A NINETY-SIX TON ELECTRIC LOCOMOTIVE.

With the view, principally, of escaping the nuisance of smoke and gases from a steam locomotive in drawing passenger trains through a long tunnel, the Baltimore & Ohio Railroad, with the co-operation of the General Electric Company, has brought into its service a powerful electric engine, illustrated on our first page. Three of these electric locomotives were ordered, and one of them has for the past few days been doing duty conveying passenger and freight trains through a tunnel 7,339 feet long, commencing at the Camden Street depot in the city of Baltimore, and over tracks at each end of the tunnel, which brings the total haulage by electric traction up to about three miles. The service calculated upon from these electric locomotives is the transfer of about 100 trains each way daily, each passenger train having a maximum weight of 500 tons, including the steam locomotive connected with the train, to be moved at a speed of 35 miles an hour, and freight trains, weighing 1,200 tons each, to be moved at a speed of about 15 miles an hour on an 0·8 per cent grade.

The powerful machine which has been constructed for this work bears with its entire weight of 96 tons, or 192,000 pounds, on its eight driving wheels, which is considerably more than twice the weight on the driving wheels of the heaviest steam locomotive. It has two trucks and eight driving wheels of a diameter of 62 inches each outside of the tires, the wheel base of each truck being 6 feet 10 inches; the length over all, 35 feet; and the height to top of cab, 14 feet 3 inches.

The cab is of sheet steel, sheathed inside with wood, and is in two parts, each supported upon one truck. There is a sloping shield on each side of the cab, forward and aft, one shield carrying a headlight and bell and the other a headlight and whistle.

There are four motors, two to each truck, or one to each axle, and a good deal of the detail of one of the motors is shown in one of our views, the top field frame being lifted away from the armature and the bottom field frame in position. The driving gear consists of a cast steel spider shrunk on and keyed to a cast steel driving sleeve, forming the core of the armature, each arm of the spider having a double rubber cushion with a chilled cast iron wearing cap, the cushion being forced into the arms of the spider and the cap, and the arms of the spider being thus held in engagement with the spokes of each driving wheel.

The motors are supported on carriers bolted to the field magnets, and rest in adjustable hangers carried on half elliptical springs placed on top of the frame and bumpers. Each motor has six poles and six sets of carbon brushes, the latter being connected to a yoke revolving through 360 degrees, and readily accessible. The field spools are incased in sheet iron cases and fitted over the pole pieces bolted to the field frame.

The armatures are built of sheet iron disks, series drum wound, and known as ironclad, each insulated winding being embedded in an insulated slot cut into the outer surface of the armature body, and held by a wooden key. The armature, with the commutator, is mounted upon and keyed to the hollow sleeve carried on the journals on the truck frame. The inside diameter of the sleeve is about two and a half inches larger than the axle, and when normally placed the motor rests in a position concentric to the axle, the clearance between the axle and the sleeve allowing a flexible support, and the rubber cushions permitting the armature to run eccentric to the axle when the motor departs from its normal position on account of unevenness in the track. As will be seen by our illustration, the field frame is readily removable for inspection or repairs.

The trolley support, shown in one of our views, is diamond shaped and compressible, contracting and expanding as may be necessary, and leaning to one side or the other as the locomotive runs on one side or the other of the overhead conductor. Contact with the conductor is made by a sliding, shuttle-like, brass shoe, shown in a small figure, and the current is brought to the locomotive by cables connected to the shoe and fastened to the trolley support. The conductor is a simple form of iron conduit or trough, erected overhead on trusses outside the tunnel, and in the tunnel attached to the crown of the arch. It is formed of 3 inch iron Z bars ⅝ inch thick, riveted to a cover plate ¼ inch thick and 11½ inches wide, and is made in sections 30 feet long, weighing about 30 pounds per foot. The insulation of the conductors is effected by conical porcelain insulators supported in transverse frames, and the supports of the frames are themselves similarly insulated where they are secured to the arch of the tunnel, thus affording a double insulation. The feeder cables are of bare standard copper of sixty-one strands each of 1,000,000 circular mils (one inch) cross section.

