting against the side of the tunnel, could be moved. As the afternoon wore on, crowds of City men gathered in the subway in the hope that the obstruction would soon be removed, but it was not till five o'clock that the line was cleared and the traffic resumed.

Once more the Twopenny Tube distinguished itself by a stoppage. It was on December 30th, 1902, the anniversary of the precisely similar mishap in 1901, but fortunately with less serious results. Then the engine fell against the side of the tube, and the workmen could only get at one side of it; but this one settled itself in such a position that jacks could be got to work under both sides. The points at the terminus very much resemble those at the ends of the tram lines, and with the tremendous traffic passing over them (engines 1,200 times a day) the only wonder is that accidents of this kind do not occur more often than once a year. With a curious perversity, the engine chose the time—four o'clock in the afternoon—when it would cause the maximum of inconvenience, and the thousands of City men and women going home realised more fully than ever the advantage of the tube. The nearest cross-over is between the British Museum and Chancery Lane, and notice was at once given that trains were running between the former station and the western terminus. As soon as possible gangs of men got to work, and within an hour and a half the wheels were got on, but unfortunately it was very difficult to see what had caused the mishap, as in getting the motor back the evidences of the cause were removed. Some little delay was occasioned by straightening the bent rails, but at half-past eight an engine was run to and fro over the points to see that they were all right again, and a few minutes later the message was sent to all stations: "Resumed bookings and ordinary working."

These mishaps showed how necessary it was that, instead of cross-overs, loops should be provided, round which trains could be run.

January 16th, 1902, witnessed an accident on the City and South London Electric Railway, happily unattended with serious consequences. A train left the Elephant and Castle Station shortly after seven a.m., and had proceeded some two hundred yards towards the Borough when what is technically known as a "short" occurred in the switch. This means, roughly, that the current had chosen to go a way of its own instead of through the insulated wires to the motor. Hence, an "arc" was produced—that is, an arc lamp on a large scale. The insulating material began to burn and smell and smoke. Small defects of this kind are common enough, and the flame is frequently put out with the driver's hand or cap. On this occasion the flame resisted all efforts to put it out, and the driver had to stop the cars and send back for assistance. The following trains came on slowly, and the engine pushed the broken-down predecessor on to the Borough Station. It was found necessary to ask the passengers (fortunately numbering only about thirty or forty) to leave the train, and the fire was then easily extinguished, though it was found necessary to cut off the current from the generating station for a short time. The line was only blocked for about an hour, and the accident was of little importance except as illustrating one advantage which, it is said, the "engine" system of electric traction possesses over the "multiple unit."

MEDICAL OBJECTIONS TO TUBE TRAVELLING

But apart from accidents and breakdowns, a terrible indictment is brought against tube railways in general, and the Central London in particular, which, if true, constitutes a veritable drawback. The accuser is Dr. L. C. Parkes, Medical Officer of Health for Chelsea, who says: "Tube railways are still such a comparative novelty, that the question of the healthiness of this mode of travel has not yet been fully determined. Dr. Wynter Blyth, in an address a year ago, gave the results of some experiments on the ventilation and condition of the atmosphere in the tubes and stations of the Central London Railway. The chief cause of the movements of air in the tubes and stations, lifts and stairways, is the passage of the trains along the tubes, which the carriages nearly fill, thus acting as a piston in a cylinder, driving air before them and sucking it in from behind in their progress from one station to another. The condition of the atmosphere, was not excessively foul, the largest amount of CO ascertained to be present, being 11·9 parts per 10,000 vols. This sample was taken in a carriage containing twenty-seven people between the Lancaster Gate and Marble Arch Stations. The amount of CO present in the air of the station's lifts and stairways varied between 8 and 11 parts per 10,000. In no case, then, did Dr. Wynter Blyth find the amount of CO in the air of the tube to be more than three times the amount usually present in the outer atmosphere of the London streets (average 4 parts per 10,000). Contrasted with the tunnel of the Metropolitan Railway between Gower Street and King's Cross Stations, where a sample of the air taken showed that CO was present to the extent of 25·9 parts per 10,000, the air of the tube railway is comparatively pure."

Dr. Parkes continues: "It may be safely asserted that constant travelling day after day, even if only for a limited period each day, in an atmosphere containing 15 to 20 parts per 10,000 of CO, such CO being derived solely from a human source, must eventually tend to injure health. There are two other dangers in tube-travelling which require notice. First, the danger in the warm summer and the cold winter months alike of bodily chill. In the hot weather the traveller passes suddenly from the warm street into a much colder atmosphere below the ground level. In the winter the reverse happens—the passenger who has been warmed and enervated by the devitalised air below meets the chilly wintry blast on emerging into the street. Secondly, the air of the tube being very dry, and constantly in movement, there must be much organic dust of human origin floating in it. The dangers of tubercular expectoration are no doubt intensified in such a dry and shifting atmosphere as that of the tube, and the cautionary notices to prevent spitting are wisely exhibited in every carriage."

On the whole, Dr. Parkes favours open air to other methods of travelling. He recommends that as far as possible travelling should be by routes open to the air of heaven.

