

LONDON'S NEW UNDERGROUND ELECTRIC RAILWAY.

In a few weeks' time the new electric railway in London will be opened for traffic. This system, called the Central London Railway, which is the third and largest of its kind constructed in the English metropolis, opens up one of the most thickly populated suburbs, which has always urgently required a rapid means of transit to the city. The line is six and a half miles in length, and stretches from the Bank of England, the focus of all London's trade, to Shepherd's Bush, in the West, passing under some of the busiest arteries, such as Cheapside, Newgate, Holborn and Oxford Streets, in its progress, with stations conveniently situated for reaching the most important centers, such as the General Post Office, the British Museum, Regent Street, etc.

It is only within recent years that the possibilities of underground electric traction has dawned upon British engineers. The City and South London Railway, which was opened in 1890, proved that the idea was not so chimerical as it had at first appeared. That experiment was attended with such prodigious success that other similar railways were rapidly projected. Now there is every reason to believe that in the near future the length and breadth of the English metropolis will be honeycombed with electric railways. Not that there is any danger of London being oversupplied in this direction, since such an event would be well nigh impossible. At the present time, considering its importance and commerce, the intercommunication of the great city is very inadequate and unsatisfactory.

It was the most cherished ambition of the late Mr. Greathead—the inventor of the shield, which has done yeoman service in the accomplishment of successful tunneling for subterranean railways—that London should be supplied with an efficient and thorough system of intercommunication. Unfortunately, there were several things which militated against the realization of such a desire. First, there was the question of vested interests, which proved an almost insurmountable difficulty. To tunnel through private property, even at a depth of eighty feet, could only be performed after the payment of exorbitant compensation to the owners of that property. When the bill for this Central London Railway was brought before Parliament in the usual course, it was passed upon the express stipulation that the railroad followed the lines of the streets, and did not encroach upon private property at all. By this means heavy expenditure in the way of compensation has been almost entirely obviated, with the result that the total actual cost of the whole work has been about \$10,500,000 or only a little over \$2,500,000 per mile.

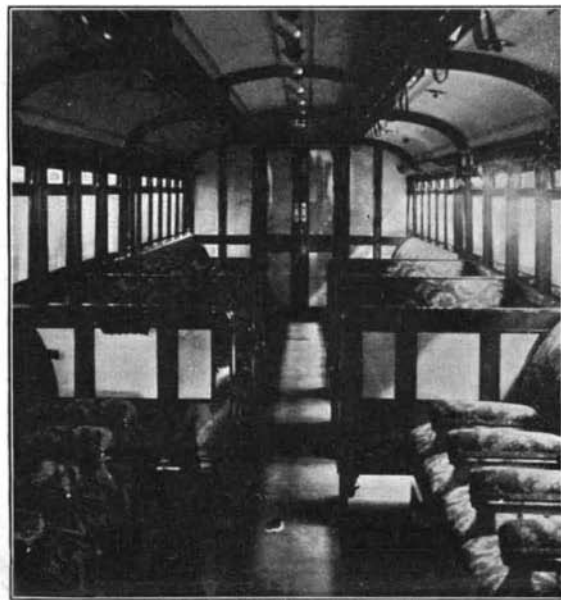
The stations on the average are placed half a mile apart. The track is arranged so that in leaving a station the train is on a down grade and is on an up grade in approaching a station. After leaving a station the track descends in a gradient of 1 in 30 for a distance of about 300 yards; and similarly rises at 1 in 60 for about 600 yards to the next station. By this system of construction the stations are placed about 10 feet above the center of the intermediate sections of the track. The advantages accruing from this principle are obvious. Standing in the station on the brow of an incline, the locomotive does not have to exert the same amount of power in starting that it would have to exert were the track level. Then, when running into a station, the incline naturally retards the speed of the train, so that excessive application of the Westinghouse brake, with which the train is provided, is not necessary to bring the train to a standstill in the station, while the danger of over-shooting the platform is considerably minimized.

