ST CLAIR TUNNEL COMPANY

C. H. RIFF

THE TUNNEL PROJECT.

Contracts Awarded for its Construction.

A meeting of the promoters of the St. Clair Frontier Tunnel Company, was held in the Bachamber House, Sarnia, last Tuesday, for the purpose of electing directors, as was duly advertised in the Canada Gazette. Mr. Charles Mackenzie occupied the chair. The following gentlemen were unanimously chosen as directors:

Joseph Hickson, Esq., Montreal; John Bell, Esq., Belleville; Joseph Hobson, Esq., Hamilton; Hon. A. Vidal and Charles Mackenzie, Esqs., Sarnia; W. E. Meddaugh and W. J. Spicer, Esqs., Detroit.

At a meeting of the directors held at the same time and place, the Board was organized as follows:

Joseph Hickson, Esq., president.

John Bell, Esq., vice president of the company in Canada.

W. E. Meddaugh, Esq., vice president for the company in the United States.

Robert Wilkie, Esq., Montreal, secretary treasurer.

The meeting then adjourned to meet in Detroit, on Wednesday, 10th inst.

The question of constructing the tunnel has become an assumed fact. The money to proceed with has been subscribed, and though a few legal formalities have to be arranged, nothing of consequence stands in the way of going on with the work.

The contract for running the drift tunnel has been awarded to General Sooey Schmidt and operations will commence immediately on both sides of the River. Report says the work is now actually in progress on the Michigan side.

Mr. G. E. Hillman, of Hamilton, Chief Engineer, in charge of the tunnel, under Mr. Hobson, has been in town for the past few days and is ready to commence operations as soon as the contractors arrive. Mr. Hobson, jr., is also in town assisting Mr. Hillman. We understand Mr. Hillman intends moving his family to Sarnia and making this his home, at least while the work on the tunnel is going on.

November 12 1886

THROUGH THE TUNNEL

Thomas A. Edison Inspects the Work—His Latest Invention.

Thos. A. Edison, the famous inventor was in Port Huron from Friday to Sunday night attending the sick bed of his brother. On Saturday afternoon Mr. Edison accompanied by Mr. Bachelor, his confidential friend and assistant, Messrs. Henry Howard, J. W. Carleton, H. S. Sherman and several other Port Huron gentlemen took a trip of inspection through the St. Clair tunnel.

The party made the trip on foot and Mr. Edison expressed himself as greatly pleased with what he saw and was enthusiastic over the future possibilities the tunnel would have for this section. After having come through the tunnel the party walked to the ferry dock where they embarked for the American side.

Old acquaintances of Mr. Edison say that he is just the same unassuming and genial person to-day that he was twenty-five years ago and more, when he was a boy and young man in Port Huron. He is a story telling and good companionship, and talks freely and frankly with all whom he meets. He is still somewhat deaf, but has entirely recovered from the effects of the attacks of the ear which threatened his life some years ago, and his health is now excellent.

He told acquaintances who he met in Port Huron last Saturday some thing about the special line of practical electrical investigation and development in which he is just now engaged. He is working on a system of electrical locomotives for railroads, and expects within a few months to run trains between Chicago and Milwaukee by electricity. Mr. Edison says that electric motive railroads are coming much sooner than the public generally imagine, and that it will be but a few years before steam locomotives will be a thing of the past.

November 28
1890

The Tunnel Commenced.

Messrs Sooy Smith & Company the contractors for running a tunnel for the St. Clair River Tunnel Company commenced Wednesday sinking a working shaft near the river on the American side and yesterday they commenced opening a shaft on this side near the ship yard at the south end of the town, Work has already commenced on the erection of their engine house. The operators here are under the supervision of Mr. George E. Thomas, General Superintendent for the company, who has leased offices in the Owrey Block which he opened last Tuesday.

December 10
1886

Tunnelling the River.

The shafts on both sides of the river are now down to the level, and the contractors are making good progress with the work of boring the small tunnel, which is the forerunner of the railroad tunnel. The preliminary tunnel is six feet in diameter. The manner of excavating it is to bore into the centre twelve feet with a sort of auger and finish up and timber that much of the tunnel before beginning a similar section. The timbers are cut into such shape that they bind closely together shutting out the water. The process of boring the large tunnel will be similar, only on a larger scale. There are ten engines, five on each side of the river, used to do the hoisting and pumping and run the electric lights that illuminate the under ground opera-

December 18
1887

ACCIDENT AT THE TUNNEL.—Wednesday night while the shunting engine at the tunnel was running several flat cars, loaded with castings for the tunnel lining, down the grade leading to the shield, a coupling pin broke and three of the cars ran full tilt into the bumper at the bottom of the grade, and were so badly smashed as to render them unfit for service. A man named Durand who was working at the bottom of the grade, had his leg broken by being struck by a piece of timber.

September 27
1889

THE ST. CLAIR TUNNEL.

Annual Election of Officers — Work will be Resumed at Once.

The Detroit Tribune publishes the following.

Last Thursday morning, in room 7 at the Brush street depot the first annual election of officers was held, Joseph Hickson, of Montreal, being made president; Robert Wright, of Montreal, secretary and treasurer, and Joseph Hobson, of Hamilton, chief engineer. The old board of directors were re elected; Joseph Hickson, Montreal, Alex. Vidal, Sarnia; John Bell, Belleville, Ont., W. J. Spicer, Detroit and E. W. Meddaugh, Detroit.

A prominent official of the company said yesterday;

The work will undoubtedly cost more than was at first anticipated, but that there has appeared, or will appear, any unsurmountable obstacles to the successful completion of the tunnel we do not believe. The gas complained of by the contractor ceased flowing soon after being struck, and water undoubtedly came from springs—not from the river, as was at first feared. At the meeting yesterday it was determined that the company would take hold of the work and push it to completion. We will be put to an expense of from one half to two thirds more than was anticipated, because the freezing process will no doubt have to be employed. The contractor saw that he was not going to make as much money as he had anticipated, so he threw up his contract for the purpose of getting a better one. There is no question but that the tunnel will be built.

October 7 1889

Railways

Chicago & Grand Trunk Railw'y

TIME TABLE, SUNDAY, NOV. 17TH, 1889

Leaves Sarnia and Port Huron

WEST BOUND.

No. 2 DAILY EXPRESS—Sarnia 7.05 a.m., Port Huron 7.15, Lapeer 8.31, Flint 9.05, Durand 9.35, Lansing 10.30, Battle Creek 11.45, Vicksburg 12.48 p. m., South Bend 2.25, Arriving in Chicago at 6.25 p. m.

No. 6 PACIFIC EXPRESS—Leaves Sarnia 8.45 p m., Port Huron 8.55, Lapeer 10.20, Flint 10.50, Durand 11.28, Lansing 12.37 a. m., Battle Creek 1.55 a. m., South Bend 4.25. Arriving in Chicago at 8.10 a. m.

ERIE LIMITED EXPRESS—Leaves Sarnia 12.50 a.m., Port Huron 12.55, Flint 2.25 p. m, Durand 2.53, Lansing 3.45, Battle Creek 4.55. Arriving in Chicago at 10.10 p. m.

TRAINS ARRIVE

EAST BOUND.

LIMITED EXPRESS—Port Huron, 1.05 a.m., Central Time, Sarnia 3.05 a. m., Eastern Standard Time).

ATLANTIC EXPRESS—Port Huron 7.35 a.m., Sarnia, 9.50 a.m.

ERIE LIMITED EXPRESS——Port Huron 1.35 a. m., Sarnia 11.50.

Pullman Palace cars are run through without change between Chicago and Port Huron, Detroit, East Saginaw, Bay City Hamilton, Niagara Falls, Buffalo, New York, Toronto, Montreal and Boston. Dining cars on 3 and 6 West Battle Creek

HURON AND DETROIT DIVISION

November 17
1889

Eastern Standard Time.

ATLANTIC EXPRESS—Port Huron 7.55 a.m., Sarnia, 9.50 a.m.

ERIE LIMITED EXPRESS——Port Huron 1.35 a. m., Sarnia 1.50.

Pullman Palace cars are run through without change between Chicago and Port Huron, Detroit, East Saginaw, Bay City Hamilton, Niagara Falls, Buffalo, New York, Toronto, Montreal and Boston. Dining cars on 3 and 6 West Battle Creek

HURON AND DETROIT DIVISION

Trains leave DETROIT at 8.00 a.m., 12.00 noon, 4.20 p. m., 11.00 p. m. Mount Clemens 8.40 a.m., 1.52 p.m. 5.20 p.m, 11.52 p.m. Lenox 23 a.m., 2.15 p.m., 5.55 p.m., 12.20 p.m. Pt. Huron Station, 10.05 a. m., 3.15 p.m., 6.40 p.m 1 a.m. Arrive at FORT GRATIOT, 10.15 a.m., 3.50 p. m., 6.50 p. m., 1.10 a. m. Train leaving Detroit at 11.00 p. m., has Through Sleeper to Toronto and Wagner Sleeper to Niagara Falls, via London and Hamilton.

Trains leave FORT GRATIOT at 7.25 a. m. 11 a. m., 3.50 p. m., 7.05 p. m. Port Huron, 7.35 a. m., 11.20 a. m., 4.00 p. m., 7.15 p. m. Lenox, 8.20 a. m., 12.33 p. m., 4.47 p.m., 7.55 p. m. Mount Clemens, 8.50 a. m., 1.25 p. m., 1.20 p. m., 8.24 p. m. Arrive at DETROIT, 9.40 a. m., 3.00 p. m., 6.10 p. m. and 9.10 p. m.

MICHIGAN AIR LINE DIVISION

Trains leave LENOX at 9.25 a. m., 5.55 p.m. D. & B. C. Crossing, 10.45 a. m., 7.05 p. m. Pontiac, at 11.39 a. m., 7.35 p. m.; depart, 5.25 a. m. 1.15 p. m. South Lyon, 9 30 a.m., 2.50 p. m. Arrive at JACKSON, 11.15 a. m. and 6.25 p. m.

Trains leave JACKSON, 5.25 a.m. 4.30 p.m South Lyon, 8.50 a. m., 6.30 p. m. Pontiac arrive 10.40 a.m. 7.45 p.m.; depart 6.55 a.m. 2.15 p. m. D. & B. C. Crossing, 7.12 a. m. 1.50 p. m. Arrive at LENOX, 8.10 a. m. and 4.40 p. m.

G. B. REEVE, Traffic Manager. W. J. SPICER, Gen'l Manager.

J. D. MURRAY, Agent, G. T. R. & C. & G. T. R

A. H. DALZIEL, CITY AGENT, SARNIA.

F. M. POMEROY, Pass. Agent, Port Huron, Mich.

November 17 1889

THROUGH THE TUNNEL.

Sarnia Yard Engine, No. 253, Successfully Makes the First Trip.

The first trial trip through the St. Clair tunnel was made yesterday afternoon by Chief Engineer Joseph Hobson, of Hamilton, accompanied by Mr. Chas. Percy, of Montreal, assistant to the General Manager of the G. T. R. and Col. Tisdale, of Simcoe, and a number of the employees. The train was made up here and proceeded from the Canadian to the American side of the river and after a short stay in Uncle Sam's dominions the return trip was made. The trip was successful in every respect and was signallized by the blowing of steam whistles on both sides of the river. The train was in charge of Conductor Nelson McKee, with driver Wm. Ovens at the throttle, and Wm McNeish as fireman, to whom the honor of being the first to take a train through the St. Clair tunnel belongs.

April 10 ~~1889~~ 1890

ria Observer.

AY MORNING, AUGUST 29, 1890 NO 35

UNDER THE ST. CLAIR.

The Great Tunnel Successfully Completed.

About 10 o'clock Monday morning the last wall of clay separating the Michigan from the Canadian end of the St. Clair tunnel, was knocked out by Mr. Hobson, Chief Engineer, and communication from end to end of the great work established. Mr. Hobson was accompanied in his trip to complete this memorable event by Mr. Chas. Mackenzie, M. P. P. and Dr. T. G. Johnston, the company's medical adviser in Sarnia, under the guidance of Messrs. Murphy and Eames, the chiefs of the boring and mechanical departments of the tunnel.

The drift from the shields on each side had been run to within a few feet of each other on Sunday, and an augur hole was bored through, so that the workmen were able to talk to each other. The excavation was then carried on until a foot or so only remained, and this was left for the Chief Engineer to remove. Monday morning Mr. Hobson, accompanied by the gentlemen above named, entered the tunnel from the Port Huron side, and when the final cutting was completed, the whole party passed through to the Canadian side. The event was announced by telephone and duly celebrated overground by the blowing of steam whistles afloat and ashore, the ringing of bells and the hoisting of flags on public and private buildings in Sarnia.