CHAPTER XX

SOME ELECTRIC LOCOMOTION DRAWBACKS (*continued*)

TRAMWAY ACCIDENTS

WHEN the Chiswick High Road tram-line was being made the tradesmen petitioned the London County Council against it. They complained of the annoyance as well as of the danger of the trams. They said that the trams, being large (carrying seventy people in all) and running on eight wheels, made considerably more noise than the light horse-car; that the motor was not silent, and the progress of the trolley along the shivering overhead wire made a continuous, most unmusical, and penetrating din; while the brake—of necessity powerful—also had a harsh note quite its own. To this was added the noise and flash of electric sparks and a singularly sonorous and imperative bell in place of the usual whistle; and as the cars came along every two and a half minutes in each direction, they who dwelt along the route did not find them altogether lovely.

Some people maintain that electric trams are not merely unlovely, but are decidedly dangerous to travel in. There have been electric tram accidents, of course, and very serious ones. For instance, at Huddersfield, one June night in 1902, a car, as it approached the town and was half-way down an incline of a mile in length, got out of control. The trolley arm left the wire, plunging the conveyance into darkness. By this time the pace of the car was too great to permit of any-one getting off. It went whizzing past the car standing in the next loop; but failing to negotiate a sharp curve at the bottom of Somerset Road, ran straight across the street, smashing the pavement and dashing with great force into a grocer's shop, the wooden front of which collapsed. The front of the car was also driven in. Three persons were killed and six seriously injured.

At Chatham a catastrophe, resulting in four deaths and many injuries, is still fresh in people's minds. It occurred on October 30th, 1902, and was extraordinary in many respects, the tram being completely wrecked. The Chatham and District Light Railway is worked as an electric tramway on the overhead trolley system, and has been in operation about twelve months. The scene of the mishap was at the foot of Westcourt Street, Old Brompton, in the parish of Gillingham, close to the main entrance to Chatham Dockyard, where there is a very steep gradient. A workmen's car, filled with mechanics and labourers on their way to work, suddenly bolted in descending the hill, notwithstanding that the brakes had been duly applied. The weight of the heavily laden vehicle increased the velocity every yard of the way, and a terrific pace was obtained.

There is a sharp curve in the railway at the end of the road. The passengers screamed as they realised their danger. The driver shouted to them to jump off the car, which many did; and the driver and conductor themselves took a leap for their lives, and thus avoided serious injury. As anticipated, the curve proved fatal to the safety of the car. The heavy vehicle toppled over on its side with a terrific crash, and the passengers, projected in all directions, made a confused heap in the highway.

Those who were not seriously injured struggled to their feet, but others remained prostrate, unable to move, shrieking or groaning with pain, and several more were rendered insensible. Assistance was speedily forthcoming, and the sufferers were removed to the Royal Naval Hospital, which is within a stone's-throw of the scene of the accident.

In September of the same year a remarkable accident took place at Glasgow, also with fatal results. About half-past nine one Saturday night, when the streets were at their busiest, a Possilpark car got out of the driver's control, and began to move down a slope of Renfield Street, which is the main car artery of Glasgow. Where Renfield Street cuts Sauchiehall Street, the principal thoroughfare of the city, the vehicle dashed into a Pollokshields car, standing at the junction. Both cars left the rails, and the runaway, without perceptible interruption, continued on its career, driving the other before it, the conductors' platforms being interlocked. A few yards further on a Dennistown car was encountered. The two locked cars swept down, and, driving the third in front of them, continued their course down to Argyle Street, a distance of about six hundred yards. A long succession of cars was moving upwards, and with the momentum the three heavy cars had then attained a disaster seemed imminent. However, where the Dennistown line, coming out of St. Vincent Place, joins Renfield Street, the foremost of the three runaways took the branch points, swerved with such speed that it failed to keep the rails, and plunged headlong across the street, being eventually brought up by the wall of a shop. The second and third cars, still locked together, followed the former, striking the shop almost at the same point.

At Devonport another accident, resulting in death, occurred the same month. About nine o'clock in the morning, a car containing eight passengers, six of whom were on the top, got beyond the control of the driver on the incline leading to the South-Western Railway Station. The powerful brakes were promptly applied, but failed to check the progress of the car, which rapidly gathered momentum, although the reversing gear was also applied at full pressure.

At the foot of the slope, where the line takes a sharp curve into one of the main roads to Devonport, the vehicle, which had by this time attained a terrific pace, jumped the rails, crossed the road, and dashed into a wall enclosing the carriage entrance to the station. The force of the impact broke the wall, and caused the car itself partly to topple over. Some of the terrified passengers on the top jumped into the roadway, and others were thrown off. One young man, in jumping off, succeeded in clearing the car and the wall, but as he alighted in the roadway, which slopes down to the entrance of the station, a piece of granite coping, weighing several hundredweight, dislodged by the force of the collision, fell on his head, death being instantaneous. Other injured persons were lying in the roadway some distance from the wrecked car, the upper part of which was a shapeless mass of broken seats and twisted rails. The position of the car enabled it to be seen that the brakes were gripping the wheels lightly, while the wooden brakes, which act on the lines, appeared to be down to the utmost extent.

In this case the verdict of the coroner's court coincided with the Board of Trade's subsequent report, to the effect that the accident was brought about by the negligence and incapacity of the driver of the car, the Board of Trade adding that the cause was excessive speed on a steep gradient and sharp curve, that the driver was responsible for the accident in failing to use the brake-power, and in disobeying the company's orders by leaving the stopping-place without a signal.