The platforms are each 325 feet in length. The stations are lined with glazed tiles and illuminated with electricity. The electrically worked lifts giving access to platforms, three to five of which are provided at each station with the exception of the termini, were constructed by Messrs. Sprague & Company, of New York. In the event of an accident rendering the lifts abortive, and for the convenience of the small minority who do not care to use them, a wide spiral staircase is provided. There are thirteen stations throughout the entire system, including the two termini. At the latter there are two large cross-over tunnels in which

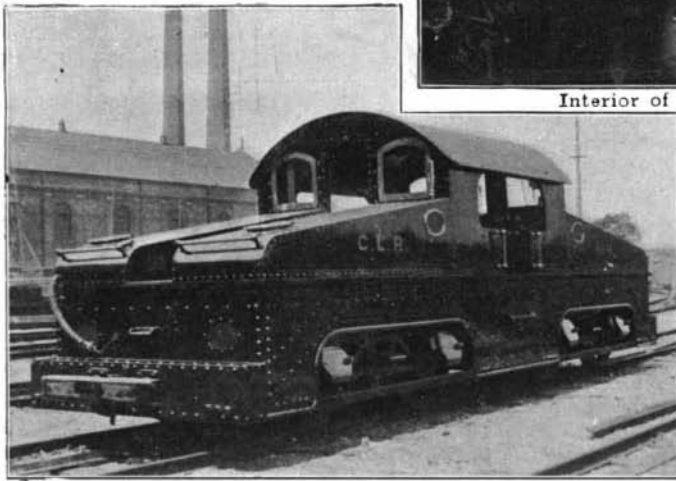
the arriving trains cross over to the departure platforms.

It was originally intended that the electric locomotives should be of English manufacture, but no engineering firm could guarantee delivery within the stipulated time, so the Electric Traction Company placed their contracts for the electric equipment with the British Thomson-Houston Company, of London. The locomotives, which were built by the General Electric Company, of Schenectady, are eight-wheeled, nearly 30 feet in length, and 48 tons in weight. They are equipped with four gearless electric motors, one applied to each axle. The driver's cab is placed in the center of the engine, thus providing a splendid lookout both in front and behind. The current is conveyed to the locomotive by the third rail, while the return current is carried back to the generating station through the ordinary rails. The third rail is steel, of 80 pounds weight to the yard, laid on porcelain insulators, while the joints are bound with flexible copper bonds. The track rails weigh 100 pounds per yard and are laid on longitudinal sleepers.

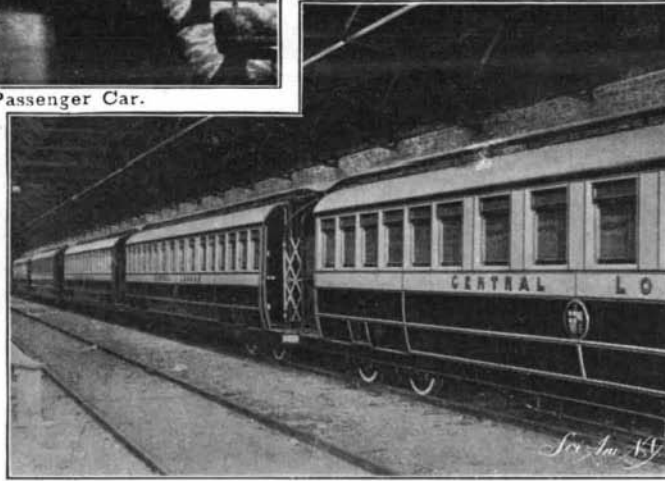
The depot is at Shepherd's Bush, the western terminus of the line. It covers a space of 800,000 square feet. The generating house measures 200 feet by 86 feet. The necessary plant was installed by the British Thomson-Houston Company, of London, and comprises six gearless compound condensing engines, each develop-



Interior of Passenger Car.



One of the 48-ton Electric Locomotives.



Train of Cars in the Terminal Sheds.

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ing 850 kilowatts. The three-phase system has been adopted as the most satisfactory in this particular instance. Each engine registers 94 revolutions per minute and indicates 1,300 h. p. The boiler house occupies 13,050 square feet, and contains 16 Babcock & Wilcox water-tube boilers, arranged in pairs. The heating surface of each boiler is 3,580 square feet; hourly evaporation of water 12,000 pounds; pressure 150 pounds to the square inch. The furnaces are fed with mechanical stokers. These are supplied by a cold storage tank at the top of the boiler house and fed by a coal conveyor, which also performs the dual office of removing the ashes. In addition there are the necessary locomotive and carriage sheds and repair shops, while three miles of sidings have been laid down. The erection of these buildings has been greatly facilitated by the utilization of numerous electrical devices for the transport of the material. The electric installation was designed by Mr. H. F. Parshall, and was carried out under his supervision, acting for the British Thomson-Houston Company.