The accuracy of the work was fully demonstrated, the alignment of the shields being found to be perfect. The chief credit of this great undertaking is due to Chief Engineer Hobson, who planned it, and under whose directions it has been carried out, and its successful accomplishment entitles him to rank with the great engineers of the century. Great praise is also due to Mr. Thomas Hillman, the resident engineer, and his assistants, who were responsible for the successful carrying out of the details, and to whose skill and care is due the astonishing accuracy with which the shields have been guided in their course underground. So pleased was Mr. Hobson with the faithful and intelligent way in which all concerned worked to carry out his plans that he gave a half-holiday to all the tunnel employees and double pay for the day.

The Hamilton Times says: The workmen who have been engaged in the construction of the St. Clair tunnel, operating from the two sides of the river, have met at last. The boring is now completed, and in a few months the masonry, the track-laying, etc., will be finished, and trains will be running under the river. Much labor and expense, incident to the old ferry system, will henceforth be avoided. The Chicago & Grand Trunk route will become the favorite, not only for freight, but for passenger traffic. Great credit is due the Grand Trunk officials for carrying out this work so successfully, and Mr. Joseph Hobson, of Hamilton is entitled to no small share of it.

SIR HENRY TYLER'S VISIT.

Sir Henry Tyler and Sir Joseph Hickson arrived here Tuesday night in their official car and at 10 o'clock Wednesday morning started on their tour of inspection of the tunnel work. They were piloted over the works by Chief Engineer Hobson, Engin. Hillman and Messrs Murphy and Eames. Sir Henry, Engineer Hobson and Messrs. Murphy and Eames went completely through the tunnel, starting from this side. The others returned when the air locks were reached, crossed the river and joined Sir Henry and party in the tunnel on the other side. They returned to Point Edward after the inspection.

THE TUNNEL HOUSE BURNED.—Fire broke out in the Tunnel House early this morning and the building was completely destroyed. A report was in circulation

August 29
1890

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August 29 1890

THROUGH THE TUNNEL

Thomas A. Edison Inspects the Work His Latest Invention

Thos. A. Edison, the famous inventor was in Port Huron from Friday to Sunday night attending the sick bed of his brother. On Saturday afternoon Mr. Edison accompanied by Mr. Bachelor, his confidential friend and assistant, Messrs. Henry Howard, J. H. Carleton, H. G. Harmon and several other Port Huron gentlemen took a trip of inspection through the St. Clair tunnel.

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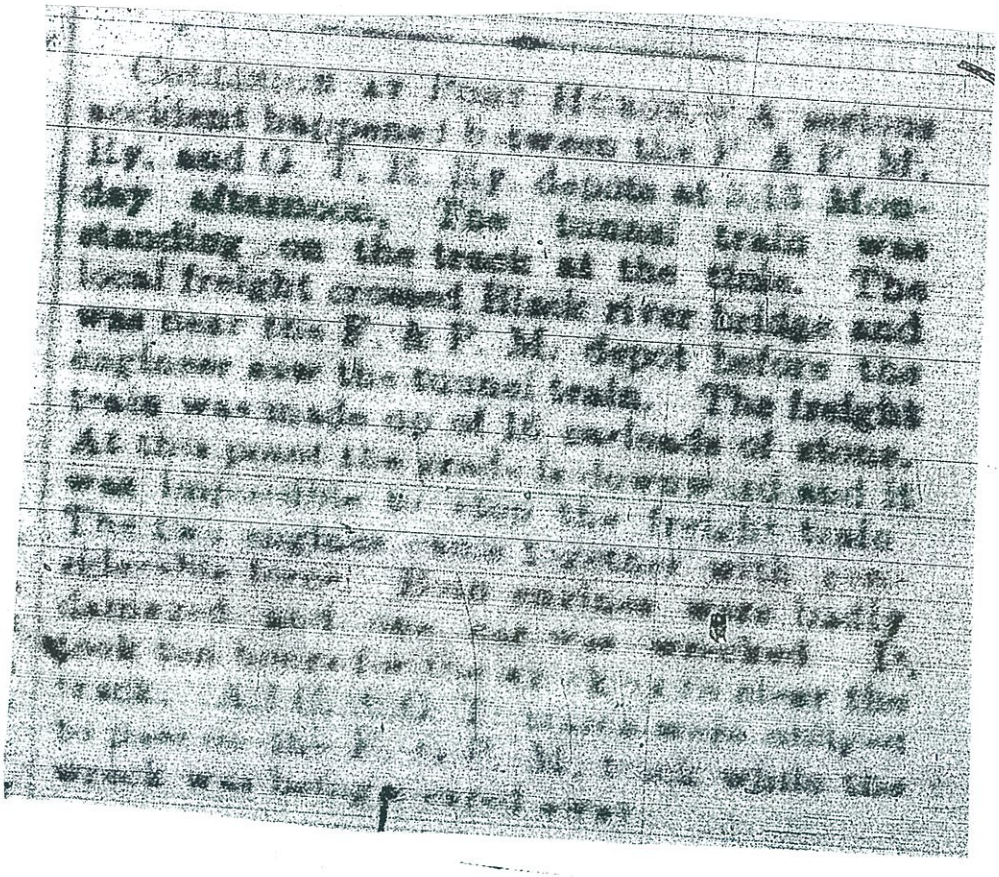
November 28
1890

Thomas
Edison



February 5
1891

A number of civil engineers of different western railways were at Sarnia last week for a visit to the St. Clair tunnel and were met by Chief Hobson, who took charge of them. They went through the tunnel, investigated, and were much impressed with the great work. The officials came here in a private car of the Atchison, Topeka and Santa Fe railway company. The interest taken by western railways in the tunnel shows the importance of the work and its effect on the passenger and freight traffic between the East and West and vice versa.

February 27
1891

THE TUNNEL LOCOMOTIVES.—Four of the largest locomotives ever built in the world are nearing completion at the Baldwin Locomotive Works in Philadelphia. They are being built for the Grand Trunk Railway and will be used in the St. Clair tunnel, which runs under the bed of the St. Clair river between Port Huron and Sarnia. The engines are peculiarly constructed. there are five pairs of 50-inch driving wheels on each. The water tanks are on each side of the boilers, and the cab is in the centre of the boiler, extending out over the two tanks. The locomotive is thus constructed to allow it to run backward and forward with equal facility. The cylinders are 22x28 inches and the boiler 74 inches in diameter, with capacity to carry 160 pounds of steam pressure. An idea of the enormous size of these monster engines may be derived from their weight. Each one with the water tanks filled and the starting supply of coal on board weighs 200,000 pounds the average weight in running order, with tanks about half filled being 180,000 pounds. The rails on which they will run will weigh 100 pounds per yard. The length of the tunnel track for which they are built to run over is only about four miles. They are designed to pull trains up the steep approaches to the tunnel. It requires about three ordinary locomotives for this service for each train. A satisfactory trial of one of the completed engines has been made. The other three will be finished in about 10 days.

February 27
1891

Tunnel Opening.

The formal opening of the tunnel takes place on Saturday, 19th inst. The proceedings are to be of a semi-public character only. The real opening to traffic, which will take place as soon as the approaches are completed, will probably be made a public one by the running of excursion trains from all points along the Grand Trunk system on both sides of the river to the tunnel.

On the 19th the programme will be as follows:

The guests invited to the luncheon at Sarnia will pass through the tunnel on special trains from Sarnia to Port Huron and return, before 2 o'clock. On the arrival of Sir Henry Tyler at Sixteenth street, it is anticipated that he will be met and welcomed to the city by Mayor McIlwain, who, in a brief address, will tender to him, and to the directors and officers of the Grand Trunk and St. Clair Tunnel companies, the freedom of the city, and present him with a testimonial expressing the appreciation of the people of Port Huron of the great work he conceived and has pushed to completion. After this presentation Sir Henry Tyler and his guests will return to Sarnia, and luncheon will be served in the freight sheds in this town, which will be appropriately decorated for the purpose.

After the special trains have returned to Sarnia the tunnel will be thrown open for the passage through it of the people of the two towns. The passage will be all one way, entering at Sarnia and leaving the tunnel at Port Huron. No charge will be made for walking through it. Men will be stationed the entire length of the tunnel to prevent people from walking on the ties between the tracks, which would be somewhat dangerous, and all will be required to move forward without stopping from end to end.

Sir Henry Tyler and General Manager Seargeant will leave for New York the Sunday or Monday following the formal opening of the tunnel and Sir Henry Tyler will sail for England a day or two later.

September 11 1891

The Tunnel Banquet.

The invitations to the tunnel banquet on the 19th are out. They are lithographed on cards 8x10½ inches in size. At the top there is a section view of the tunnel, under which the United States and British flags are crossed. At the right, lower down, is the portal of the tunnel, with the river in the back ground. On the left is a view of the Victoria bridge at Montreal, and the Lachine rapids. At the bottom of the card on the left is a view of the suspension bridge at Niagara Falls, and on the lower right hand corner the international bridge at Buffalo is represented. The invitation, which is engraved in the centre of the card, reads as follows:

Sir Henry Tyler, M. P., President, and the Directors of the Grand Trunk Railway Company of Canada, and of the St. Clair Tunnel Company, request the honor of your presence at Luncheon at 2 p. m., on Saturday the 19th of September, 1891, at Sarnia, Ont., to inaugurate the approaching opening of the St. Clair Tunnel route for public traffic.

Grand Trunk Railway Offices.

Montreal, 31st August, 1891.

R. S. V. P.

September 11 1891

SEPTEMBER 18, 1891

THE TUNNEL OPENING.

Preparations for the opening of the St. Clair Tunnel have been in progress here this week. The Grand Trunk freight shed has been cleared and is in the hands of the decorators, under charge of Mr. Atchison, Chief of the Hamilton Fire Brigade who has a wide spread reputation for his taste and skill in preparing large buildings for festive occasions. Mr. Anderson also of Hamilton, has been commissioned to provide the floral embellishments, which are to be on an extensive scale.

The banquet will be furnished by Montreal caterers. The Band of the 13th Batt., Hamilton will provide the music. The 13th Band is reported to be one of the finest in the Canadian militia service, but had the Grand Trunk authorities consulted its agents here they would have found equally as good music could have been rendered by the 27th Batt. Band of this town which ranks with the best of the bands in our militia service.

SATURDAY'S PROGRAMME.

Yesterday afternoon Sir Henry Tyler and the municipal authorities of Sarnia and Port Huron met and arranged the portion of the programme in which Sarnia and Port Huron figure. At 12:15 p. m. a special train of official coaches will leave here and proceed to the head of the tunnel approach where a large arch has been erected. Here a military escort will be drawn up and the 27th Batt. Band will be present to provide music. On behalf of the town Mayor Watson will present an address to Sir Henry Tyler. The guests will inspect the work on this side and pass through the tunnel to the American side, where Sir Henry and party will be met by Gov. Winans, of Michigan. At the head of the American approach Mayor McIlwain of Port Huron, will present an address on behalf of the citizens of the city. Sir Henry and party will then return to Sarnia in time to be present at the freight sheds in the afternoon and welcome their guests to the banquet.

September 18
1891

NO 39

FORMALLY OPENED.

THE ST. CLAIR TUNNEL RECEIVES A ROYAL BAPTISM.

Sir Henry Tyler Conducts the Ceremonies with Profuse Hospitality.

THE UNITED STATES AND CANADA WELL REPRESENTED.

The St. Clair Tunnel was formally opened on Saturday last, Sept. 19th, with all the rejoicings and congratulations that an important work of its kind would naturally bring forth. The weather was superb; the assemblage gathered in response to the invitations of Sir Henry Tyler, President of the G. T. R. and of the Tunnel Co., was one of the most notable in point of eminence of position, the vast interests and capital represented, and in individual ability and intelligence that has ever been brought together on this continent. The arrangements were complete, to the minutest detail and the programme of the day's proceedings was carried out without a hitch and with a smoothness that went far to make the occasion one of pleasant recollections to all who participated in it.

The first official act of the day was the presentation to Sir Henry Tyler, of an address from the municipal council and citizens of Sarnia. This took place at the grade level at the head of the approach to the tunnel on the Canadian side, immediately after the arrival of the Erie Express at that point, with a large number of distinguished guests from the principal points between here and New York. Sir Henry and the invited guests who had previously arrived were waiting on the special train that was to make the trip through the tunnel. When the party was completed by the arrival of the eastern contingent, an adjournment was made to a cleared space on the track

fully it picked its way down the incline. The banks on each side were lined with a cheering crowd of spectators, and on the sides of the cutting stood rows of clay begrimed workmen, with pick and shovel, resting from their labors to greet with cheers the appearance of the official train that marked the successful completion of the most important part of the great work in which they had borne so laborious and dangerous a part. The trip through the tunnel, brief though it was, occupying barely four minutes, was entered upon with mingled feelings of awe, wonder and trepidation by many on the train. The plunge from the brilliant sunshine into the dense darkness of the great tube was swift and startling. The inky blackness was so heavy that the lamps burning in the cars appeared to have no effect upon the impenetrable gloom. The electric lights set at intervals through the tunnel, flashed brief gleams as they were passed, but these as a result of the accumulating smoke and dust grew dimmer and hazier as the train progressed until at length they seemed enshrouded in fog. With closed windows and doors, the heat was getting to be oppressive and the passengers were beginning to wonder how much longer they would have to endure the heat and oppressiveness when with the suddenness of a lightning flash the broad glare of day burst upon them. The tunnel had been safely navigated, and the pent up feelings of those who had made the trip found vent in a prolonged cheer. From the banks on the Michigan side responsive cheers swelled upwards and rolled along as the train went gallantly up the grade. At the summit, a sight was obtained of one of the mammoth special engines built to convey trains through the tunnel. These are immense affairs, of peculiar construction, built to burn coke and to consume the smoke and gases generated in the processes of combustion. With one of these the trip through the tunnel will be entirely free from the disagreeable features that were beginning to be felt towards the close of the inaugural trip, which was made with an ordinary coal burning, smoke and cinder puffing locomotive.