These runnings away of electric trams called for increased attention to the question of brakes, which, though they will always hold a car on a stiff incline on dry rails, yet when the track is greasy they introduce an element of danger by reason of their very power. They skid the wheels, which is always a source of great danger. In such cases safety lies in relaxing the pressure, but it needs a wary brain and firm nerves to ease off the brake at all when the car has already bolted.

Then there are collisions, which luckily seldom occur. In October last one took place between two electric tramcars between Middleton and Rhodes, near Manchester. The cars were carrying workmen, and the accident occurred near what is known as the Parkfield loop. The vehicles were travelling in opposite directions, and owing to some cause, at present unexplained, they both got on the same line, instead of one waiting on the loop. About twelve of the passengers were more or less hurt by broken glass, and one of the drivers was injured about the leg.

Cars can be completely overturned, as was proved by an incident that happened in December last year to one of the London County Council trams. It left the metals at St. George's Circus, and after jolting along for a few yards slowly toppled over into a ditch three feet deep, which had been dug on the near side for the purpose of laying the electrical connections. There were about ten passengers on the top and twelve inside, and the tram was already overturning before they had fully realised their danger. Fortunately they retained their presence of mind, and those on the top, by clinging to the rails, prevented themselves from being hurled into the roadway. Two small boys, who were unable to retain their grip of the rail when the side of the car struck the ground, were thrown off into the gutter, but escaped with little more than a few cuts and a severe shaking. The cause was difficult to discover, but probably as the lines were being rearranged some piece of iron or other hard substance eluded the observation of those put to watch, got into the groove of the metals, and caused the car to jump the rail at a spot where excavations were being made.

In our climate tramway traffic is not exposed to any very inclement weather, so that electric traction is not likely to prove a failure by reason of heavy snowfalls, as in New York last winter during a blizzard.

ELECTRIC SHOCKS

There is a serious feature in the overhead trolley system which ought not to be overlooked, as the following will show. In the centre of Sunderland four principal streets cross, and here, about eight o'clock one Saturday night in August, 1902, when the thoroughfares were congested with people, the trolley-arm of a tramcar became entangled, and no fewer than three live electric wires snapped. A woman received a severe shock through one of them striking an iron handrail on the tram which she was boarding; but the promptitude of a motor inspector in turning off the current averted further personal injury.

The Fulham Public Baths tragedy at the beginning of this year exemplified the fact that it does not require a high alternative current to kill. Under certain conditions 200 volts are sufficient. Criminals are electrocuted at a voltage of 2,000, the current passes in at the skull. The murderous elephant, Topsy, in New York paid the penalty of her misdeeds by having a current of 6,600 volts passed through her, and died in ten seconds; but a minute before, she had swallowed 460 grains of cyanide of potassium!

My own personal experience somewhat resembles that of the woman at Sunderland. It was at Ramsgate on a rainy day, and, the car being full inside, I had to travel outside, seats, metal-work, and everything being naturally very wet, and in taking hold of the iron framing of a seat I experienced so strong a shock that I called up the conductor. He ridiculed the idea, but while he was arguing the matter out, contending that it was an impossibility, he inadvertently grasped the wet trolley-pole, which gave him such an electric sensation that he yelled and fell flat on the roof. The car had to be stopped, and until the rain ceased no passengers were allowed outside.

MOTOR-CAR ACCIDENTS

By those who dislike them, every imaginable evil is laid at the doors, or, rather, the wheels of motor-cars, whether propelled by petrol or electricity, and recorded accidents are quoted, chapter and verse being given to show that they are the enemies of pedestrian, driving, and cycling mankind. Here are some examples.

On a steep hill in the neighbourhood of Grimsthorpe, near Bourne, on May 25th, 1902, a motor-car got out of control and overturned. The driver, employed by

Lord Willoughby de Eresby, M.P., for whom the vehicle had been built at Birmingham, was instantaneously killed, his skull being fractured. He had brought the car to Grimsthorpe Castle only the previous evening, and was out with a party of friends, mostly Lord Ancaster's employés, when the accident happened. One man was badly injured, and two others of the party received slight injuries, but a child, who was flung over a hedge, escaped unhurt.

The following day a motor-car was being driven down a steep hill just outside Stroud, when the brake failed to act, and the car ran violently into a stone wall, carrying part of it away. One of the occupants, a local cloth manufacturer, was seriously injured, and a gentleman who accompanied him escaped with some ugly bruises.

An accident occurred near Rearsby, Leicestershire, on August 9th, 1902, whereby the master of the Quorn Hunt, Captain Burns Hartopp, and Mr. A. Burnaby were injured. The party were motoring from Little Dalby Hall to Quorn, when, near Rearsby, the car ran into a cow, with the result that the occupants were pitched out and the car was wrecked. Captain Burns Hartopp was picked up in a semi-conscious condition, Mr. Burnaby was more seriously injured, while Mr. Dashwood escaped with a shaking.