Each motor is rated at 360 horse power and takes a normal current of 900 amperes at a pressure of 700 volts. The controlling devices and measuring instruments occupy the interior of the cab, the controller being of the series parallel type. Above the controller are the instruments which tell the driver the amount and pressure of the current the motors are taking, and a slot in the floor enables him to keep his eye on the commutators. The reversing lever projects through the upper plate of the controller cover, and the resistances are placed around the frame beneath the floor of the cab. The locomotive is equipped with a 1,200 to 3,500 ampere automatic circuit breaker and one 2,000 ampere magnetic cut-out, a 5,000 ampere illuminated dial Weston ammeter, and one illuminated dial Weston voltmeter. The compressed air for the whistle and brakes is supplied by an oscillating cylinder electric air pump, the air tanks being placed at each end of the complete locomotive. The interior of the cab is illuminated by clusters of incandescent lights.

The power house, which is also equipped with an electric lighting plant for lighting the tunnel, is in the immediate neighborhood of the tunnel entrance, and is 30 feet high and 322 feet long. It has an engine room 223 feet long by 57 feet wide, and the dimensions of the boiler house are 98 × 69 feet. In the latter, in six batteries, are twelve 250 horse power Abendroth & Root water tube boilers. Five engines and generators have been provided for, and four are now in place. The engines are of the tandem compound Reynolds-Corliss type, and have 24 and 40 inch cylinders. Directly coupled to them are 500 kilowatt General Electric multipolar generators, adapted to run with the engine at 110 revolutions a minute, and from these generators the current is taken over cables of 1,000,000 circular mils (1 inch) cross section to a switchboard on a platform at the south end of the engine room. From the positive receiver or bus on the switchboard eight cables of stranded copper pass to an overhead structure immediately outside the power house, where connection is made to three feeder cables and to an overhead conductor. The negative bus is similarly connected to the rails, which are double bonded with No. 0000 wire, and also to return cables laid in a wooden box between the tracks.

The tunnel, for use in which this locomotive was built, runs under Howard Street, one of Baltimore's principal thoroughfares, and was driven without any interference to the surface traffic, the vertical shafts being sunk to the tunnel through the cellars of houses along its line. The only severe cave-in occurred in the vicinity of the Baltimore City College, which was ruined. A new college was built by the contractors on the site of the collapsed building. Work on the tunnel was begun in September, 1890, and it was finished early this year. It is 27 feet high and 22 feet wide, and cost $7,500,000.

Further particulars of this remarkable electrical equipment will be found in the current issue of our SUPPLEMENT.

The History of the Jacquard Loom—How French Designers Study.

The history of the introduction of the Jacquard loom is a most instructive lesson on the advantage of free intercourse and rivalship between different countries. The inventor of that beautiful mechanism was originally engaged in a plaster quarry, afterward working at cutlery, type founding and weaving, having been a man who had never turned his mind to automatic mechanics, till he had an opportunity, by the peace of Amiens, of seeing in an English newspaper the offer of a reward by the Society of Arts, to any man who would weave a net by machinery. He forthwith roused his dormant faculties and produced a net by mechanism; but not finding the means of encouragement in the state of his country, he threw it aside for some time and eventually gave it to a friend as a matter of little moment. The net, however, got by some means into the hands of the public authorities and was sent to Paris.

After a considerable period, when Jacquard had ceased to think of his invention, the prefect of the department sent for him and said, "You have directed your attention to the making of net by machinery." He did not immediately recollect it, but, the net being produced, recalled everything to his mind.

On being desired by the prefect to make the machine which had led to the result, Jacquard asked three weeks time for the purpose. He then returned with it and requested the prefect to strike with his foot on a part of the machine, whereby a mesh was added to the net.

On its being sent to Paris, an order was issued for the arrest of its constructor by Napoleon, in his usual sudden and arbitrary way. He was placed immediately in charge of a gendarme, and was not allowed to go to his house to provide himself with necessaries for his journey. Arrived at the metropolis, he was placed in the Conservatoire des Arts, and required to make the machine then in presence of inspectors; an order with which he accordingly complied.