At the grade level in Port Huron the customs office was fitted up with a platform, and decorated with evergreens and flags, and there Sir Henry and party were conducted to listen to a flowery address, delivered with elocutionary emphasis by the Mayor of Port Huron.

In the course of his reply Sir Henry

September 25 1891

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September 25 1891

the day's proceedings was carried out without a hitch and with a smoothness that went far to make the occasion one of pleasant recollections to all who participated in it.

The first official act of the day was the presentation to Sir Henry Tyler, of an address from the municipal council and citizens of Sarnia. This took place at the grade level at the head of the approach to the tunnel on the Canadian side, immediately after the arrival of the Erie Express at that point, with a large number of distinguished guests from the principal points between here and New York. Sir Henry and the invited guests who had previously arrived were waiting on the special train that was to make the trip through the tunnel. When the party was completed by the arrival of the eastern contingent, an adjournment was made to a cleared space on the track, and there Mayor Watson, surrounded by members of the Town Council and a large concourse of interested spectators, read the following address:

To Sir Henry Tyler, M. P., President, and the Directors of the Grand Trunk Railway Company of Canada and the St. Clair Tunnel Company.

The municipal council and citizens of Sarnia desire to extend through me, their official head and chief magistrate, their hearty congratulations on the successful completion of the St. Clair tunnel, a work of vast commercial importance to the two great nations of this continent, and an engineering achievement that will stand for all time as a monument of the enterprise, foresight and skill of its designers and builders.

To you, sir, we believe, is due the credit of its inception. The successful carrying out of your happily conceived idea must, therefore, be exceedingly gratifying to you personally, as it no doubt is to all who had the honor of being associated with you in giving effect to the undertaking.

As Canadians we take pride in the fact that the engineering talent and ability requisite for working out the details of a scheme of such magnitude was obtainable among citizens of this dominion, and within the limits of the engineering staff of the Grand Trunk Railway company. This fact furnishes a striking proof of the care and judgment exercised in selecting able and experienced men to fill responsible positions in all branches of the service of the company in this country, and is a guarantee of thoroughness and efficiency in the management of the company's affairs, that cannot fail to still further increase public confidence in the president and board of directors.

We trust that the most sanguine ex-

tantly up the grade. At the summit, a sight was obtained of one of the mammoth special engines built to convey trains through the tunnel. These are immense affairs, of peculiar construction, built to burn coke and to consume the smoke and gases generated in the process of combustion. With one of these the trip through the tunnel will be entirely free from the disagreeable features that were beginning to be felt towards the close of the inaugural trip, which was made with an ordinary coal burning, smoke and cinder puffing locomotive.

At the grade level in Port Huron the customs office was fitted up with a platform, and decorated with evergreens and flags, and there Sir Henry and party were conducted to listen to a flowery address, delivered with elocutionary emphasis by the Mayor of Port Huron.

In the course of his reply Sir Henry alluded to the scandalous effort of the Toronto Empire to spread abroad the impression that hostile feelings existed on the part of Port Huron and Sarnia citizens towards the Grand Trunk. The best of proof had been given that day of the utter untruthfulness of the statements in that journal by the cordial way in which he had been received by the representatives of the two towns and by the citizens on both sides of the river. What could have impelled a prominent journal to so misrepresent the citizens of Sarnia and Port Huron he could not imagine. While the slanderous statements were being read in this part of the country, a banquet in his honor was being given in Port Huron by the citizens, at which the most cordial good wishes were interchanged. Before concluding his remarks, Sir Henry alluded to an incident of the banquet to the effect that a lady presented him with an American flag there with a request that he carry it through the tunnel on the inaugural train. He had done so, and in proof of the fact he would produce the flag. Diving his hand deep down into his coat pocket he brought forth what he thought was the United States flag and waved it gally above his head. A roar of laughter greeted the act and Sir Henry then saw that instead of the flag he had been waving a spotless white handkerchief. Quickly recovering himself Sir Henry tried another pocket and with a smile of exceeding satisfaction he drew forth another white handkerchief. The cheers and laughter were deafening over this second contretemps, and were in nowise abated by the earnest search Sir Henry was carrying on in pockets likely and unlikely for the missing flag. At length Mr. Seargeant, General Manager of the G. T. R., stepped forward and presented the lost banner to Sir Henry. The latter

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THE MOTTOES.

Certainly much praise for versatility, judgment and an appreciation of the occasion is due to those who originated the mottoes which adorned the banquet hall. They were handsomely painted in lettering of red and black, and formed an elegant feature of the scene. They were as follows:

On the large American flag at the rear of the principal table:

'The peaceful tunnel's silent bore
Forbids the cannon's warlike roar.'

On the Dominion flag conjoined to the American flag:

'May we always meet in peace.' Having also an olive branch displayed.

'Anglo-Saxon pluck and skill
Conquer nature's obstacles.'

'In friendship's grasp
Two nations clasp.'

'The bonds of commerce unite us:
Let no jealousies divide us.'

'Another link in friendship's chain.'

'Britain's American children reunited.'

'Canada and the United States Wedded in the Bonds of Peace.'

'Unfettered Commerce, the Harbinger of Peace the World Over.'

'May hostile band ne'er pass the gates
That lead 'neath St. Clair's silv'ry straits.'

'The Triumphs of Peace are Nobler Than Those of War.'

The Herald of Untrammeled Commerce Between Canada and the United States.'

'A Free Commerce, the Heritage of a Free People.'

'The Stars and Stripes and Union Jack
A Peaceful Bond No Longer Lack;
Long May These Banners Wave Combined,
With Wreaths of Maple Leaves Entwin'd!'

The Toronto Globe reporter says of it: The long, low brick building in front is almost hidden in flags, bunting and evergreens, and at each end is a luxuriant and artistic mass of spruce-pine boughs and foliage plants canopying the entrances and giving a finish to the whole. But if the exterior is striking, what can be said of the banqueting hall itself? Can this be the bare, dirty, malodorous freight shed? It stands revealed now a veritable bower of beauty, clothed in a wealth of color and prodigality of decoration, and bathed in the softened effulgence of a [illegible] globes. From and

Foster, H. Fleming, L. J. Forget, J. W. Fortune, J. Flintoft, Col. Faithorn, Wm. Farr, H. [illegible]. Fairbairn, H. German, D. Guerin, A. T. Gurd (mayor Petrolea), Mr. Hildersleeve, Mr. Graves, A. H. Harris, J. J. Hobson, J. I. Hobson, R. Hobson, H. Holgate, Jos. Robson, Mr. Hoskin, Mr. Hopkins, Henry Howard, T. Hillman, W. Hartsuff, F. A. Howe, Mr. [illegible]ald, Mr. Hammond, W. Hendrie, Jas. Harper, C. J. Haigh, Mayor Harvey, Mr. Hollingshead, Geo. Hughes, Hon. R. Harcourt, R. Hering, C. F. Harrington, E. J. Hilliard, Mr. Hoag, T. C. Irving, Mr. Jennings, Dr. Johnstone, Frank Jenks, John Kennedy, T. C. Keefer, T. [illegible] Kilvert, Mr. Kirby, Thomas Kenny, James King, G. Laye, J. W. Loud, Col. Lindlow, J. S. Lougheed, Commodore Ludlow, Jos. Lusard, J. J. Lanning, Mr. Leonard, Mr. Merrill, J. H. Muir, E. W. Meddaugh, Geo. N. Matheson, L. G. Mason, Geo. A. Mitchell, W. T. Mitchell (Port Huron), T. H. Madgeburg, J. T. Maynard, J. A. Moore, Mr. Murphy, Mr. Mead, Mr. Middleton, Mr. McGuinean, Geo. Musson, J. B. Murray, Col. Morgan, Mr. Millis, Geo. Macrae, D. McIntyre, J. G. Macklin, F. B. McNamee, J. D. McIlwain, D. McMaster, C. McKenzie, W. B. McMurrick, Mr. McQueen, J. McShane, Mr. McVicar, Robt. Mackenzie, J. A. McKenzie, A. McLean, A. MacFarlane, Dr. McLaren, Geo. Neville, J. G. O'Neal, Geo. Omsted, Mr. Plewes, John Porteous, Col. Prout, R. H. Phillips, Dr. Pousett, Hugh Paton, H. J. Pettypiece, G. M. Pullman, Gen. Pope, U. S. Consul Pace, Hon. Mr. Pope (Toronto) J. Playfair, D. O. Pease, Mr. Price, Mr. Parizeau; C. Pullman, J. W. Poster, G. B. Reeve, Mr. Robinson, H. Roberts, A. C. Raymond, C. Robinson, Sarnia; Capt. J. O. Reno, J. J. Ross, W. A. Ritchie, R. Reford, M. Ritchot, R. M. Roy, L. A. Sherman, J. Stephenson, Hon. Byron Stout, F. C. Stone, C. S. & M.; C. Stiff, J. S. Symington, A. W. Street, Rev. Mr. Stout, John Small, W. J. Spicer, P. W. St. George, D. T. Skinner, Lieut.-Gov. John Strong, A. Stuart, F. W. Sherman, H. W. Stevens, Olive Symons, L. J. Seargeant; F. Smith, Sarnia; A. H. Smith, Gen Roy Stone, T D Sheridan, Mr Stackpole, F Symons, Mr Simpson, P B Sanborn, H G S Tyler, R Turner, (Que.), John Torrance, E H Twohey, Hon Mr Tarnsey, E B Taylor (Port Huron), Gen Trowbridge, C W Taylor, W F Tiffin, Mr Talbot (Railway Age), Joseph Taylor (Detroit), W H Tarsney, Wm Thurston, Dr Vail, H W Vance, Richard White, H Wallis, A White, Hon Mr Woadcock, J. S. Willison, G W Wells, F L Wells, E P Watson, F C Watson, Hon C R Whitman, Governor Winans, Hon Mr Whiting, H W Walker, C A Ward, Chas Wellman, D S Wagstaff, T R Wright, W B Williams, Mr Wickes.

which have made the name of Hobson distinguished above all others in connection with the St. Clair Tunnel.

The cordiality of the reception visibly affected him. His voice was low and while sufficiently distinct showed his unfamiliarity with the effort necessary to fill a large hall. Mr. Hobson said this overflowing measure of good-will was so much beyond his deserts, had so taken him by surprise that he could hardly express himself. (Cheers.) He desired most cordially to return his thanks. The difficulties to be overcome in making the tunnel were great, but this generous recognition made ample amends for all the toil and anxiety. The work had been carried on under the most favorable circumstances. It was never embarrassed by lack of means. (Cheers.) No engineer ever had less cause to complain of annoyance or interference from those above him. (Applause.) There was no circumlocution office attached to the tunnel. (Laughter.) There had been no red tape about it. [Renewed laughter and cheers.] He had been allowed to select his own assistants, to appoint his own men. He paid at this point a feeling tribute to Messrs. Hickson and Seargeant the general managers under whom he worked, and spoke of the courage and unflagging energy with which Sir Henry Tyler directed the progress and continuance of the work. That gentleman under whom he was serving was undismayed by the predictions of the prophets of evil who foretold failure and disaster. (Cheers.) He spoke in feeling appreciation of the men who, under him, had directed departments of the work—Mr. Hillman, who set out the work and whose calculations brought the two shields together with less than a quarter of an inch deviation in the centre of the tunnel; Mr. Murphy, who had charge of the excavating work, a man whose resources, said Mr. Hobson, were unlimited, and whose courage was wonderful; and Mr. Eames, who managed the machinery, and whose marvellous knowledge and ingenuity as a mechanic had often stood the enterprise in good stead.

These gentlemen were called forward upon their chief resuming his seat, and their reception was only second to his. Mr. Hillman returned thanks in a few unpretentious words, and Mr. Murphy remarked they were workers, not talkers; they knew not and cared not for the differences between Grits or Tories, Democrats or Republicans.

Sir Henry proposed 'Trade and Commerce,' and called on Mr. Erastus Wiman as representative of the New York Chamber of Commerce for a reply.