A curious escape was witnessed the same day at Monmouth. General Sir Evelyn Wood, who was accompanied by Colonel Grierson, acting Q.M.G., and Captain Wood, A.D.C., had been inspecting the Monmouth Royal Engineers (Militia) under the command of Lord Raglan. Afterwards the General and staff proceeded in a motor-car to Abergavenny. While the machine was being reversed towards the entrance of the Angel

Hotel a brake refused to work, and the car mounted the pavement and ran into the wall of a shop, just missing a plate-glass window. Captain Wood, who had alighted, narrowly escaped being caught between the motor and the wall.

The following month a motor-car accident occurred at Barnet, when the Hon. C. S. Rolls was returning home in a motor-car from Barnet Fair. Mr. Rolls saw a trap containing three or four persons approaching him, and he steered his car into the hedge, but a collision could not be avoided. One of the occupants of the trap—a youth—was thrown to the ground, and the horse was cut on the leg. Mr. Rolls escaped with a slight shaking.

On the 17th of October last, while motoring from Chester, the Rev. Arthur Guest, vicar of Lower Peover with his wife and a friend, had a startling experience. In steering past a milkcart near Lostock Chemical Works, the car ran into a brick wall and was overturned and badly smashed. The vicar, strange to say, escaped without injury, but his wife and friend were not so fortunate.

A lamentable catastrophe occurred in February this year in London, when Mr. George Edward Colebrook, an Australian merchant, of St. Mary Axe, E.C., lost his life. It appeared that on the previous Sunday the deceased went for his first motor-car ride with his brother-in-law, accompanied also by the owner of the car and a professional driver. There had been a sharp fall of snow and hail, and the roads were in a bad state. When attempting to pass at a moderate pace another car in the Finchley Road, near the Royal Oak at Hendon, the hind wheels skidded. The car turned round and ran against a raised footpath and then overturned. Mr. Colebrook was fatally injured, and died on Tuesday night from concussion of the brain, having been unconscious from the time of the accident. His brother-in-law received a fractured arm and other injuries.

THE GENERAL VERDICT

Thus much for the opposition, and the *Advocatus Diaboli* now resumes his seat. His accusations appear formidable; but it might be justly pointed out that if a catalogue were compiled of the serious results caused by the shortcomings of the horse, motor-car accidents would be found few in comparison. It might be demonstrated that in twelve days 17 persons had been killed and 143 injured in accidents attributable to that noble animal.

When the foregoing tram and motor casualties are analysed, it will be found that the majority were due to lack of control over the brake power, to ignorance, or to careless driving.

As I have observed before, many evils have been laid to the charge of electric traction. Last year it was reported in the papers that a young woman had been instantaneously killed at Shepherd's Bush by the overhead wires. The fatality was attributed to one of the guide-wires breaking at the extreme end (an accident which had really occurred on the line), but it had been replaced *before* the young lady fell down in the road, and it was proved at the inquest that she died in the normal way of heart disease.

In the old coaching days the dire forebodings of evil arising from travelling by steam were much more comprehensive than those of the present day from electric travelling. Horse-breeding, it was said, would cease and farmers become ruined, their crops perhaps destroyed by sparks from passing engines; human beings would be asphyxiated while rushing through the air at tremendous speeds; high roads would fall to rack and ruin; and every innkeeper on coach routes would be bankrupted! In fact, a lamentable social revolution was bound to be brought about by Stephenson's pestilential proposals!

Of electrical traction, its greatest detractors can only urge—and with truth—that it is not yet without drawbacks, not yet so perfected as to render accidents impossible. And the *Advocatus Diaboli*, after due consideration of his own arguments, generously acknowledges that he has failed to make out his case.

CHAPTER XXI

ELECTRIC LOCOMOTION AND OUR NATIONAL LIFE

> "Long sleeps the summer in the seed;
> Run out your measured arcs, and lead
> The closing cycle rich in good."—TENNYSON.

HOW IT AFFECTS EXISTING RAILWAYS

THOMAS ALVA EDISON is reported to have said, "Electricity will displace steam," and, taking his prediction as a text, I will begin by quoting a few figures; for Britishers, though they may affect otherwise, dearly love statistics.

Well, in the year that Queen Victoria ascended the throne the capital invested in railways might have been expressed in a few figures. When she died, the "iron horse" represented the vast sum of twelve hundred millions sterling.

Twenty years ago investments in electric traction enterprises amounted to not more than £100,000. To-day they involve immense sums, the County Council's scheme for London alone running up to £50,000,000! But this is nothing to the probabilities of the near future, as Mr. Percy Sellon pointed out to the London Chamber of Commerce. "Within the next ten years," he said, "electric supply and traction may be expected, with a fair field, to engage at least 250 millions of capital"; and this estimate seems to be by no means exaggerated; in fact, it is underrated. As one of the leading "dailies" observes, "Apart from such a large project as the electrification of the District and Metropolitan Railways, there is scarcely a municipal authority in Great Britain which has not in hand some scheme of electric railway, tramway, or lighting. It is as well to think that electricity is not the agent of the future, but of the present, and an era which has already dawned. In displacement of steam, electricity is evidently destined to be one of the products of the first quarter of the twentieth century."

It may be surmised that by the time Mr. Sellon's ten years have expired all the great railway companies in the kingdom will have adopted electricity as motive power, certainly on their suburban lines, and for the passenger traffic on the main lines.