On his being presented to Bonaparte and Carnot, the former addressed him with an air of incredulity in the following terms: "Are you the man who pretend to tie a knot in a stretched string?" He then produced the machine and exhibited its mode of operation.

He was afterward called upon to examine a loom on which 30,000 francs had been expended for making fabrics for Bonaparte's use. He undertook to do by simple mechanism what had been attempted in vain by a very complicated one; and taking for his model a machine of Vaucanson, he produced the famous Jacquard loom.

He returned to his native town rewarded with a pension of 1,000 crowns, but experienced the utmost difficulty to introduce his machine among the silk weavers, and was three times exposed to imminent danger of assassination. The Conseil des Prudhommes, who are the official conservators of the trade of Lyons, broke up his loom in the public place, sold the iron and wood for old materials, and denounced him as an object of universal hatred and ignominy. Nor was it till the French people were beginning to feel the force of foreign competition that they had recourse to this admirable aid of their countryman; since which time they have found it to be the only real protection and prop of their trade.

It is in the production of the patterns of silk goods that the French have a decided advantage over other nations; they have probably little or none after the design is put into the loom.

The modes in which taste is cultivated in Lyons deserve particular study and imitation in this country. Among the weavers, the children and everybody connected with devising patterns, much attention is devoted to everything in any way connected with the beautiful, either in figure or color. Weavers may be seen in their holiday leisure gathering flowers and grouping them in the most engaging combinations. They are continually suggesting new designs to their employers, and are thus the fruitful source of elegant patterns. There is hardly any firm of consequence in Lyons in which there is not a partner who owes his place in it to his success as an artist.

The town of Lyons is so conscious of the value of such studies that it largely contributes to the government establishment of the School of Arts, which takes charge of every youth who shows an aptitude for drawing or imitative design of any kind applicable to manufactures. Hence all the eminent painters, sculptors, even botanists and florists of Lyons become eventually associated with the staple trade, and devote to it their happiest conceptions.

In the principal textile school of Lyons every one of the students receives from the town a gratuitous education in art for five years; comprehending delineations in anatomy, botany, architecture and loom pattern drawing. A botanical garden is attached to the school. The government of France also greatly assists said textile school of Lyons by money. The school supplies the scholars with everything but the materials, and allows them to reap the benefit of their works. The professor of painting is a man of distinguished talent, well known to connoisseurs.

The French manufacturer justly considers that his pattern is the principal element of his success in trade; for the mere handiwork of weaving is a simple affair with the Jacquard loom. He therefore visits the school and picks out the boy who promises by taste and invention to suit his purposes best. He invites him to his house and gives him a small salary to be gradually advanced.

After three or four years, if the young artist's success be remarkable, he may have his salary raised, and when his reputation is once established, he is sure of the offer of a partnership. Such is the general history of many of the school boys of Lyons.

Even the French weaver prides himself upon his knowledge of design; he will turn over several hundred patterns in his possession and discourse on their relative merits, seldom erring far in predicting the success of any new style. By this disposition the minds of silk weavers in France become elevated and refined, instead of being stultified in gin shops, as those of our weavers too frequently are.

In flower patterns the French designs are remarkably free from incongruities, being copied from nature with scientific precision. They supply taste to the whole world in the extent of their exportations.

In the Lyons school, collections of silk fabrics may be studied extending over a period of four thousand years, with explanations of the modes in which every pattern was produced, from the rude silk of the Egyptian mummies to figured webs of the last year.—Textile Record.

Electricity on the Japanese War Vessels.

The firing of great guns and the explosion of shells appears to have the effect of disarranging some of the electrical devices on war ships. The Japanese legation in Paris has forwarded to the French government a report relating to the recent naval combats, in which it is stated, with regard to the electric installations on board the Mikado's warships, that the interruptions of current which took place were not caused, as has been said, by the recoil of the guns, but by the bursting of Chinese shells. The working of the ordnance maneuvered by electricity was not interfered with. The electric wires used for igniting charges were, however, broken by the vibration set up by the firing of the heavy guns.