

Interesting Facts and Figures Concerning The Construction of the Great Tubes. ENTERPRISE COST ABOUT \$160,000,000.

aken." to quote the words

shared the responsibility of authorizing

mond. "Chief engineer, North River Division,

"Chief engineer, East River Division,

"Chief engineer, electric traction and

"Chlef engineer, Meadows Division

William H. Brown; retired March 1, 1905;

"Architects, New York Station, Me-

"Engineers, station, steel structure and

machinery, Westinghouse, Church, Kern

The tablet then recites the names of

The other tablet gives the dates of

franchises, the composition of the rapid

transit commission that made the grants,

"The construction of the tunnel exten-

sion was begun June 10, 1903. The two

unnels under the North River and the

ompleted by the junction of the last

North River tunnels, October 9, 1906.

"These were the first tunnels for stand-

ard railroad trains constructed under

"The construction of the New York sta-

"North River tunnels, O'Rourke .Engin-

Crosstown tunnnels, East River to New

eering Construction Company. "East River tunnels, S. Pearson & Son.

on building was begun May 1 1904.

The principal contractors were:

"East River tunnels, March 18, 1909.

our tunnels under the East River were

built by shields driven from each side of he respective rivers, and union , was

tubes on the following dates:

the directors of the railroad company.

station construction, George Globs.

succeeded by Alexander C. Shand.

Charles M. Jacobs.

Kim, Mead & White,

and then states:

hese rivers.

Alfred Noble.

& Co."

and constructing the undertaking.

River tubes was five of these rings or an advance of twelve and a half feet. Hy-

the giant every few inches around the tube, were board of engineers which supervised the the completed ter- used to push forward the huge shields designing and construction of the Newwith which the tunnels were bored. York tunnel extension of the Pennsylbeauty against the River tunnels weighed 194 tons and had tem, said one day to Charles W. Raybeen nine doors in it, through which rock, mond, the engineer, that he was unable silt and sand was forced backward and to reconcile himself to the idea that a actually marvelous, to skilled engineers the head ou meeting of the tunuels, driv-ing blindly-foward each other under the river's bed, and guided by instruments of mile wide. The remark was the germ of the most precise kind, was a mere incl. The wide, the remark was the indent. A deflection of a few inches in the present huge improvement

THE greatest railroad tunnel and difficulties; secondly, because of the all directions to take care of the pres-reconstruction project over un- greater number of tubes, and, thirdly, ont large traffic and the larger traffic because they were built to stand a tro- which will come with the use of the tunmendous, rapidly moving, local and ex- nels into the Pennsylvania station in New road's terminal and tunnel plans in New rings. The installation of each ring in easy reach of New York City. To-York City, is the result of the workings feet. Eleven segments and a key piece railroad improvements years count but at the top complete the circumference, as days, the New York Counceling Rail-rorise and an entire ring weighs about fifteen road, cryssing the East River on a fourgantic method of pro-tern corporation indus-to the surface, and it is through these ice between New England and the West

Years Ago. raulic rams, placed against the flanges Years before the appointment of the The type of shield used in the East vania Railroad, A. J. Cassatt, of the syscen'out. Though to a layman it seems railroad of the scope of the Pennsylvathe miles of tunneling would have been Railroad in 1900 introduced new elements horizon of plans which The Eagle is cele; brating to-day as one of the most in ortant events in the history of Long sland Railroad into the schemes and omputations of the railroad men it beame imperative to provide for the most issal short haul continuous system ompleted, the following improvements Long Island City the tunnels rise to the tunnel, where open gravel was passed vere made by the Long Island Railroad, surface and go through the Sunnyside through."