With what effect, and at what cost?

The latter question can hardly be answered, but the former may be guessed at. For a long time the railway companies will naturally be reluctant to bring about such a revolution as the substitution of electricity for steam. Engines of enormous power, such as the new Great Eastern "Decapod" or ten-wheeler, will be requisitioned to accelerate the working of trains; and, to save fuel, petroleum will be extensively adopted on others.

But electricity the public will have, if it is shown to be more economical in the long run.

Still, to entirely dispense with a great stock of costly locomotives, substituting up-to-date motor engines—with the possibility looming in the future that these, too, in their turn, by the perfecting of storage batteries, may be displaced—to, perhaps, build new cars, or completely remodel existing rolling-stock; to erect new buildings (in many cases) for power stations; to lay down third rails; all this would involve an expenditure that even long-suffering shareholders would rebel against. While, if the steam locomotives were retained to work an accelerated goods service on separate tracks, the widening of bridges, cuttings, and viaducts, the duplication of tunnels on many lines, and the enlargement of stations and sidings, would entail disastrous expenditure. However, the change will doubtless be made gradually, perhaps commencing with the suburban lines, probably as a direct result of the electrification of the Inner Circle Railway, over whose system several main lines have important running powers, and which will then be compelled to abandon steam. Or should some enterprising Socialistic Government come into power with no such trifling matters as Education, Water, Gas, or Tube Bills on its hands, it might by the year 1913, in its anxiety to carry theory into practice, decide to nationalise and electrify our railways wholesale, and at any cost—to the ratepayers!

The effect, anyhow, would not be so very startling, for by that time electric travelling would be a matter of course, and disused locomotives of the type so familiar on the "Underground" would be inquired for by relic hunters and presented as curios to every big town.

Already the change on the great lines has begun, and it is a significant fact that the North Eastern have decided to adopt electricity on some thirty-seven miles of their system in the neighbourhood of Newcastle-on-Tyne, and a modified form of it in the shape of auto-cars with petrol engines and dynamos generating the current, on the short line between Hartlepool and West Hartlepool.

Of electric lines in progress or projected, we have the

Manchester and Liverpool, the London and Brighton, the Edinburgh and Glasgow, and others.

In London all the big termini will be linked together, and connected with the metropolitan Tube systems, whatever form the latter may ultimately assume. This may have the effect of increasing the crowding and bustling of our big stations, but, on the other hand, a vast number of wealthy people will use motor-cars from "house-to-house," dispensing altogether with the railway.

Trains, more speedily and more economically run, will start more frequently. Goods traffic will be on entirely separate lines, and passenger trains will be able to follow one another in rapid and safe succession.

Exteriorily all the termini will look as they do now, minus the presence of horsed four-wheelers and hansoms. But Victoria will be greatly enlarged along Buckingham Palace Road; while Euston, nearly doubled in size, will have its frontage brought forward to Euston Square. Within, there will be less confusion, as either the American check system of booking luggage will be adopted, or that of collecting it beforehand by the railway company's swift motor-vans, and there will be less steam. On the whole, however, the old stations will probably be unchanged—Paddington, with its familiar transept roof, impressive as in 1854, when the late Queen, travelling from Windsor, paid it her first visit; the Midland, remarkable for its noble span roof, soaring one hundred feet above the level of its eleven lines of rail and its four platforms; the Great Eastern, the largest terminus in the kingdom, under five great spans—four parallel and one transverse—of glazed roofing, with its eighteen arrival and departure platforms; and Waterloo, once a mere shed propped up by arches, but now second in size only to Liverpool Street, a maze to the uninitiated.

The large provincial stations will most likely remain much as they are at present—Bristol, Exeter, York, Glasgow, Liverpool, all splendid specimens of important termini and junctions; Swindon, Crewe, Manchester, and Warrington, greatly improved, if not entirely rebuilt.

Power machinery will be housed in existing railway buildings when practicable, and intermediate sub-stations will be marked features along the railway routes. Pumping-houses, water-tanks, coalyards, stages, and sidings will have disappeared.

Sleepy wayside stations, with their pleasant gardens and rural surroundings, will probably remain untouched by the new order of things, save that the rapid delivery of farm produce by horseless vehicles or by light railways, acting as feeders, will wake them up.

THE IMPROVEMENT OF STREET TRAFFIC

The general use of horseless vehicles will do more—at any rate in London—towards the sanitation of great cities than all the enactments of county or borough councils. Medical experts are agreed that the condition of the roads, however well kept, in dry weather particularly, is highly conducive to the spread of all kinds of throat diseases, not to mention influenza; while if the roads are neglected, the peril is increased and every sense is offended. Horses, as beasts of burden, should have no place in crowded thoroughfares, and their presence in numbers produces on wood-paving a pernicious and offensive ammoniacal result which anyone can test in, say, Broad Street, after the omnibuses have ceased running for the day, or, rather, for the night. All over London, and even in the suburbs, the streets are Augean stables, which no effort of the Hercules of Spring Gardens or the Guildhall can effectually cleanse. It is estimated that at the present time there are over 16,000 licensed horse carriages in London, besides tradesmen's vans and other vehicles, and that 200,000 horses are stabled every night, necessitating the removal of thousands of tons of manure and refuse daily.