Mr. Wiman's remarks were devoted to a review of the great advancement of the railway enterprises of the continent and of the constant efforts that are being made to expedite the carriage of freight—the exchange of commodities between the two chief countries on this continent and the community of interest that as a consequence exists between them. He referred to the great natural advantages possessed by Canada and argued that its slow rate of progress, as compared with that of the United States, pointed to some radical defect in its government, or rather in its trade policy. While the English capitalist has been pour-

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'The Stars and Stripes and Union Jack
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The long, low brick building in front is almost hidden in flags, bunting and evergreens, and at each end is a luxuriant and artistic mass of spruce-pine boughs and foliage plants canopying the entrances and giving a finish to the whole. But if the exterior is striking, what can be said of the banqueting hall itself? Can this be the bare, dirty, malodorous freight shed? It stands revealed now a veritable bower of beauty, clothed in a wealth of color and prodigality of decoration, and bathed in the softened effulgence of a hundred transincent globes. From end to end of the ceiling is stretched broad bands of red, white and blue bunting from which at short intervals hang outspread streamers of every nation under heaven; around the walls are draped the good old Union Jack and the glorious Stars and Stripes, each so rich in memories, both so reverenced and beloved, at times held asunder by force of circumstances or the cunning of crafty politicians, but now and here entwined and interwoven in the dual unity which at one and the same time speaks with equal force of their individuality and their common brotherhood and kindship. Not a square inch of bricks or boards is visible on the walls or ceiling of this elegant salon, and even the floor is carpeted with sheeting to hide the least traces of its stained and trade-worn boards. Nor must the mottoes which display their well-timed and appropriate sentenpes at frequent intervals around the room be overlooked.

The general effect of the tout ensemble is greatly enhanced by the softly-tinted light afforded by the rays from the four-branched gasoliers pendent at frequent intervals down either side of the hall.

On the floor of this brilliant apartment are arranged tables for the entertainment of some 400 guests. The main table runs north and south along the west side of the building and the remainder at right angles thereto run across the building from west to east. The caterers hail from Montreal, and have brought the whole of their paraphernalia with them, and very inviting do those rows of tables look to the hungry guests, loaded down with [illegible] and decorated

Reford, M. Ritchot, R. M. Roy, L. A. Sherman, J. Stephenson, Hon. Byron Stout, F. C. Stone, C. S. & M.; C. Stiff, J. S. Symington, A. W. Street, Rev. Mr. Stout, John Small, W. J. Spicer, P. W. St. George, D. T. Skinner, Lieut.-Gov. John Strong, A. Stuart, F. W. Sherman, H. W. Stevens, Olive Symons, L. J. Seargeant; F. Smith, Sarnia; A. H. Smith, Gen Roy Stone, T D Sheridan, Mr Stackpole, F Symons, Mr Simpson, P B Sanborn, H G S Tyler, R Turner, (Que.), John Torrance, E H Twohey, Hon Mr Tarsney, E B Taylor (Port Huron), Gen Trowbridge, C W Taylor, W R Tiffin, Mr Talbot (Railway Age), Joseph Taylor (Detroit), W H Tarsney, Wm Thurston, Dr [illegible]il, H W Vance, Richard White, H [illegible]allis, A White, Hon Mr Weadcock, [illegible] S. Willison, G W Wells, F L Wells, [illegible] P Watson, F C Watson, Hon C R W[illegible]itman, Governor Winans, Hon Mr Whi[illegible]ng, H W Walker, C A Ward, Chas W[illegible]man, D S Wagstaff, T R Wright, W [illegible]B Williams, Mr Wickes.

The toasts and respon[illegible]s were presented in the following order, Sir Henry Tyler prefacing each toast with appropriate remarks. The first on the list was:

The Queen—Received with cheers. The band of the 13th playing God Save the Queen. Mr. Spicer, General Manager Chicago & Grand Trunk and other Grand Trunk lines in Michigan, led off in singing God Save the Queen; the audience joining in with great viger and good will.

The President of the United States came next, Sir Henry referring to the United States and its President in eulogistic terms. Consul General Knapp, of Montreal, responded with a brilliant oratorical effort. He told in eloquent language how he had, during his official residence in Canada, learned that the people while loyal toward their own country were always glad to extend the right hand of fellowship to the people of the United States. By all the surroundings of the hour we were reminded that it was our privilege to live in the most advanced age, and, however much we might revere antiquity, to attempt to live in the past was to simply stand still and let the age move by us. 'Beneath the waters,' he said, in conclusion, 'we have clasped hands, and here beneath these flags we join in a unity of hearts and unite in the hope that these two nations will dwell in peace one with the other and in good-will toward all the earth.' He thought the sentiment could not be better expressed than by the motto before him.

The Stars and Stripes and Union Jack
A peaceful bond no longer lack.
Long may these banners wave combined
With wreaths of maple leaves entwined.

Mr. O'Brien J. Atkinson also responded to the toast, showing what a great man in some respects and what a small man in others the President of the United States in his official capacity really was.

These gentlemen were [illegible] on their chief resuming [illegible] reception was only sec[illegible] Hillman returned thank[illegible] tentious words, and Mr. [illegible] they were workers, not ta[illegible] not and cared not for th[illegible] tween Grits or Tories. [illegible] publicans.

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Let us hope that the great [illegible] we now inaugurate will illust[illegible] ed advantage of unrestricted [illegible] such a degree that before lon[illegible] reciprocity that exists betwee[illegible] the union and the provinces [illegible] ion will be created betwe[illegible] nations. To obliterate th[illegible] barrier that, like a barbed wi[illegible] runs athwart the continent, [illegible] inaugurate a movement, the [illegible] of which would take rank a[illegible] those which followed the d[illegible] independence, or the ema[illegible] slaves, setting the south free [illegible] marvelous career of prosperit[illegible] north land needs only a simil[illegible] intercourse to contribute in e[illegible] degree to the prosperity of [illegible] States.

All these regions within B[illegible] sions need only the near by [illegible] the United States will afford t[illegible] contributary to the comm[illegible]

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not to demonstrate that this continent, though occupied by two nations, was commercially one? Can it be possible that He who scooped out the great lakes which lie between us and canaled the continent by rivers of such mighty volume, the waters of which intermingle as freely as the air which floats over them; can it be possible He ever intended that man—the best and wisest of His creatures—should mar that freedom by exacting tribute from those who cross from one side of the water to the other? Surely not. Why have we expended so much engineering skill in circumventing the rapids of the Sault or the tremendous cataract of Niagara or the whirling, rushing floods at Lachine if it was not to facilitate the freedom of exchange between the centre of this continent and the seaboard? (Applause.) But, sir, either nature has made a mistake in furnishing us with lakes and rivers for commercial purposes, and our people have made a mistake in spending millions upon their improvement, or we are making a mistake in diminishing their usefulness by needless restrictions on the commerce which every day moves upon their surface. And similarly with our railways. Canada has invested $760,000,000 in railroads; in proportion to her population she has in this respect evinced even greater enterprise than the people of the United States. But why this lavish expenditure, why this bridging of rivers and ravines, why this restless enterprise to find a short cut from centre to circumference, why this tunnel through which we have passed, completed at such enormous cost? Is it to find employment for the customs officers, or is it to demonstrate, as by a great object lesson, the commercial unity of the continent and by the removal of physical obstructions from the natural channels of trade anticipate the removal by and bye of all artificial and fiscal obstructions? To my mind that is what it means. (Cheers.) I cannot say whether the authorities of the Grand Trunk Railway intended, when this scheme was projected, that anyperson should moralize, as I am now doing, upon the lessons to be drawn from its completion. Surely it cannot be the good sense of the two great nations—for I claim that title for Canada as I concede it to the States who to day clasp hands in fraternal unity, who today recognize a common kinmanship and a common purpose in directing the civilization of this continent—surely it cannot be that they will long sustain a fiscal policy which is neither logical nor equitable, which tends to national irritation and distrust and which is entirely out of harmony with the institutions of a free people. (Cheers.)

Leo Cannan (Bismarck) of the Chicago Tribune, and stirring speeches from ex-mayor Beaugrand, of Montreal, and Mr. Jas. Harper, of the Montreal Witness.

This brought the banquet to a close. The band played the National Anthem and the gathering dispersed in high good humor over the success that had attended the whole of the day's proceedings.

NOTES.

The playing of the 13th Batt. Band during the banquet was greatly admired by those outside who could hear it. It was only a faint echo to the banqueters inside.

The decorations of the freight shed outside and in were the subject of much praise on all sides. Chief Atchison, of Hamilton, was the designer. This part of the arrangements was under the direction of Mr. Stiff, superintendent of the Southern Division, and he saw that the decorators lacked nothing that would go to make the banquet hall look inviting.

Our townsman, Mr. Alex. Joss, put in the gas fixtures to light up the banquet hall. The work was done on short notice but it was one of the features that added brilliancy to the affair.

Constable Logan, of the G. T. R., was brought from London to assist in keeping order on the company's premises here during the tunnel celebration. A better man for the place could not have been selected. His smiling face disarmed resentment even when he had to refuse the throngs of visitors who beseiged the place for a near view of the inside of the banquet hall.

The address presented to Sir Henry Tyler by the Corporation of Sarnia was very handsomely engrossed by Mr. W. J. Barber, of this town.

The ornamental arches at the portals of the tunnel were very tastily gotten up. That on the Sarnia side deserves the palm.

The time from portal to portal was 3½ minutes, and the full time of the inaugural train from grade level to grade level was a trifle over four minutes.

The engine of the special train which took Sir Henry and guests through the tunnel was in charge of Engineer Whittaker. Mr. Chas K. Domville, Supt. Loco. Department, was also on the engine. The train was in charge of Conductor Shaw.

Conspicuous by its absence was the British flag among the decorations on the Port Huron side. Our neighbors have very crude ideas of what is due as a matter of courtesy to visitors from a foreign soil.

Port Huron entertained Sir Henry and party at dinner in that city on Saturday night. A pleasant time was spent.

Miss Tyler and Miss Sergeant were the only ladies who made the trip through the tunnel on the inaugural train.

Sir Henry makes an excellent host. He presided at the banquet in a way that made everyone feel at ease and his fund of good

[illegible] now doing, upon the lessons to be drawn from its completion. Surely it cannot be the good sense of the two great nations—for I claim that title for Canada as I concede it to the States who to day clasp hands in fraternal unity, who today recognize a common kinmanship and a common purpose in directing the civilization of this continent—surely it cannot be that they will long sustain a fiscal policy which is neither logical nor equitable, which tends to national irritation and distrust and which is entirely out of harmony with the institutions of a free people. (Cheers.) When the United States 30 years ago entered upon that great struggle for the maintenance of the Union, which culminated in the abolition of slavery, we sent 33,000 of our sons to fight the battles of a nation's life, and we rejoiced when the flag which floats so proudly from every hilltop of the great republic represented an equal measure of liberty for all citizens, irrespective of race or color. We were with you then in your struggle for national life and equal citizenship. We are with you now in your endeavors to unfetter trade, to liberate commerce and to make this continent from pole to pole and from sea to sea as free and as untrammelled commercially as the millions represented by the flags entwined above us are socially and politically. (Loud and prolonged cheering.)

At the conclusion of his remarks the honorable gentleman was congratulated heartily by numbers of the gentlemen who had listened with eager interest to his remarks. Distinguished men left their seats to shake hands with Mr. Ross and thank him for the noble sentiments to which he given utterance.

Mr. Richard White, of the Montreal Board of Trade, congratulated Sir Henry Tyler, the Tunnel Company and the Grand Trunk Railway on the completion of this great work. He felt that the tunnel would be a great benefit to Montreal, and not only that city, but the whole of Canada and the United States. He endorsed all that Hon. G. W. Ross had said regarding the unity of interests of the two countries commercially.

Mr. W. J. Spicer was called upon and responded with a verse of a song extolling the delights of friendship.

The railway interests of the continent was responded to by Congressman J. Logan Chipman, of Detroit. The opening of the tunnel, he said, was not only an event in the history of civilisation but one that the children of this generation should look back to with pride. He was prepared to denounce any attempt to breed discord between the two countries as an attempt against the progress of civilisation, and anyone who sought to create such international strife was an enemy to the people of the continent. He hoped that the men on both sides of the border river would unite to break down the barriers to trade that separated the two countries. He held the greatest admiration for Mr. Ross who had made him feel that the brotherhood of the two nations was not a mere dream but an established fact, and that the countries were joined together by God and man. 'I would add,' he continued, to what he has said—down with every barrier—down with every custom house Open wide the door is the motto for the banner under which Canada and the United States could march band in hand and lead the world to a higher and more glorious liberty.

Senator Frank Smith, acting minister of railways and canals, a Cabinet officer of the Dominion said it was an honor to any man to be present on this occasion of the opening of the tunnel, whereby the two peoples could shake hands under water. He was sorry that anything had been said about reciprocity. He could not accord with all that had been said by his friend from New York (Mr. Wi[illegible]

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Miss Tyler and Miss Seargeant were the only ladies who made the trip through the tunnel on the inaugural train.

Sir Henry makes an excellent host. He presided at the banquet in a way that made everyone feel at ease and his fund of good humor appeared inexhaustible.