\$14,000,000. the State of New Jersey, \$10.000,000.

rban traffic so Brooklyn and to the Eagle's readers will tions of the tunnels:

Met and Solved.

completion of the work here set

transportation of between 100,000,000 and 140,000,000 passengers a year. was early in 1890, when he was consulted by the late Austin Corbin, presilent of the Long Island, Railroad Com-

ing), by a tunnel from the foot of Atantic avenue, Brooklyn, under the Bat-



precedent. Of the two systems of tun- East River, and the vast station and weight. These engines are of 4,000 horse atch was reinforced by longitudinal etcel power each and will draw 1,000 tons on a tunnel grade. but these were not introduced into the most difficult Island will benefit, the Long Island Rall- Twenty-six of these electric locomotives the engineering road is increasing its own facilities in have been continueed and others will tunusual stresses were anticipated, as for follow, Local trains on the Long Island instance, where the tunnels pass from

CROSS SECTION OF ONE SET OF TWIN TUNNELS system will be run by motors as at prea-

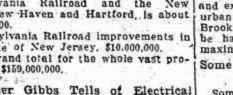


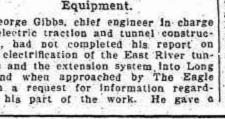
names of the directors and officers who Placing of Concrete Lining Was Comparatively Easy. "The tunnels and stations were planned end to end the work of putting in the ject is \$159,000,000. and constructed under the executive di- 22-inch concrete lining was immediately

and parlot cars.

a single motive power."

ment and power houses.







to provide for the increased traffic. Ail "One of the most important questions

steel cars including sleeping, diping nels was their probable stability under

"This electrification is the most impor- and rapid railroad traffic. The tunnels

aken in connection with the growth of place, even when the weight of the heavy

population in the big cities. It has also live load is included. In the East River

made a place for the engineer that a fex the character of the material seemed to

clalized information, in a high degree, laction of the live load. In the North

tiles, is effective, accure and highly eat- fidered, but was eventually deemed un

lafactory. The electric system now being necessary, and was given up, installed by the Pennsylvania for the Alfred Noble, past president, Am. 856

a simplified the transit problems of the Biver the question of supports was con-

pencht or the people of New York and C.E., has written a detail of the work

Long Island is the most colossal ever put of the East River tunnels, which supinto service. The work here being done plements the general paper of Mr. Ray-

has never been matched and, indeed, mond, a never again in this country may 'c "The borings," he says, "revealed two

nal system, locomotives, electrical equip- project that the tunnels under the East

tant feature of modern railroading when are lighter than the materials they dis-

ie Feansylvania tunnel trains will be connected with the design of these tun-

the long continued action of a heavy

proposed tunnels, these depressions being

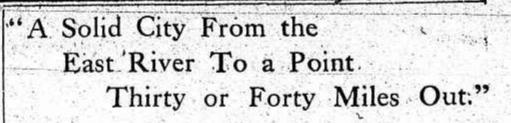


could only have that the successive rings are field to- and South by way of New York City." men used to dealing gether with bolts. The record progress onchalantly with figures for one day of eight hours on the East Plan Discussed by A. J. Cassatt Mahy

MEETING OF HEADINGS UNDER EAST RIVER.

the Street a





By RALPH PETERS, President of the Long Island Railroad."

September 8, 1910, the Long Island Railroad will be linked to the railroads of the United States by its own rails through the great tunnels and station of the Pennsylvania.

The electric trains of the Long Island Railroad will run from the Pennsylvania station in Manhattan and from Flatbush avenue, Brooklyn, where a connection is made with the Manhattan subway, to practically all the points in Queens and Nassau Counties. Within a year this electric service will be extended so that all of the stations in Queens and Nassau counties will be taken care of with electric train service, running direct to Manhattan and Brooklyn without change of cars. This means that one can live on the North Shore as far as Port Washington and reach the heart of the city in thirty minutes.

A million people could locate on the North Shore Division and still not overcrowd that vasr and beautiful section of Long Island. It means that the territory in the center of the island, as far as Garden City and Hempstead and Mineola, will be within thirty-five minutes of the hearts of Brooklyn and Manhattan. Another million people could be located in this section without overcrowding in any respect.