Noise, too—that distracting rattle and rumble of vans, light carts, omnibuses, and cabs—will be done away with, and how much this will help to restore the nervous system of Londoners who can tell? Horses having almost vanished, the space each one would occupy—some seven feet in length—will be saved on each vehicle, and thus the increase of traffic will be partly provided for. Collisions and the running-down of cars will be unheard of, the steering and stopping powers of the electric motors being perfect.

ITS SOCIAL RESULTS

The effect of universal electric traction on our social life may be far-reaching and prodigious. It may result in a partial decrease in the resident population of London, the working-classes living largely in the country and travelling up and down at uniform penny fares, clerks and others doing the same; while the wealthy and the well-to-do may use their motor-cars to such an extent as to habitually sleep outside the town boundaries, as may also members of both Houses. Only those persons whose duties compel them, will live within hearing of Big Ben.

Society will be still more restless, but its members will be healthier, as fresh air will readily be obtainable. There will be even less time for reading than now. Formal calls will largely cease; friends in luxurious electro-cars will "pop in" *en route* on short surprise visits, and hospitality will, on the whole, diminish.

In these vehicles, touring parties (*without* Cook and Son, or Gaze and Co.) will be constantly arranged to traverse the world. House rents generally will be lower, save at the seaside and other health resorts, where they may actually become higher. So that for those who elect to remain in town, it will be possible to live on a moderate income, rates and taxes, it is to be hoped, also being lessened.

The cost of living will be reduced, produce of all kinds being more extensively home-grown and more economically brought to market.

Horses, being discarded for draught purposes, will be plentiful and cheap; cavalry remounts will be readily obtained, and all over Europe mounted forces may be the order of the day. The smallest farmer will be able to employ several horses on his farm, and everyone in the country, grown tired of cycling and motoring, will have their stables full at low cost, while in the season Rotten Row will be more crowded than ever with equestrians.

Wages will be higher, and there will be a wider field and less competition.

Lastly, hygienic conditions being vastly improved, and smoke abolished, the death-rate of London and all large cities will be reduced. But the greatest boon electrical traction can bestow, will be reserved for the working and poorer classes. Take London, for example.

THE EFFECT ON OVERCROWDING

"Overcrowding! Why, everybody knows what that means!" said the Hon. John Middlemass. "Only the other day I had to travel to town from Southampton, and the first-class compartment actually filled up—a beastly nuisance, for we could not play whist as we had hoped. And in the afternoon, when on my way to pay a visit at Lancaster Gate, I couldn't get a seat in the Twopenny Tube, but had to stand all the way, holding on by one of the straps in the roof! Overcrowding! Why, the last time I dined at the Gresham Club in the City, there was not a table to be got to one's self. They were all packed, and the waiters could hardly move about. And that evening at Lady Danby's reception in Piccadilly we couldn't even stir, I can assure you, once we were in her big drawing-room. While as for supper, it was a fight to get near the buffet, and when I did manage to get some consommé for Sybil Clare, who was positively starving, just as I was piloting it out of the crush, some fool jobbed my elbow, and sent the lot of it right into old Colonel Curry's face, and made him swear like a trooper! To make matters worse, I stepped upon the Dowager Lady Harvey's train, which had no business on the floor at all, and, I am told, tore three breadths out of it, whatever that may mean. Anyhow, I was not asked to any of her dinners again that season.

"Overcrowding! Yes! You should have been stopping with me at Rookfort Castle the Christmas after young Lord Staunton had come of age! Two in each bedroom, I assure you, and they actually had the cheek to ask some of us to put up with the box-room at the top of the house, as every square foot of the place was occupied. Oh, yes, I know what trying to put too many eggs in one basket means! I went through it all on board the P. and O. *Arabia*, from Bombay. Six in a cabin; no room to dress, had to take it by turns; all the grub served in double relays; baths out of the question, unless a fellow sat up all night to grab one;

and the promenade-deck like the enclosure at Ascot on Cup Day; which reminds me that I never was at any of the big races when the grand stand wasn't crowded out.

"Then, as to overcrowding in small houses, used I not to call upon poor Bristowe, my chum at Eton, who became a lawyer's clerk at £300 a year, got married, had eleven children, and lives in a poky little house down Fulham way—only eight rooms—and I believe some of them sleep in the bathroom and the kitchen, and the slavey in the scullery!"

Evidently the Hon. John did not know much about the social problem of overcrowding amongst the poor, and how it has arisen.

"It is not good that man should be alone," and ever since that divine maxim was enunciated, man has taken good care to act upon it, in more senses than one. His nature is gregarious, and as the world he was sent into ceased to give him its fruits spontaneously, he was obliged to take to a country life to obtain the means of existence by the sweat of his brow. He did not readily adapt himself to the new conditions, and, as the history of Babel shows, there was always a tendency to congregate, build great cities, and get as much agricultural work done as possible by slaves.

Nowadays the dislike of solitude is more marked than ever. Who does not know of beautiful country vicarages whose inmates would give their souls to go and live in towns; of farms where wife and daughters pass their time in grumbling because it is so dull at the old house; of squatters far away in Gipp's Land or Maneroo Plains, who, as soon as they make their pile, leave the roomy verandahed station, and, importuned by an impatient family, settle down at St. Kilda, Toorak, Darling Point, in Melbourne, or Sydney? Even peasants, country born and bred, seeking to "better themselves" in Canada, often cannot, or will not, bear the absence of such small excitement as falls to their lot in their native village.