Mr Spicer performed a difficult task with great success in leading the vocal contributions to the festivities at the banquet. The effort to regulate the voice so as to reach all parts of a large building is very trying and if the audience failed to give Mr Spicer good backing it was because the pace he set was beyond its capabilities.

The speech of the day, beyond doubt, was that of Hon. G. W. Ross. Choice in language, noble in sentiment and clear in its meaning, its every work struck the mark.

The hero of the occasion was Mr. Hobson. The reception accorded his name every time it was mentioned and the tumultuous cheering that greeted him as he rose to acknowledge the toast in his honor proved that he was the lion of the hour.

Mr. Hillman, the capable engineer upon whom the responsibility for carrying out Mr. Hobson's plans rested, came next in public favor. No man could have been given a more flattering reception, and he deserved it all.

Murphy, the boss of the working gang, whose pluck, determination and readiness of resource saved from failure the carrying forward of the tunnel at critical stages in its progress, came next in order for the plaudits of the assemblage.

Mr. Wiman was censured by some for, what they said was, introducing politics at the banquet. But it was hardly possible for him to do otherwise. He was called upon to represent Trade and Commerce. These are so fettered by the cobweb meshes of politics that it was impossible to touch them without damaging the bonds in which they are confined. We rather admire Mr. Wiman for having the courage of his convictions on an occasion of that kind and fearlessly drawing a lesson from the event at which he was called upon to assist.

The heart and pulse of the audience was with Mr. Wiman, and succeeding orators vied with each other in giving voice to the expressed wish that commerce between the two countries should be free and untrammeled.

Democrats and Republicans were as one in declaring that the customs barriers should be levelled, and pronounced Conservatives like Mr. Richard White endorsed the sentiments of Hon. G. W. Ross in support of the same free trade policy

Senator Smith's feeble protests only served to emphasize the fact that Reciprocity is the policy of the hour and that it is bound to prevail.

A conspicuous feature of the oratory of our neighbors over the border is its indulgence in self praise. The custom on this side is to find pleasant things to say of the stranger within their gates. With our American cousins it is to blow their own bugle, and the louder it is blown and the more extravagant its discordant notes the better do they imagine they are doing their duty.

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joined together by God and man. 'I would add,' he continued, to what he has said—down with every barrier—down with every custom house. Open wide the door is the motto for the banner under which Canada and the United States could march hand in hand and lead the world to a higher and more glorious liberty.

Senator Frank Smith, acting minister of railways and canals, a Cabinet officer of the Dominion said it was an honor to any man to be present on this occasion of the opening of the tunnel, whereby the two peoples could shake hands under water. He was sorry that anything had been said about reciprocity. He could not accord with all that had been said by his friend from New York (Mr. Wiman). They had come here as railroad men, engineers and merchants to witness the opening of the great tunnel, and any expression of political views on such an occasion was hardly the proper thing. Mr. Smith proceeded with a general protest against any reference to reciprocity and a declaration of his devotion to Great Britain and to the Old Flag, but he was out of touch with the audience and his remarks fell flat.

Hon. Timothy Tarnsey, an ex-Congressman from the northern part of Michigan whose prowess as a speaker has earned for him the sobriquet of The Roaring Lion of Michigan, held the audience spellbound for a few moments while he poured out burning words of earnest appeal for brotherly amity and inter-trade. I wish, sir, he thundered, that the day were come when wars and rumors of war had ceased; that the day had come when English-speaking people throughout the world would unite to teach the world peace; that the day had come when the only weapon used by man was the logic of the tongue and pen. You will tell me, sir, that that would be the millennium: it would, sir, and you, sir, by your work which has culminated in to-day's ceremonies have done much to bring us nearer to that day of universal peace and brotherhood. (Loud applause.)

After the cheering that greeted the Roaring Lion of the Saginaw had died away, the other side of the shield was presented by Gen. William Hartsuff of Port Huron. He declared himself an out-and-out Republican, and twitted the Democratic speakers with having loudly advocated reciprocity of trade and with having done nothing in that direction during the term that they had been in power. He claimed that the only move in that direction had been made by his party, and if they were sustained at the next election they would make a further move toward the same end.

Mayor McShane and Mr. Wm. Clendennin, of Montreal, were the next speakers, the latter expressing the belief that the tunnel was an augury of a solid connection between the people of Canada and of the United States.

Gen. Poe contributed his word of praise to the projectors of the tunnel and to the engineer who planned and the men under him who carried out as perfect a piece of engineering as he had ever seen.

The toast of the press brought out an exceedingly humorous response from Mr. [illegible] is the policy of the hour and that it is bound to prevail.

A conspicuous feature of the oratory of our neighbors over the border is its indulgence in self praise. The custom on this side is to find pleasant things to say of the stranger within their gates. With our American cousins it is to blow their own bugle, and the louder it is blown and the more extravagant its discordant notes the better do they imagine they are doing their duty.

[illegible] proof of the care and judgment exercised in selecting able and experienced men to fill responsible positions in all branches of the service of the company in this country, and is a guarantee of thoroughness and efficiency in the management of the company's affairs, that cannot fail to still further increase public confidence in the president and board of directors.

We trust that the most sanguine expectations of the board as to the vast benefits that will follow the opening of the St. Clair tunnel to public traffic will be more than realized, and that it will bring increased prosperity to the great railway corporation over which you so ably preside.

In so doing it must also promote the growth and prosperity of this municipality, now become the western terminus of the Grand Trunk system in Canada. We can assure you, therefore, that we appreciate the increased advantage and importance our town is designed to enjoy as a result of the completion of this important link in the chain of communication which unites Grand Trunk interests in one unbroken line from the Atlantic seaboard to the great distributing center of the vast traffic of the illimitable West.

Sir, we trust that the pleasant relations which exist between this corporation and the Grand Trunk Railway company will be still further strengthened by the additional bonds of interest that have been created by the location here of so important an outlet for international trade.

Permit me, sir, to take advantage of the present opportunity to extend to you and the Grand Trunk company the thanks of this municipality for the munificent gift bestowed upon it and the neighboring municipality of Point Edward and which was recently dedicated to the public use under the name of Bay View Park. Already it has been converted into an attractive place of recreation for the general public and it will be the ambition of our citizens to make it one of the most desirable spots in western Ontario for excursionists.

I take great pleasure, sir, on behalf of the corporation and citizens of Sarnia in extending a hearty welcome to you and your associates, and to the distinguished visitors who have honored us with their presence here to-day, to take part in the ceremony of formally opening the St. Clair tunnel. We hope you will carry away pleasant recollections of your visit, and that the greatest success may follow the official commemoration of the completion of one of the greatest engineering feats of the nineteenth century.

Sir Henry briefly returned thanks for the kind manner in which his name had [illegible] exceeding satisfaction he drew forth another white handkerchief. The cheers and laughter were deafening over this second contretempe, and were in nowise abated by the earnest search Sir Henry was carrying on in pockets likely and unlikely for the missing flag. At length Mr. Seargeant, General Manager of the G. T. R., stepped forward and presented the lost banner to Sir Henry. The latter turned the point nicely by saying that his prize was so greatly coveted that they actually stole it out of his pocket on the way over.

The Band of the 13th, Hamilton, at the close of the presentation played the Star Spangled Banner, and at the conclusion of Sir Henry's remarks played Hail Columbia. The return trip was made by train to the C. & G. T. R., depot, and from there by the Conger to the G. T. R., freight dock, Sarnia. There the guests disembarked and were ushered into the

BANQUET HALL.

Of this part of the arrangements we prefer to present the views of visitors rather than of our own, the metamorphosis being so great that strangers refused to believe that the banquet hall was a transformed freight shed. The Detroit Free Press reporter writes:

The banquet hall was transformed from a freight house on the wharf at Sarnia, against whose piers the waters of the beautiful river washed, into an ideal dining hall, a fit place for an international symposium. It was adorned with wreaths and festoons of evergreens; with flags, bunting and mottoes. The floor was carpeted with spruce, the ceiling was covered with red, white and blue stripe, running longitudinally. The material was a glossy fabric, rich like satin. Lamps and incandescent electric lights illuminated the place. The British flag, and the dominion modification of it, and the stars and stripes were everywhere intermingled in token of amity and in skillful, artistic arrangement. There were three long tables; a center one at which the officers of the Grand Trunk Company and the principal speakers and invited guests sat, and one long table on either end of it. There were besides twenty two shorter tables set crosswise of the hall. The tables were furnished with fine napery, china and silver. The repast was excellently ordered and as excellently served. There was no confusion among the waiters, and the caterer deserves the highest credit for carrying out the details of a feast for upwards of four hundred persons, without jar, friction or unseemly interruption.

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Sir Henry briefly returned thanks for the kind manner in which his name had been mentioned and expressed his gratification at the harmony that prevailed between the Town of Sarnia and the Grand Trunk Company. Cheers for Sir Henry Tyler were called for and given with hearty good will. This part of the ceremonies was closed with cheers for the Queen, the Band of the 27th Batt., playing God Save the Queen.

In a few moments the special train was in motion towards the portal. Carcerie, against whose piers the waters of the beautiful river washed, into an ideal dining hall, a fit place for an international symposium. It was adorned with wreaths and boughs of evergreens, with flags, bunting and mottoes. The floor was carpeted with canvas, the ceiling was covered with red, white and blue stripe, running longitudinally. The material was a glossy fabric, rich like satin. Lamps and incandescent electric lights illuminated the place. The British flag, and the dominion modification of it, and the stars and stripes were everywhere intermingled in token of amity and in skillful, artistic arrangement. There were three long tables, a center one at which the officers of the Grand Trunk Company and the principal speakers and invited guests sat, and one long table on either end of it. There were besides twenty two shorter tables set crosswise of the hall. The tables were furnished with fine napery, china and silver. The repast was excellently ordered and as excellently served. There was no confusion among the waiters, and the caterer deserves the highest credit for carrying out the details of a feast for upwards of four hundred persons, without jar, friction or unseemly interruption.

Wines of choice vintages were supplied in abundance. The cost of this feature is said to have been nearly as great, as that at the Grand Army banquet, being confidentially reported to be nearly $4,000. The bottles were placed upon the table in profusion and each guest was his own judge of his requirements in this respect. Without it being said that there was no over-indulgence, the class of men present at the feast being of that kind who have their appetites in complete control.

(Continued on page 2.)

force of their individuality [illegible] common brotherhood and kindship. Not a square inch of bricks or boards is visible on the walls or ceiling of this elegant salon, and even the floor is carpeted with sheeting to hide the least traces of its stained and trade-worn boards. Nor must the mottoes which display their well-timed and appropriate sentences at frequent intervals around the room be overlooked.

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ponded with a brilliant oratory [illegible] He told in eloquent language how he had, during his official residence in Canada, learned that the people while loyal toward their own country were always glad to extend the right hand of fellowship to the people of the United States. By all the surroundings of the hour we were reminded that it was our privilege to live in the most advanced age, and, however much we might revere antiquity, to attempt to live in the past was to simply stand still and let the age move by us. 'Beneath the waters,' he said, in conclusion, 'we have clasped hands, and here beneath these flags we join in a unity of hearts and unite in the hope that these two nations will dwell in peace one with the other and in good-will toward all the earth.' He thought the sentiment could not be better expressed than by the motto before him.

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The success of the Grand Trunk Railway Company and the St. Clair Tunnel Company, coupled with the name of Sir Henry Tyler.

Sir Henry was received with great cheering. In a few eloquent words he returned thanks for the toast. He then entered upon a detailed history of the tunnel from its inception to its completion. The St. Clair Tunnel Railway, hardly three miles long, and costing about $2,500,000, is no very gigantic operation, and looks very small as one means of communication between the 14,000 miles of railway in Canada, costing $800,000,000; and the 165,000 miles of railway in the United States, costing $9,000,000,000. But it is the first example of a tunnel twenty feet in diameter, so constructed to carry a railway under a river on this continent or elsewhere, and as such it is likely to be followed in other localities. The idea of its construction was first broached a number of years ago. A survey of the river, made by Mr. Walter Shanly, was forwarded to him by Sir Joseph Hickson and on examining it he (Sir Henry) put his finger on the spot where the tunnel now stands. After referring to Gen. Sooey Smith's failure to put a drift tunnel beneath the river, Sir Henry said the company resolved to undertake the work itself and the carrying out of the idea was placed in the hands of Mr. Hobson. Mr. Hobson designed and had constructed under his superintendence all the necessary apparatus and appliances, and had himself carried through the work. No contractor was employed. It is impossible to praise too highly the caution, the pains, the capability displayed by Mr. Hobson throughout the whole business. There were serious difficulties as might have been expected, but they were overcome by the use of compressed air—to three atmospheres. At one time the river came through and a piece of wood was washed through from the river into the tunnel, and the compressed air blew out through the water and made a hole in the bottom of the river which is still visible about 100 feet from the tunnel. The two headings met at length with perfect precision, and the tunnel itself was completed in twelve months. (Applause.) Sir Henry then asked the company to join him in drinking the health of Mr. Hobson, the most modest and the most conscientious of engineers, and, at the present time, as has been proved in the construction of this work, a gentleman who is, from his painstaking character, and high qualifications, an honor to his profession, to the Grand Trunk Railway, and to Canada, the country of his birth. (Cheers.)