Part of the through trains from Greenport and Amagansett will be run in and out of the station by electric locomotives from Sunnyside yard, but all other steam trains for the time being will run in and out of Long Island City as at present, transferring both Brooklyn and Manhattan passengers at Jamaica. This will be continued until through electric service can be gradually extended to Whitestone, Port Washington, Oyster Bay, Babylon and other points

Some confusion and delay will doubtless be experienced at Jamaica and Woodside, but this cannot be avoided until this company can com-RALPH PETERS, PRESIDENT OF THE L. I. R. R. CO. plete the remainder of its improvements and get them in operation.

Long Island's greatest growth has been within the last ten years. ever The length over all of the East River expensive section of the East River di- There is no question in the minds of those who have handled the vast en. It became desirable to extend the division) tunnels from the Pennsylvania vision. Where there was rock it was amounts of money which have been expended in Long Island that the next only for a great prospective local traffic, but also for through passenger and freight traffsportation to all parts of the New England States and to and form all parts of the twin tunnels under the same streets to the same streets to sixth avenue, twin tunnels under the same streets to New England States and to and from a twin tunnels under the same streets to terial met in tunneling was guicksand; solid city from the East River to a point thirty to forty miles out. I firmly New England States and to and from any twin tunnels under the same stretce to the nearest parallels in work previous, points on the Pennsylvania mater the First avenue shaft, and then four the nearest parallels in work previous. Believe that that will come much faster than any of us can realize. It done were some of the tunnels under in done were some of the tunnels under is no greater opportunity to make money in the East River to Long Island City. At the Thames, particularly the Blackwell I believe there is no greater opportunity to make money in this concrete is no greater opportunity to make money in the state the tunnels under is the tunnels under

I believe there is no greater opportunity to make money in this part of the country than to buy property and build houses on Long Island. The ere made by the Long Island Railroad, reparatory to further improvements as he huge plan developed: Elimination of grade crossings in Brook. In Conversion of the Atlantic avenue sur-Conversion of the Atlantic avenue sur-The line to subway and elevated. Electrification, to avoid combustion and Electrification of a greater stretch of track later. To cost of the New York tunnel sis 144, and the proposed trans, The northern side of the trans, The northern side of the Bay Ridge and Atlantic evenue im-N. J., and Sunnyside, L. I., is \$100,000,000. The cost of the Loog Island electrifica-tion, Bay Ridge and Atlantic evenue im-Big along Thirty-third street, has been to a global trains. The northern side of the Bay Ridge and Atlantic evenue im-Big along Thirty-third street, has been to a global trains. The northern side of the Bay Ridge and Atlantic evenue im-Big along Thirty-third street, has been to a global big white station in Manhattan, extend-Big along Thirty-third street, has been to a global big white station in Manhattan, extend-Big along Thirty-third street, has been Big along Thirty-third street, has been Big along Catalon big white station in Manhattan, extend-Big along Thirty-third street, has been Big along Thirty-third street, has been Big al

s matter and a positive reflec-the men behind the work. Em-the men behind the work and new equipment. Is \$35,000,000. Island Railroad. Into this part of the the men behind the work and new equipment. Is \$35,000,000. Island Railroad. Into this part of the The cost of the New York Connect- Island Ratiroad. Into this part of the The opening of the tibes to-day marks for pleasure than can be found on Long Island. The communities that all kinds of outdoor amusements. There are a great many beautiful golf charge of all parts of the work; George courses within easy reach of the railroad.

Speaking from an agricultural standpoint, the Long Island Road work; George Leighton, resident engineer has proven beyond a doubt that everything can be grown on-Longs Island. and 500,000 acres that exist in Suffolk County, uncultivated, can be furned into little gardens which will make many thousands of people very happy.