This is illustrated by a case known to myself, where a labouring lad, assisted out to the far West, and there obtaining good wages, and—what to him was luxury indeed—unlimited eggs to eat, threw up his situation and came back to his home in Kent and to his wretched wages, simply because, as he said, "It was too lonely in Manitoba; there was no amusement and no village inns."

As Mr. Rider Haggard has remarked, "Some parts of England are becoming almost as lonesome as the veldt of Africa."

Therefore there is the danger ahead that Goldsmith's foreboding may be realised:—

> "Ill fares the land, to hastening ills a prey,
> Where wealth accumulates and men decay.
> Princes and lords may flourish, or may fade,
> A breath can make them as a breath has made,
> But a bold peasantry, their country's pride,
> When once destroyed can never be supplied."

Hodge, as a class, cannot emigrate. He has muscle, he has a wife and usually several children, but he has no capital, and the colonies, with the exception of Canada, do not encourage him or want him without. His advent also means a disturbance in the labour market and lowers the wage rate. So millions of acres of fertile land in our dependencies where there is room, and more than room, for all, remain untilled, dependencies created by British capital, defended from invasion by British fleets, helped by British taxpayers, but allowed by a succession of Governments, with the precedent of the American colonies in their minds, to surround themselves with *chevaux-de-frise* of exclusiveness.

No longer do great clipper ships leave these shores crowded with hopeful emigrants, the refrain of "Cheer, boys, cheer," on their lips, and speed across wide oceans to the Antipodes. A new order of things prevails. Workmen's wages in Australasia must be maintained at a fixed standard, come what may. Heavy duties must be levied to effect this, and everything must be "protected," except the interests of Great Britain.

But Hodge wants to move somewhere and earn more money, so he and his belongings migrate to London, side by side with other kinds of impoverished labourers; but, alas! for them, side by side also with the poor alien, who is unquestionably one great cause of the congestion in certain districts. Russians, Poles, and Germans swarm into the world's metropolis, whose streets, they have been told, are paved with gold that only requires picking up! They are willing to pay almost any price for wretched accommodation near their work, where they herd together under conditions as low as they can well be.

The following illustrates this. At the London Hospital in December of last year Mr. Wynne E. Baxter held an inquest on the body of Mary Moretsky Libermann, aged nine, who was accidentally burnt to death. The coroner said the only articles in the room where the fatality took place were a small bed and a broken chair, and that the mother and two children slept in the bed, and four other children on the floor. The woman, it appeared, came from Russia, and had only been in England seven weeks. For the small room she paid 3*s.* 6*d.* a week. A juryman urged that there ought to be some sort of supervision over the kind of house in which this woman and her family existed.

The presence of aliens and their competition also

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FIG. 36. WHERE THE POOR LIVE

Original drawing by Hanslip Fletcher

lowers the already sufficiently low rate of wages. Houses, therefore, in these localities—once tenanted by a single family—are let off at exorbitant rates to as many as can be crammed into them. Lucky, indeed, is the married labourer who can anywhere secure a single room for

4*s*. to 6*s*. a week. And such a room! No means of preparing a real meal, the family fare generally consisting of tea, "two-eyed steaks" (herrings), and a "couple of doorsteps" (two slices of bread) per head.

But, as "General" Booth says, "A home is a home be it ever so low, and the desperate tenacity with which the poor cling to the last wretched semblance of one is very touching. There are vile dens, fever-haunted and stenchful crowded courts, where the return of summer is dreaded because it means the unloosing of myriads of vermin which render night unbearable, which (the dens) nevertheless are regarded as havens of rest by their hard-working occupants. They can scarcely be said to be furnished. A chair, a mattress, and a few miserable sticks constitute all the furniture of the single room in which they have to sleep and breed and die; but they cling to it as a drowning man to a half-submerged raft. . . . So long as the family has a lair into which it can creep at night, the married man keeps his footing, but when he loses that solitary foothold, there arrives the time, if there be such a thing as Christian compassion, for the helping hand to be held out to save him from the vortex that sucks him downward, aye, downward to the hopeless under-strata of crime and despair."

Truly in such cases one realises the truth of these lines :—

> "God made the country, and man made the town,
> What wonder then that health and virtue, gifts
> That can alone make sweet the bitter draft
> That life holds out to all, should most abound
> And least be threatened in the fields and groves."

Booth writes chiefly of the East of London; but of all overcrowded vile dens, perhaps none are so bad as those in the West End, frequently not a stone's-throw from fashionable thoroughfares and luxurious residences.

At Notting Dale, Kensington, is a district comprising five streets, consisting entirely of common lodging-houses and "furnished rooms," whose occupants are thieves, rogues, professional beggars, hawkers, and "unfortunates." It has been rightly named the "West End Avernus," and so offensive are the habits of its unwashed crowds, that the policeman on his beat is often compelled to hold his handkerchief to his nose as he passes by.

Still lower in the grade of accommodation for a married labourer is the "part of one room" system; and, lowest of all, the common lodging-house, where over-crowding is inevitable.