Mr. Hobson, on rising to respond, received an ovation. Cheer after cheer rang through the banquet hall, and the scene for some minutes was one of joyous tumult such as is seldom witnessed. Every man present seemed to appreciate the merits

[illegible] as to delicacy of relations between the two people is concerned. No trade between the two countries will exist to justify so large an expenditure so long as the policies of both are actuated by a reciprocity in tariffs rather than a reciprocity in trade.

Let us hope that the great tunnel which we now inaugurate will illustrate the blessed advantage of unrestricted intercourse to such a degree that before long the perfect reciprocity that exists between the states of the union and the provinces of the dominion will be created between the two nations. To obliterate the commercial barrier that, like a barbed wire fence, now runs athwart the continent, would be to inaugurate a movement, the consequences of which would take rank second only to those which followed the declaration of independence, or the emancipation of slaves, setting the south free to pursue her marvelous career of prosperity. The great north land needs only a similar freedom of intercourse to contribute in even a greater degree to the prosperity of the United States.

All these regions within British possessions need only the near by markets which the United States will afford to make them contributary to the commerce of that country that would augment it to even double its present great extent. Thus would be created a possibility not only of enrichment to Canada, and incidentally to the people of Great Britain, whose investments in such works as this tunnel indicate their faith in the future, but also enlarge the opportunities of the people of the United States to a degree that would assure a success in the future measured only by that which has been achieved in the past. Literally and truly may it be said to them as it has never yet been said to any people in the world:

'No pent up Utica confines your powers,
The whole, the boundless continent is yours!'

The speaker's references to reciprocal trade were received with outbursts of applause interspersed with faint signs of disapproval. It was evident that the sentiments of nine tenths of the assemblage were in favor of reciprocity and the efforts of the few to repudiate that sentiment only served to show how hopelessly they were in a minority.

The next speaker was Hon. G. W. Ross, Minister of Education for Ontario. He said:—We regard sir, the opening of this tunnel as a guarantee of perpetual peace between the people of Canada and the United States, if such a guarantee were needed. The natural affinity of race and language existing between us, the similarity of our national institution and aspirations, that sense of honor which is the product of an educated and prosperous democracy, furnish, I have no doubt, sufficient security for the political integrity of the two countries, but when to all these you add the bonds of an extended commercial relationship, the position is strengthened a hundred-fold. (Hear, hear.) Commissioners, high and low, and plenipotentiaries ordinary and extraordinary, may quarrel over a few codfish in the Bay of Fundy or the breeding of seals in Bering Sea, and palpitating patriots may twist the lion's tail or hurl foul epithets at the eagle, but when all their rant and declamation has spent its force, the ship of State, your ship as well as ours, will be found careering as smoothly over the waves as if the promoters of political cyclones never had an existence. (Cheers.) The educated democracy of Canada and the United States are on a peace footing, and thank God they are the majority in both countries. The jingoism which masquerades under the name of loyalty, which puts on its war paint on national holidays, and is insolent in proportion to its insincerity, seldom disturbs the Corn Exchange in Chicago or the securities of the Bank of England in London. I regard this celebration as a token of commercial unity on this continent. Do not mistake my meaning. So far as the political autonomy and independence of Canada is concerned, I want it understood that I am a Canadian first, last and always. And it is because I am a Canadian and because I love Canada and believe in the intelligence, energy and capacity of her people that I see no danger, so far as she is concerned, in the commercial unification of this continent. What have we been doing for the last half century but preparing ourselves on both sides of the line for this end? What meant the reciprocity treaty of 1854, the Washington treaty of 1872, and the negociations of the last few years with respect to the treaty of 1818, if it was

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The speaker's references to reciprocal trade were received with outbursts of applause interspersed with faint signs of disapproval. It was evident that the sentiments of nine tenths of the assemblage were in favor of reciprocity and the efforts of the few to repudiate that sentiment only served to show how hopelessly they were in a minority.

The next speaker was Hon. G. W. Ross, Minister of Education for Ontario. He said:—We regard sir, the opening of this tunnel as a guarantee of perpetual peace between the people of Canada and the United States, if such a guarantee were needed. The natural affinity of race and language existing between us, the similarity of our national institution and aspirations, that sense of honor which is the product of an educated and prosperous democracy, furnish, I have no doubt, sufficient security for the political integrity of the two countries, but when to all these you add the bonds of an extended commercial relationship, the position is strengthened a hundred-fold. (Hear, hear.) Commissioners, high and low, and plenipotentiaries, ordinary and extraordinary, may barrel over a few codfish in the Bay of Fundy or the breeding of seals in Bering Sea, and palpitating patriots may twist the lion's tail or hurl foul epithets at the eagle, but when all their rant and declamation has spent its force, the ship of State, your ship as well as ours, will be found careering as smoothly over the waves as if the promoters of political cyclones never had an existence. (Cheers.) The educated democracy of Canada and the United States are on a peace footing, and thank God they are the majority in both countries. The jingoism which masquerades under the name of loyalty, which puts on its war paint on national holidays, and is insolent in proportion to its insincerity, seldom disturbs the Corn Exchange in Chicago or the securities of the Bank of England in London. I regard this celebration as a token of commercial unity on this continent. Do not mistake my meaning. So far as the political autonomy and independence of Canada is concerned I want it understood that I am a Canadian first, last and always. And it is because I am a Canadian and because I love Canada and believe in the intelligence, energy and capacity of her people that I see no danger, so far as she is concerned, in the commercial unification of this continent. What have we been doing for the last half century but preparing ourselves on both sides of the line for this end? What meant the reciprocity treaty of 1854, the Washington treaty of 1872, and the negociations of the last few years with respect to the treaty of 1818 if it was

(Continued on page 8.)

Locomotives for The St Clair Tunnel.

The Baldwin Locomotive Works, Philadelphia, have the contract for building four decapled tank locomotives for service in the new railway tunnel under the St. River between Port Huron, Mich., and Sarnia, Canada. These engines are to have cylinders 22 by 28 inches in diameter outside the tires, and will weigh in working order, including 1,800 gallons of water in the tank, about 150,000 pounds. They will have boilers 7[illegible] inches in diameter, carry 160 lbs. steam pressure. The firebox is 11 feet long by 3½ feet wide. There will be about 280 tubes, 2¼ inches in diameter and 13 feet 6 inches long. The cab is placed centrally over the boiler with foot plate and coal box at the rear of the boiler. The wheel base is 15 feet 3 inches. As the track through the tunnel is straight, the engines are not required to pass the curves on the main line, and are only required to enter ordinary sidings. Additional play will be given the tires of the extreme driving wheels. The second and fourth pairs of driving wheels will be flanged with the usual play, and the distance between the centers is 8 feet 9 inches. The tires are to be secured by Manell retaining rings, and each engine will be fitted with two sandboxes and two headlights, a Cooke steam bell ringer, and the Westinghouse automatic brake, with equalized driver brake fixtures acting on all the wheels. The fuel will be anthracite coal or coke. The load which these engines are intended to haul is about 700 tons, and the grades are 105.6 per mile. They are to be delivered in January.

November
18
1891

Approaching the tunnel mouth they encountered the accumulated steam and smoke and gas, and were overpowered. Had they remained in the van for a short time the smoke and gas would have cleared and all danger would have been past.

By this time the engineer had disposed of his cars and was on his way back. A brakeman, Seth Lee, was sent ahead with a lantern, as the rules of the company provide. As he was nearing the detached portion of the train he suddenly stumbled over a man lying across the track. An investigation revealed the fact that it was Brakeman Whalen. He was nearly overcome with the gas, but still conscious. He was helped aboard the engine at once by the engineer and fireman, while Brakeman Lee started down the track to find the conductor. He could see the light of a lantern ahead of him, and when he approached it he found the unfortunate conductor unconscious and breathing hard. He also was helped aboard the engine, and a start for fresh air was made. Medical aid was at once summoned. Conductor Hawthorne died soon after reaching the Canadian side in spite of every effort to save him; being in poor health at the time he more quickly succumbed to the effects of the gas he had inhaled. Whalen was recovered, and was taken to his boarding house.

Deceased came from London about six weeks ago to do duty on the suburban train but latterly had the run through the tunnel. He was well known and highly esteemed both here and in London where he resided. He was a member of St. John's Lodge, 209a, A. F. and A. M., of the Canadian Order of Foresters, and of the Brotherhood of Railway Trainmen. A wife and two young children are left to mourn his departure. His father is Mr. W. Hawthorne, of Bellville, formerly proprietor of the Hub Restaurant, London.

The breaking in two of freight trains is not an unusual thing, owing to the enormous strain on the [illegible]

February 5
1892

Fatal Accident.

A peculiarly unfortunate accident occurred in the tunnel early Sunday morning last resulting in the death of Conductor Geo. H. Hawthorne, of London, and a narrow escape from the same fate by Brakeman Jas. Whalen, of Point Edward.

The particulars of the disaster are as follows:

About 2 30 a.m. a train of heavily loaded cars arrived at Port Huron from Chicago. Soon one of the switcher engines hitched on to the train and started for Sarnia by the underground route. When about two-thirds through the tunnel the train broke in two, only six cars remaining with the engine. Twenty-two cars started to run back. The engineer concluded to take the six cars to Sarnia and run back for the others. When the engineer came back and made fast to the train, full steam had to be put on to make a start, and as a consequence far more than the usual amount of steam and smoke was made in the tunnel.

When nearing the portal the train broke in two again. The engineer attempted to pick up the detached cars but was unable to do so. He finally concluded to pull the half dozen cars through and make another trip for the rear cars. Conductor Hawthorne and Brakeman Whalen remained in the caboose for some time, but finally resolved to go forward and see what caused the delay. Approaching the tunnel mouth they encountered the accumulated steam and smoke and gas, and were overpowered. Had they remained in the van for a short time the smoke and gas would have cleared and all danger would have been past.

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The breaking in two of freight trains is not an unusual thing, owing to the enormous strain on the coupling pins. In some instances a delay of two hours has been occasioned, but no bad effects from gas had been experienced previously. Passenger trains do not break apart owing to the improved couplings, and not the slightest inconvenience has been experienced by occupants of these trains.

This is the first accident in the tunnel and every precaution has been taken to prevent anything of the kind happening again.

February 5 1892

THE TUNNEL LOCOMOTIVES.—Four of the largest loocmotives ever built in the world are nearing completion at the Baldwin Locomotive Works in Philadelphia. They are being built for the Grand Trunk Railway and will be used in the St. Clair tunnel, which runs under the bed of the St. Clair river between Port Huron and Sarnia. The engines are peculiarly constructed. there are five pairs of 50-inch drlying wheels on each. The water tanks are on each side of the boilerr, and the cab is in the centre of the boiler, extending out over the two tanks. The locomotive is thus constructed to allow it to run backward and forward with equal facility. The cylinders are 22x28 inches and the boiler 74 inches in diameter, with capacity to carry 160 pounds of steam pressure. An idea of the enormous size of these monster engines may be derived from their weight. Each one with the water tanks filled and the starting supply of coal on board weighs 200,000 pounds the average weight in running order, with tanks about half filled being 180,000 pounds. The rails on which they will run will weigh 100 pounds per yard. The length of the tunnel track for which they are built to run over is only about four miles. They are designed to pull trains up the steep approaches to the tunnel. It requires about three ordinary locomotives for this service for each train. A satisfactory trial of one of the completed engines has been made. The other three will be finished in about 10 days.

February 27 1891

THE

Railway and Marine World

With which are incorporated The Western World and
The Railway and Shipping World, Established 1890

Devoted to Steam and Electric Railway, Marine, Grain Elevator, Express, Telegraph, Telephone and Contractors' interests

Old Series, No. 212.
New Series, No. 130.

TORONTO, CANADA, DECEMBER, 1908.

For Subscription Rates, See page 875.

Entered as second class matter, March 5, 1908, at the Post Office at Buffalo, N.Y., under the act of Congress of March 3, 1879.

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ELECTRIFICATION OF THE ST. CLAIR TUNNEL.