It is proposed that a frequent and rapid service of trains shall be inaugurated. Trains will run every 2½ minutes and will complete the entire journey in twenty-five minutes. The weight of the train is 105 tons, exclusive of locomotive, and it will carry 336 passengers. The cars are constructed on the American principle, with the corridor extending down the center and the seats ranged on each side. Only one class of accommodation is provided. A mean speed of 14 miles per hour will be attained, though fast traveling is somewhat prevented by the short distance between the stations.

The fare will be 2d (about 4 cents) and up to 8 o'clock in the morning it will be possible to cover the journey for 2 cents. The service will be for twenty hours of the day, commencing at 5 A. M. and finishing at 1 the next morning. It was hoped that an incessant day and night service would be possible, but this scheme was frustrated by the Board of Trade, who stipulate that the permanent way should be examined daily, and, as this is impossible while the trains are running, the early hours of the morning will be set aside for this purpose. The ventilation of the tunnels is perfect. The trains almost fit the tunnels, and thus act as pistons, so that there is a constant current of fresh air in circulation. The temperature is also very even—cool in summer and warm in winter.

In a future article we shall illustrate the engineering features involved in the construction of the road.

Strategy of the Ants.

Says The New Orleans Times-Democrat: "There are a good many ants of different varieties on the lot at my country place near Covington," said a New Orleans business man, "and last year I began to make a systematic study of their habits. I found it a most fascinating pursuit, and have resumed it with much enthusiasm during several visits this year. A little investigation will convince almost anybody, I think, that the ant approaches nearer to man in point of intelligence than any of the lower animals. Some of the things I have seen are so marvellous that I would hesitate to speak of them if similar wonders had not been fully recorded by trained scientists. Near one of my flower-beds is a colony of small red ants that are extremely industrious in collecting food, and they frequently performed the most astonishing engineering feats in transporting heavy burdens to their homes. Not long ago I watched a party of about a dozen, that had found the body of a small spider and were dragging it toward the nest. The spider had hairy legs, which stuck out in every direction and caught on obstacles, greatly retarding progress. For several minutes the ants rolled away with their awkward booty, and then stopped and seemed to hold a council. A minute fragment of dry leaf was lying on the ground, presently they all laid hold and pulled the spider on top of it. They then seized the edges and slid it along without difficulty. On another occasion I saw a large

body of these same ants start out for a raid on another colony. They marched like an army, with scouts thrown out at the sides, and, when several feet distant from the nest, divided into two parties. One kept straight on and was soon engaged in fierce combat with the other tribe, while the second detachment made a detour and fell upon the rear. The result was a great

victory for the invaders. Anybody who feels interested in the subject and who will put in a little time at close study will be certain to witness exploits fully as astonishing as those I have described. I doubt whether there is any line of scientific research so attractive to the amateur."

A New Star in Aquila.

From an examination of the Draper Memorial photographs, Mrs. Fleming has discovered, says Prof. Pickering, a new star in the constellation Aquila. It was too faint to be photographed on 96 plates taken between August 21, 1886, and November 1, 1898, although stars as faint as the thirteenth magnitude are visible on some of them. It appears on eighteen photographs taken between April 21, 1899, and October 27, 1899. On April 21 it was of the seventh magnitude, and on October 27, 1899, of the tenth magnitude. Two photographs taken on July 6 and 9, 1900, show that the star is still visible. Photographs taken on July 3, 1899, show that its spectrum resembled those of other new stars, while the photograph taken on October 27, 1899, shows that the spectrum resembled that of the gaseous nebulae. On July 9, 1900, the object was observed with a 15-inch equatorial by Prof. Wendell, who estimated its magnitude as 11.5 to 12.0 and confirmed the monochromatic character of its spectrum.

In the month of March, upon the railroads of the United States, there occurred 82 collisions and 116 derailments and 6 other accidents, killing 37 passengers and injuring 168.