With the growth of population will come more and quicker service. There are many complex problems connected with the inauguration Worked in the tunnels were protected as the cleater line in such more difficult the terminal, passenger service alone bay, "Chairman, General Charles W, Ray-" worked on the giant Simplon tunnel, un- with a request for information regardder the Alps, in Egypt, South Africa, ing his part of the work. He gave a occurs in the East River and on the provided is expected to accommodate the we work out the solution of these problems. We handled over 220,000 passengers on Sunday, July 24. We will handle 300,000 on a similar day One Man on Work Twenty Years, in 1911. We are doing our best to give good service. I know we will Charles M. Jacobs, engineer of the succeed, and Long Island will be famous the world over for its wonderfully North Siver Division, in his report on climate, its productive soil, its beautiful hills and plains, its woods and with the tunneling of the North River waters, and its attractive homes.

hany and also of the Philadelphia and backs caused by the use of steam loco- The final decision to extend the Pein-

of the Central Railroad of New Jersey. the Jersey City station of the Pennsylof the Central Hailroad of New Jersey. Surveys and borings were made, and the Metropolitan Underground Rallway Com-pany was incorporated in the State of New York to construct the railway. Mr. Corbin, however, Mr. Jacobs states, was aware that in the transportation problem he had in hand the Central Rallroad of Under Maiden Lane, the East River, Pine-

interested in the plan, had a study of the subject made by Joseph T. Richards, C.E., for a route beginning in New York at Thirty-eighth street, and Park Avenue; thence crossing the East River on a bridge and passing around Brooklyn to Bay Ridge: thence under the completion of the tubes will fevolutionize but the but had being plants, and were rejected, for one reason, because they would interfere se-riously with river traffic. Railroad men believe that the comple-tious of the tubes will fevolutionize to a subway under Atlantic avenue to the present Flatbush avenue terminal bridge and passing around Brooklyn to

Reading Railroad, as to the feasibility motives in full-sized tunnels, the plan of sylvania system into New York and to connecting the Long Island Rollroad the North River Bridge was the best connect it with the Long Island Railroad with the Philadelphia and Reading, or with the Central Railroad of New Jersey (the New York connection of the Reade) in terminals was the factor which made by a minute for the benefit of the people in a dozen, into the the second sec the present system possible and feasible, of years of painstaking study and investi-Mr. Corbin's Pet Scheme. gation in which all routes, plans and aug-gestions either originating with the comtery and New York City, and directly The scheme of Mr. Corbin for a subway panies concerned or suggested to them

New Jersey and the Philadelphia and Reading were not as important factors as the Pennsylvania, and, in conse-quence, he abandoned the scheme for a tunnel plan calling for a line direct to and Jersey City Terminal Company, and would be taken into consideration. Most he station in New Jersey. Meanwhile the matter progressed. The estimates on construction were made to of the methods urged included the use Pennsylvania Railread, becoming vitally Interested in the plan, had a study of necessary franchises.

ger car yard in the world.



ford Railroad

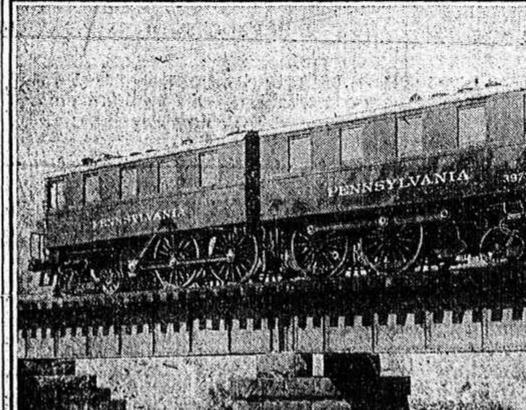
be brought into service as needed. There feet in length. are 73 miles of tracks in the yard, ar- Steel Viaduct 1,000 Feet Long. ranged in a system of loops that will Honeywell street is carried over th bave a capacity for the storage of 1,116 yard by a viaduct 1,000 feet in length. Waldo avenue yard in Jersey City has a sides. Waldo avenue yard in Jersey City has a Bides. capacity of 320 cars, and the, total capacity of the big Long Island Railroad with abutments 700 feet in length. It also