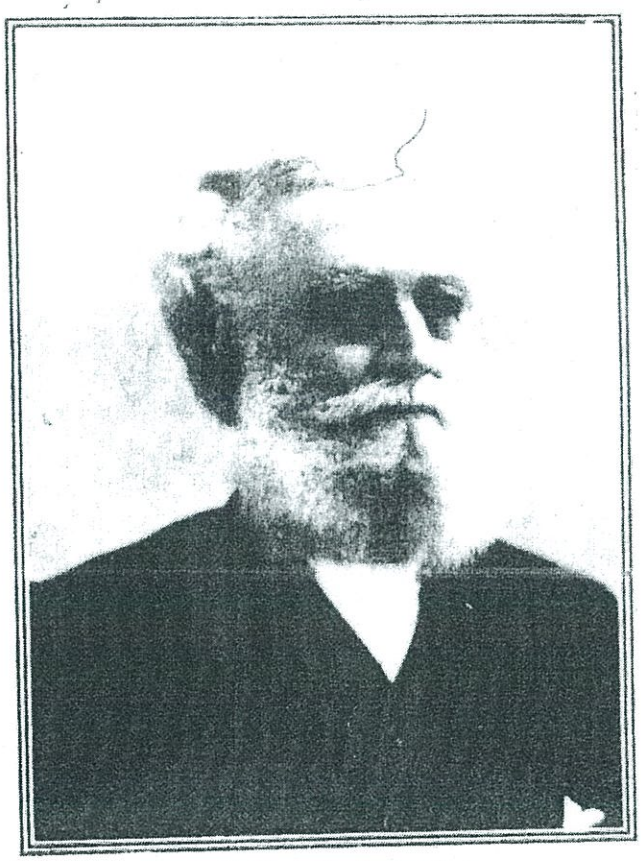
The St. Clair tunnel was opened for traffic in 1890, by the St. Clair Tunnel Co., organized as a subsidiary company to the G.T.R. Co. The tunnel, located under the St. Clair River, is the connecting link between the terminal of the Eastern Division at Sarnia, Ont., and the Western Division at Port Huron, Mich. The length of the tunnel from portal to portal is 6,032 ft. The open tunnel approaches are of considerable magnitude, that on the Port Huron side being slightly over 2,500 ft. long, while that on the Sarnia side is nearly 3,300 ft. long, the total distance between the Canadian and U.S. summits being 12,000 ft., or about 2¼ miles. The grade on the tunnel approaches and the inclined sections of the tunnel is 2 %, while the flat middle section of the tunnel, about 1,700 ft. long, has a grade of 0.1 % downward toward the east, just enough to provide for the proper drainage of any seepage water.

A single track extends through the tunnel, while a double track is laid in both of the approaches. The necessary tracks for handling the freight and passenger traffic are provided in the yards at Sarnia and Port Huron. The map and profile of the zone operated by the St. Clair Tunnel Co. is shown in an accompanying illustration. The tracks in the yards and on the tunnel approaches are shown on a larger scale on the same drawing.

The tunnel shell consists of cast iron rings built up in sections, the inside diameter being about 19 ft. The hydraulic shield was used in advancing the bore from each of the tunnel portals, by which means the entire work of construction was carried on with reasonable expedition. A vertical shaft was sunk near the bank of the river on both the Canadian and U.S. sides.

The disposal of the rainfall on the [illegible] pumps, boiler plants were provided at each portal, and attendants were constantly on duty, it being necessary to keep up steam during a large part of the year in order to take care at a moment's notice of any rainfall that might occur.

Four steam locomotives of special design had been in commission for handling the freight and passenger traffic since the construction of the tunnel. These were designed as would increase its possible capacity for handling traffic, and at the same time obviate the danger and inconvenience due to the presence of the locomotive gases in the tunnel.



JOSEPH THOMSON, M. Inst. C.E.,
Consulting Engineer G.T.R. and Chief Engineer St. Clair Tunnel Co. from its organization to the completion of the work.

The advantage of the use of electric locomotives, on account of the freedom from smoke and the attendant discomfort, together with the possible greater economy in operation, led finally to the decision to provide an electrical equipment to handle the tunnel service, this equipment to provide for the operation of the trains through the tunnel by means of electric locomotives, the handling of the drainage and seepage water by means of electric pumps, the lighting of the passenger stations, the tunnel and the roundhouses by electricity, as well as furnishing a certain amount of power to the roundhouses, also provision was made for a limited amount of outside lighting in the form of arc lamps. The different electrical systems available for such service were considered, and estimates as to the relative cost and efficiency of the various systems were prepared and submitted to the tunnel company. These estimates covered the direct current system both with and without battery, as well as estimates on the alternating current systems. Complete specifications were prepared, covering both the direct and alternating current systems, and propositions on these received and considered. The specifications stipulated, in addition to various guarantees regarding efficiencies of different parts of the system, and of the system as a whole, that the installation when completed should be capable of hauling a 1,000-ton train through the tunnel, from terminal to terminal, in 15 minutes, and that in so doing, the maximum speed should not exceed 25 miles per hour, and the minimum speed, when ascending a 2 % grade, should not be less than 10 miles per hour. Tenders were submitted by the companies that were prepared to undertake the work as specified, and after careful analysis the decision was made to adopt the alternating current system, using a 3 phase sys-

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is nearly 3,300 ft. long, the total
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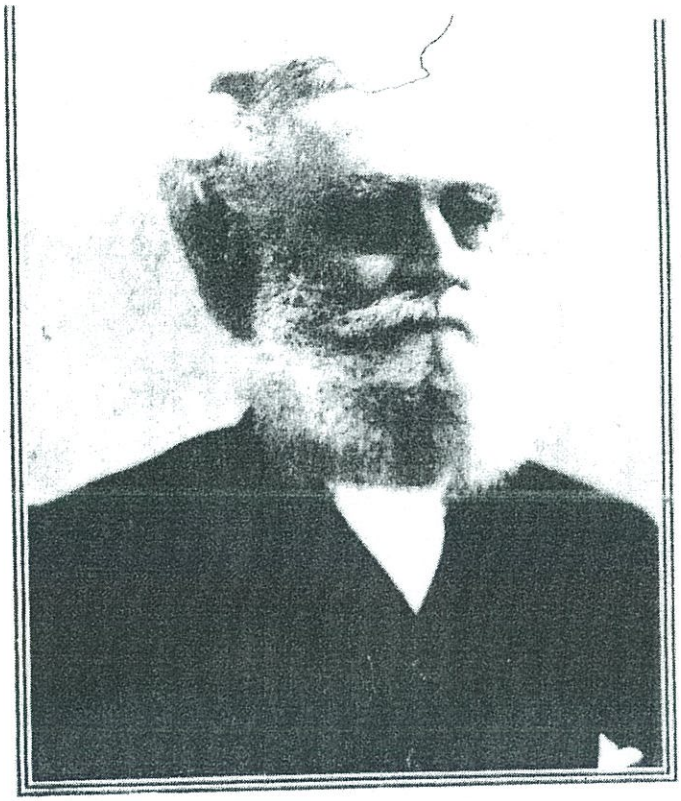
The disposal of the rainfall on the
nnel approaches required particular
ention. The areas of the Port Huron and
nia approaches are approximately 11 and
acres respectively. Water precipitated
these areas during a rainfall is discharged
waste ditches on the bank above by
ns of pumps of large capacity. Retain-
levees have been constructed, scattered
impound a large proportion of the water,
ng on the approaches. By this method
pumps have to handle only the water
ng on the central portion of the approaches
ng the rainstorm. Later the impounded
r is discharged into the pump sump by
es provided for the purpose. As is evi-
this pumping service is of great im-
ance in the operation of the tunnel, as,
ld the tunnel become flooded with water,
e interruption of the traffic would ensue
the operation of the steam drainage



JOSEPH THOMSON, M. Inst. C.E.
Consulting Engineer G.T.R. and Chief Engineer St. Clair Tunnel Co. from its inception to completion of the work

to provide the necessary high tractive effort required to operate the locomotives in the tunnel. [illegible] arrangement [illegible] intolerable [illegible] due to escape smoke in the tunnel. These locomotives were [illegible] good account of themselves, and have handled the traffic [illegible] satisfactory [illegible] throughout their service. Their maximum [illegible] weight of the locomotive handled [illegible] 200 tons, and even with this load they [illegible] up the 2% grade [illegible] speed. [illegible] the capacity of the tunnel with the locomotive equipment [illegible] in handling the tonnage delivered to the tunnel company by the different divisions of the G.T.R., and it was the right decision to make such changes in the operation of the tunnel

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nating current system, using a 3 phase sys-
tem for distribution of power required for
pumping, and for step motors, with sin-
gle phase distribution for locomotives and for
lighting, an overhead working conductor
being the basis, the last decision providing for
the application of the single phase system
to any steam road service. The contract
was awarded to the Westinghouse Electric
Manufacturing Co., and provided that it
was responsible for the installation and successful
operation of the entire equipment.
The equipment has been in continuous operation
since May 17, 1908, handling the entire traffic
service of the tunnel company, this service
being the heaviest railway service handled
electricity in the world.

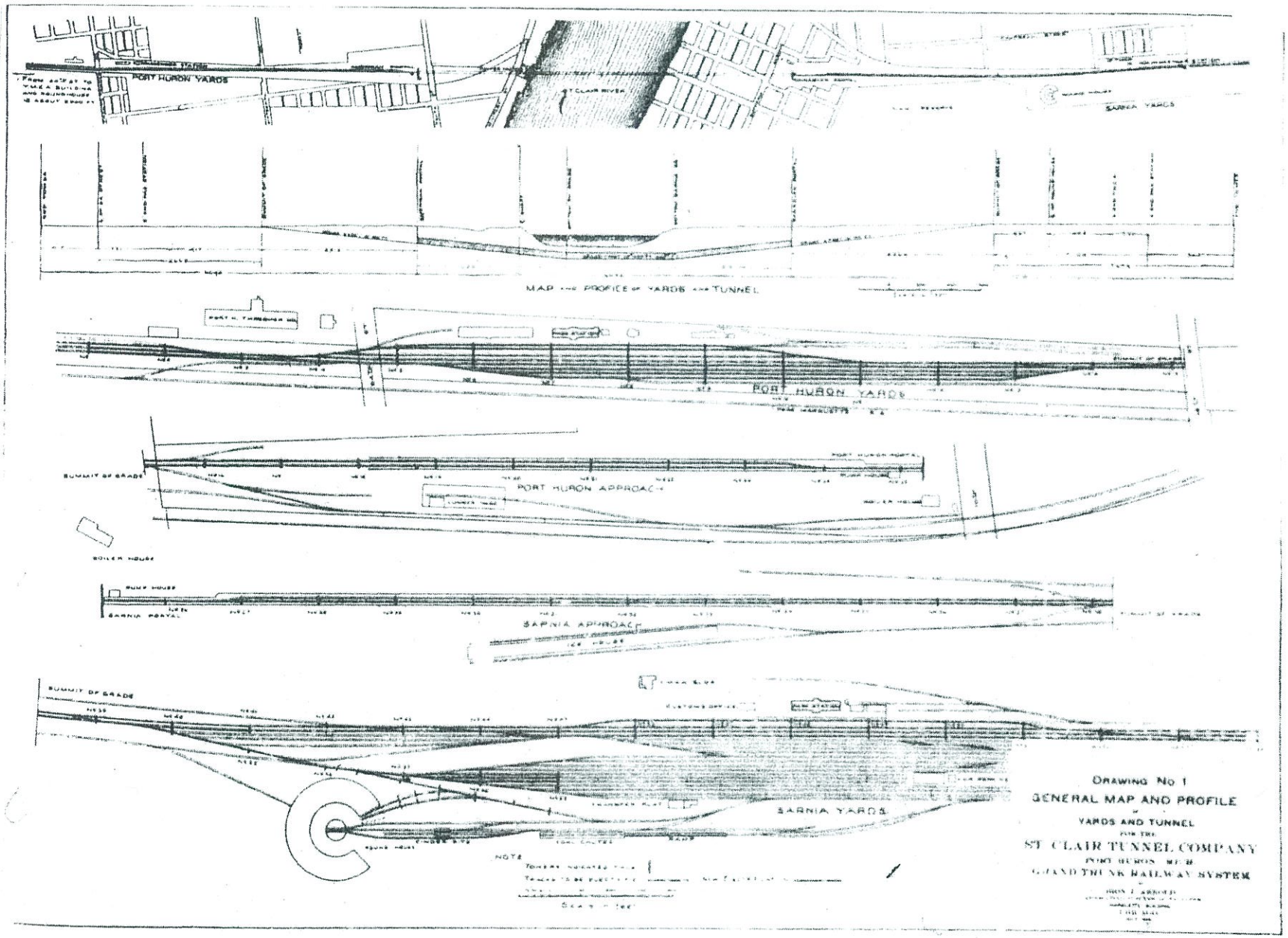
The tunnel is operated as an independent
division of the railway, the trains being

ivered by the Eastern Division in the yards t Sarnia, and taken by the tunnel locomotives through the tunnel, and delivered to the Western Division at the yards in Port Huron, he eastbound trains being handled in the everse order. The steam locomotives operating on the divisions adjacent to the tunnel are never operated through the tunnel. In order to increase the capacity of the tunnel, it was desirable to provide for the maximum practicable tractive effort in the new locomotives. The capacity limit was determined by the maximum pull to which it was deemed wise to subject the drawbars on the mixed rolling stock that must be handled, without danger of breaking trains in two. For this reason the locomotives were specified of sufficient capacity to develop a drawbar pull of 50,000 lbs., when operating at a speed of 10 miles an hour. It was estimated that such a locomotive would be able to make the complete trip through the tunnel from terminal to terminal with a 1,000-ton train in 15 minutes, or four 1,000-ton trains per hour, which would provide a capacity for traffic about three times larger than the actual maximum demands up to the present time.