In one alley in Spitalfields there were last year ten houses in whose fifty-one rooms (none of them more than 8 ft. by 9 ft.—about the size of a biggish bathroom) no fewer than 254 human beings were distributed; from two to nine in each apartment, but nine in the room was not the maximum.

There is an old story to the effect that a district visitor, sympathising with an occupant of some such lodging as the above in St. Giles'-in-the-Fields, where four families respectively *tenanted* the four corners, was met with the philosophic reply, "Oh, yes, we should have been comfortable enough if the landlord hadn't gone and let the middle of the room to a fifth family."

Think of all this, fathers and mothers, who jealously guard your children from every possible source of moral contamination, whose daughters' modesty would be startled if accidentally a bedroom window momentarily revealed their toilettes, whose children at boarding-schools feel sensitive about dressing and undressing before others.

Yet this is nothing! A well-known rector in the East

End says: "From one of my parochial buildings I have seen through the thinly-veiled windows of a house, four men and six women retiring for the night in one room, all of them respectable, hard-working people, and the majority of them sleeping in beds on the floor," the rent per week being eight shillings.

As to the alleged dislike of the very poor to the use of soap and water, it is chiefly because the privacy essential for tubbing is simply non-existent.

Probably the lowest depth is attained, as I have said, in the common lodging-house, where all kinds of characters assemble under conditions which make innocence and decency impossible, children looking without any emotion upon sights they ought never to see, and listening to language they ought never to hear.

The victims of this result of overcrowding are human beings like ourselves, "fed with the same food, hurt with the same weapons, subject to the same diseases, healed by the same means, warmed and cooled by the same winter and summer."

It is not from choice that men, women, and children are thus herded worse than cattle. Necessity compels them to dwell within a certain area, especially the "docker," who cannot afford to take a journey in search of work, while the smallness and uncertainty of their earnings, together with the high rent they pay, deprive them of the power to exist otherwise.

Figures prove little, but it is a fact that for all London the average population per acre is fifty-seven; and an idea of the extent of overcrowding in certain localities may be gathered by comparing this with that of St. George the Martyr, Southwark, which is 210; with Whitechapel, 225; and with Spitalfields, 330; the latter equivalent to crowding into the area of Grosvenor Square (six acres), tenements containing 1,980 souls, instead of 342! On the other hand, in the wealthy parts of London there is far too much room, great mansions that could comfortably accommodate scores of people being habitually left almost empty.

The moral effect of it all is terrible. Thousands of infants, ill-born, tainted, ill-fed, ill-clothed, ill-housed, are growing up under conditions where purity of thought is impossible, growing up to taint future generations and undo the good work effected elsewhere in social regeneration. Why keep the main stream pure if foul rivulets be allowed to arise and pollute it again? Why make clean the outside only of the cup and platter?

But, as Cervantes says, "there is a remedy for everything but death." And for the "submerged tenth," who cannot move away to the suburbs, no doubt in time vast barracks built of steel with garden roofs, unsightly but utilitarian, will be created in every poor quarter, resembling the Park Row Buildings in New York, 380 feet in height, and consisting of thirty stories; or the Fisher, the Marquette, and the Champlain blocks in Chicago, of seventeen stories each.

These buildings would accommodate thousands of lodgers—British subjects only—at low rentals, under decent and sanitary conditions. While for workmen and others in receipt of fair wages cheap electric traction, enabling them to go to and from their daily task, will solve the problem of overcrowding so far as they are concerned.

Overcrowding, however, is only one out of a host of problems and questions that characterised the closing decades of the last century, and beset the opening of the present one.

We are haunted with problems, and if none existed we should probably regret it, and try to invent them. There are endless political and economic problems, the naval and military, the religious and educational, the national food supply, and with it the land and agricultural question, the labour question, and the relief of the poor, who are always with us.

Social problems bristle on all sides, and every active lady appears to belong, not to one, but to many of the societies for the reform or abolition of this, and for the bringing about of that, which abound. Mr. Jellyby's little project for civilising the natives of Borrioboola-Gha on the left bank of the Niger, and providing them with blankets, would be but a drop in the philanthropic ocean of to-day!

Temperance, morality, smoking, marriage laws, vaccination, funeral customs and cremation, early closing, domestic service, cooking, dress, hygiene, our boys and girls and what to do with them, in fact, everything in life, seems to have been converted into a "Question," and provides a text upon which more or less eloquent sermons are preached.

Everyone seems to work hard, and has no time for anything. Everyone, too, is restless and expectant, eager for excitement and change, while miracles of discovery and invention are wrought so frequently as to be almost unnoticed.

All nations are being chained together by iron roads or lines of swift steamers, and everybody travels. Locomotion is the order of the day, a sign of the times, and electricity is the great factor that has brought it about.

Just as in the building of some vast cathedral unsightly scaffolding conceals the graceful proportions of the uprising building, so in what is going on around us may appear much confusion and absence of purpose. But out of it is being evolved a state of readiness for the coming era, when wars shall cease and vexed problems be finally solved.

Meantime the world's feverish workers might well despair, were it not that they

> "... see in part
> That all, as in some piece of art,
> Is toil co-operant to an end."

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