tion of all the bridges of the yard ... Diagonal street, a new highway extend-

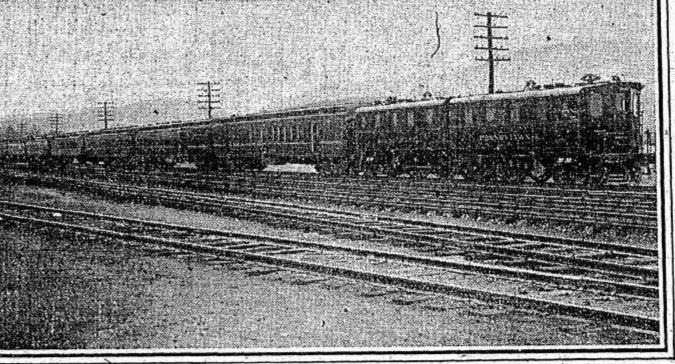
have a capacity for the storage of 1,116 An excavation 40 feet in depth had to be made at this point. Harold avenue to over 2,000 cars in the storage section. An idea of the size of the storage section. tion may be gained from the fact that the searth embankment, with natural slope

ward at Long Island City is 350 cars. | goes over Laurel Hill avenue and Gos-The portion of the Sunnyside yard used man avenue by equally big structures. The portion of a coach and Pullmen storage yard consists of 11 tracks spaced al- Hies that highway over the westerly intarnately 25 and 16 feet, center to center, trance to the yard at a height of 40 feet. and 25 tracks divided into groups of 6 each, with a spacing of 14 feet. These tracks vary in length from 950 to 1150 Pyramids. There are six plies of

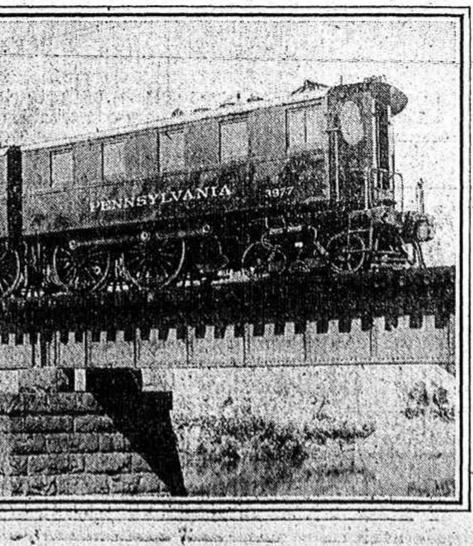
"PAIR" OF 4,000 HORSE-POWER ELECTRIC ENGINES THAT WILL HAUL TRAINS THROUGH TUNNELS.



tween the trunk lines of the latter and pounds of expanded metal and 2.211 all New England points on the line of pounds of welded wire fabric. The above the New York, New Haven and Hart- gives an idea of the solidity of construc-Yard Contains 73 Miles of Track. The yard is 5,550 feet in length and avenue and Van Dam street, is carried 2.550 fest in width. Only 153 acres is over the railroad yard to its full width, used at present, but the remainder will 100 feet, by a steel bridge about 1,200



GREAT "DOUBLE" ENGINES PULLING THEIR FIRST TRAIN.



been necessary to raise or lower the old tracks a maximum of about 15 feet. At Maple Grove or the new Kew station. ust north of Richmond Hall, a radical departure was made from the old Align-1. ment and the road was straightened a a heavy expense, going through the Richmond Hills Golf Club grounds, climinating two dangerous curves and saving about 500 feet in distance. A cut 50 feet in depth was made through Forest Park hills, heavy concrete retaining walls having to be used in portions of the cut. n the changing of the track grades in the main lines between Jamaica and Winfield Junction over 703,030 tons of earth were handled, and nearly 4,000 tons of bridge steel. Bridges 160 feet afin 1 length cach have been built over JAmalca arenue, Hillstde and Metropolitan. avenues, 46 feet over Lefferts avenue. two 42 feet each over as yet unopened streets on the Mann property at Richmond Hill 60 feet over Union turnplke. 80 feet each over Arcan. Continental and Yellowstone avenues, 60 feet over Penelope avenue, 100 feet over Woodhaven avepue, 60 feet over Caldwoll avenue, 66 feet over Grand street and 70 feet over Manrice avenue, all of which lengths are the ultimate street widths provided for in the final plans of the Borough of Queens. One of the notable features of the construction is where the westbound track of the Rockaway Beach Division is carried under the four tracks of the main _ line, coming to the grade of that fine several hundred feet to the north of the point of crossing. This underneath crossing is in the line of polley of the Pennsylvania Railroad to safeguard life and [property at any practicable expense, To Make Sixty Miles an Hour on L. I. R. R. Main Line.

A great majority of the passenger traine

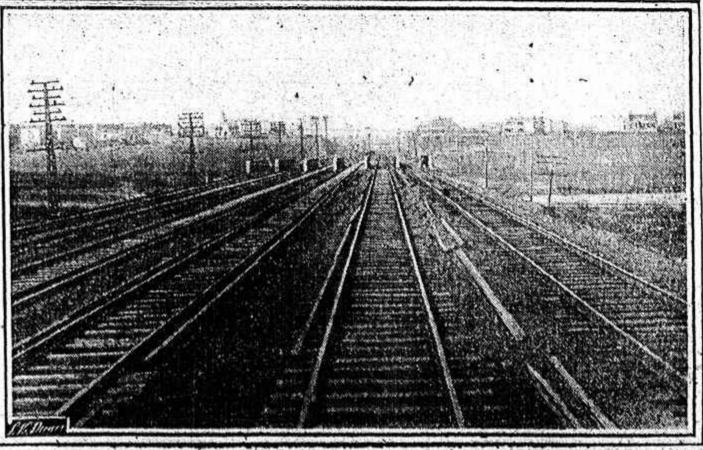
Water will be supplied for the whole yard and the big Long Island City power house from a reservoir south of the main tracks, which will be filled from wells near the Honeywell street viaduct. Au

of the question under the present condi-Last year's rate of increase in poula- tions. They cannot go north, or west or tion was 250,000: At that rate the city's south.

tion in four years, or two million in Long Island-the Land of Promise. eight years. On account of the new tran- Long Island is the only place left for it facilities and the new industries which, the coming millions of the city. Can it because of new conditions are coming provide homes for these millions? Until here and will bring added new popula- recently the East River has formed an tion, the probabilities are that the city's almost impassable barrier between Manrease in population within eight years hattan and Long Island, but the new subwill be nearer three million than two ways, tunnels and bridges are practically million people. It is probably safe to say obliterating the East River so far as that the city's net increase in population transit is concerned. It is now definitely within the next eight years will not be provided that there will be thirty-two less than two and one-half million people. tracks to carry passengers from Manhat-If This Is So, Where Can the People tan to Long Island and back again, com-fortably and quickly, and it is practically assured that there will be thirty-six If this is so, where can this phenomenal tracks. The thirty-two tracks and the increase in population go, and what will ferries which will continue to run can

be its effect on real estate? These people and if they are worked to their maximum, comfortably carry 450,000 people per hour, must go where they can get homes within like the subway, they would probably the limit which they can pay for them carry about 500.000 people per hour. and where they can get quick and com-fortable transit to and from the city's means that, if New York City's present opulation were to be distributed in har

SIX-TRACK RAILROAD NEAR WINFIELD.



and a second of the second second

In carrying out the new grades so as to material, which will be transported on The teeming population coming to our answer to that question.

ably not less than \$0,000 people.

acrease in population would be one mil-

GoP

ing of future highways at a minimum cubic yards of material for embankment work, and the company is going to Cold subway running to the outlying sections in probably not less than three million to the north of the city can be built and people, with no other territory so acces.