It was estimated that the pumping service, for which adequate provision must be made, would require the installation at the Sarnia portal of two pumps each of capacity of 5,500 gallons a minute, and at the Port Huron portal the installation of two pumps each with a capacity of 4,000 gallons a minute. To provide absolute continuity of service, duplicate pumping equipments were provided in each portal, as well as duplicate feeder lines leading from the power plant to the pump houses. As noted above, the pumps must always be in readiness for operation day and night throughout the entire year, which in case of electrical pumps, simply necessitates the presence in the pump house of a pump operator and the continuous operation of the power plant. The lighting service to be provided for is of minor importance in so far as the amount of power required at both Sarnia and Port Huron is concerned, this being somewhat less than 100 kw. The power requirement for motors in the roundhouses at Sarnia and Port Huron is about 100 kw. for both shops. To furnish electrical energy for the service outlined above, provision must be made in the power plant for supplying single-phase current for the electrical locomotives, 3-phase current for the pumping service, and 3-phase and single-phase current both for the power and lighting service at various points throughout Sarnia and Port Huron, as well as for a small amount of arc lighting.

ELECTRIFICATION EQUIPMENT.—Three locomotives have been provided for this service, each consisting of two half-units, each half-unit mounted on three pairs of axles driven through gears by three single-phase motors with a nominal rating of 250 h.p. each, the nominal horse power of the complete locomotive unit being 1,500. In so far as the electric motors have a very liberal overload rating, it is easily possible to develop 2,000 h.p., and on occasion in excess of this, in one locomotive. The half-units are duplicate in every respect, and as the multiple unit system of control is used, they can be operated when coupled together with the same facility that a single-phase half-unit can be operated. The locomotives are designed to develop a drawbar pull of 50,000 lbs. at the comparatively low speed of 10 miles an hour. The locomotives are powerful enough to start a 1,000-ton train on a 2% grade in case this should be necessary. At a test made on a half-unit, using a dynometer car, it was found that a single half-unit developed 43,000 lbs. drawbar pull before slipping the wheels. This was done on a comparatively dry rail, with a liberal use of sand. On this basis it would be possible to develop about 86,000 lbs. drawbar pull with a complete locomotive. The maximum speed of the locomotives is 35 miles an hour. However, it is not the intention of the tunnel company to operate the locomotives at a speed in excess of 30 miles an hour. Speed indicators are provided, which indicate on a large dial located in the locomotive cab near the engine driver's seat the speed at which the locomotive is running, and at the same time record the speed throughout the length of the run. This assists the driver in keeping the speed of trains within prescribed limits at all times, and furnishes records of the exact speed of the trains throughout all trips, for the inspection of the superintendent of the tunnel.

The locomotive cab is rectangular in section, constructed of sheet metal supported by structural steel shapes. Inside the cab are located practically all of the apparatus used in connection with the locomotive, with the exception of the motors and the brake rigging. Included in this apparatus is a single-phase transformer used for reducing the voltage from 3,300 to a voltage suitable for application to the motor. The transformer, as well as the motors, are air-cooled, the supply of air being furnished by an electrically driven blower, also located in the locomotive cab. The blower is driven by a single-phase motor, the current being supplied at 100 volts by a tap from the main transformer. With the moderate supply of cooling air furnished by the blower fan, both transformers and motors are able to operate at full capacity with com-



ST. CLAIR TUNNEL, MAPS OF YARDS AND PROFILE OF TUNNEL AND APPROACHES

flow of the water are all located so as to be conveniently accessible for the pump house operator. The equipment has been found to operate in an entirely satisfactory manner, and provides for the handling of water with a minimum amount of attendance and expense. Two 150-gallon, motor-operated, centrifugal pumps are located at the foot of the Sarnia grade, and serve to remove from the tunnel the condensation and seepage water, delivering it to the well at the Sarnia portal. The seepage pumps are similar to the small pumps installed at the portal pump houses, with the exception of motors, which for this service are entirely enclosed, suitable for continuous operation in the tunnel, where they are liable to be subjected to more moisture than are the motors located in the pump rooms.

Incandescent lamps in the roundhouses, the passenger stations, the Y.M.C.A. buildings in both Sarnia and Port Huron, installed previous to the electrification of the tunnel, are being furnished with current from the electric power plant by means of step-down transformers, reducing the voltage from 2,300 to 110 volts. Motors operating at 2,300 volts have been installed in the roundhouses at Sarnia and Port Huron, the current supply being taken from the power plant. In all, 180 lights have been installed throughout the tunnel on either side at a height of 10 ft. above the rail. The tunnel lamps are operated four in series from the 440-volt secondaries of the lighting transformers installed in the tunnel. Similar transformers furnish the current supply for the tunnel drainage pump motors. In addition about 30 arc lights have been provided and installed in the yards at either terminal. These arc are used for general illumination around passenger stations, roundhouses, and coal chutes. The current for the arc lights is furnished at the power plant by means of a motor-driven arc exciter. The total amount of lighting is somewhat under 100 kw., which, together with the motor requirements of 100 kw., makes a total of slightly over 200 kw. for small power and lighting outside of the plant.

For distribution of the single-phase current to the locomotive, substantial steel towers have been erected throughout the tunnel circuit. The steel work used for supporting the working conductor consists of strong lattice column supporting bridges of trussed construction. The average spacing of the overhead bridges is 250 ft. They are designed to extend over all tracks that are to be electrified, and so one of these located at passenger station extend, in addition, over the platforms, thus in no way interfering with the access of passengers to and from the trains. This necessitates a length of about 141 ft. in case of some of the bridges located on the Port Huron side, in which case the bridge spans seven electrified tracks, in addition to the station platform. Single catenary construction is used throughout, a messenger cable of ½ inch extra heavy galvanized steel being suspended on the insulators located on the overhead bridges immediately over the centre lines of the track to be equipped. The working conductor is attached to the messenger cable by means of fittings of varying lengths so arranged as to support it at a uniform height of 22 ft. above the top of the rail. Number 4/0 hard-drawn grooved copper is used throughout the yards, and at all places, excepting on the tunnel approaches and throughout the tunnel, on which section two 350,000 cm. conductors have been installed. The messenger cables forming the catenary construction terminate at the tunnel portals, where they are securely anchored to eye bolts imbedded in the heavy masonry portal. At this point the messenger wires supporting the working conductor throughout the tunnel are anchored to special brackets located on the tunnel face. The working conductors in the tunnel are continuous with those on the tunnel approaches.

The method of supporting the trolley inside of the tunnel shell was conditioned by the requirement that complete overhead equipment should not encroach on the tunnel opening more than 9 inches. This has been accomplished by bolting to the tunnel shell special iron brackets, each of which supports two spool-shaped insulators. These insulators in turn support steel messenger cables, which are drawn taut throughout the length of the tunnel, and attached at the tunnel portal to special brackets. Special clamps are attached to these messenger cables at points between the insulator supports, and these in turn serve to support the two trolley wires. The insulating supports are attached to the tunnel shell at intervals of 12 ft., as also are the clamps connecting the messenger cable with the trolley. This method provides an attachment at once sufficiently rigid to maintain the proper clearance between the trolley and the tunnel shell, and at the same time sufficiently flexible to provide for the proper operation of the trolley bow on the overhead conductor. Section switches have been provided where necessary to permit of disconnecting the working conductor over any switch track from the main line extending throughout the tunnel.

The columns at one end of the transmission bridges have been lengthened, for the purpose of supporting the transmission wires which supply current for the power and lighting service at the roundhouses and stations, as well as for the arc light circuits. Overhead lines terminate in the pump houses at either tunnel portal, where they are connected with the underground feeder system at the panel boards.

All feeder lines connecting the various parts of the equipment to be supplied from the power plant are carried in the tunnel conduits. For this purpose four conduit lines have been laid on either side of the tunnel throughout its length. Connection has been made with these conduit lines about 1,700 ft. from the Port Huron portal, with a vertical shaft extending from the top of the tunnel to the surface of the ground, terminating about 75 ft. from the power plant. The overhead feeders, terminating as above noted in the portal pump houses, are continued as underground feeders down through the tunnel and up the shaft, finally terminating in the switchboard at the power plant. For the pumping service, two independent feeders are laid from each portal pump house, one being installed on either side of the tunnel and both terminating at the power plant switchboard. The heavy feeders for supplying the locomotive current to the trolley extend from the tunnel through the vertical shaft to the power house. This arrangement provides for all feeders leaving the power plant underground. The cables are paper insulated, lead covered and are installed in tile ducts.

THE POWER PLANT is located on the Port Huron bank of the St. Clair River, about 100 ft. from the centre line of the tunnel. The building is 50 ft. from the street property line, which provides ample space for a lawn in front, while the back building line is about 50 ft. from the retaining wall, which serves as a dock line along the river. Sufficient space is afforded between the building and the river front for a G.T.R. spur, which is used for bringing in coal and carrying away the ashes.

nnel on either side at a height of 10 ft. bove the rail. The tunnel lamps are opered four in series from the 440-volt secondies of the lighting transformers installed in e tunnel. Similar transformers furnish the rrent supply for the tunnel drainage pump otors. In addition about 30 arc lights have een provided and installed in the yards at ther terminal. These arcs are used for genal illumination around passenger stations, undhouses, and coal chutes. The current r the arc lights is furnished at the power lant by means of a mercury arc rectifier. he total amount of lighting is somewhat nder 100 kw., which, together with the otor requirements of 100 kw., makes a total f slightly over 200 kw. for small power and ighting outside of the plant.

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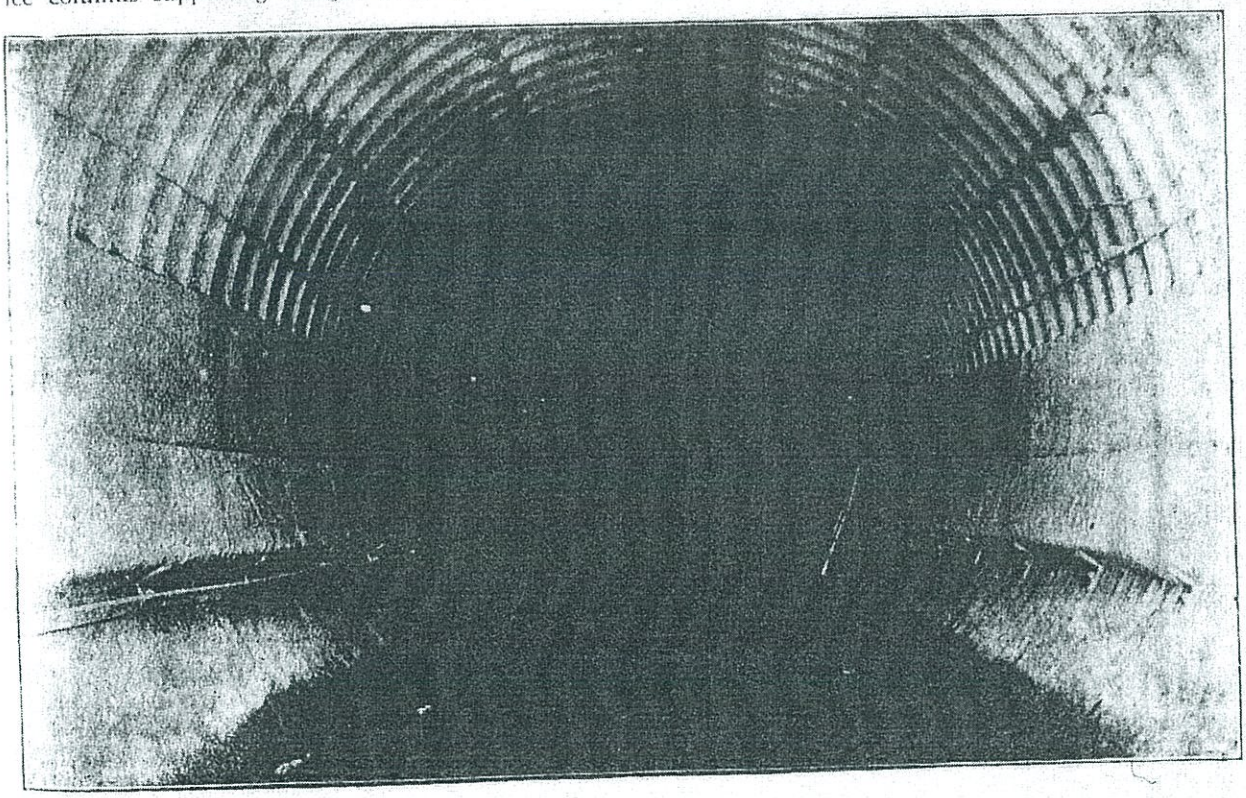
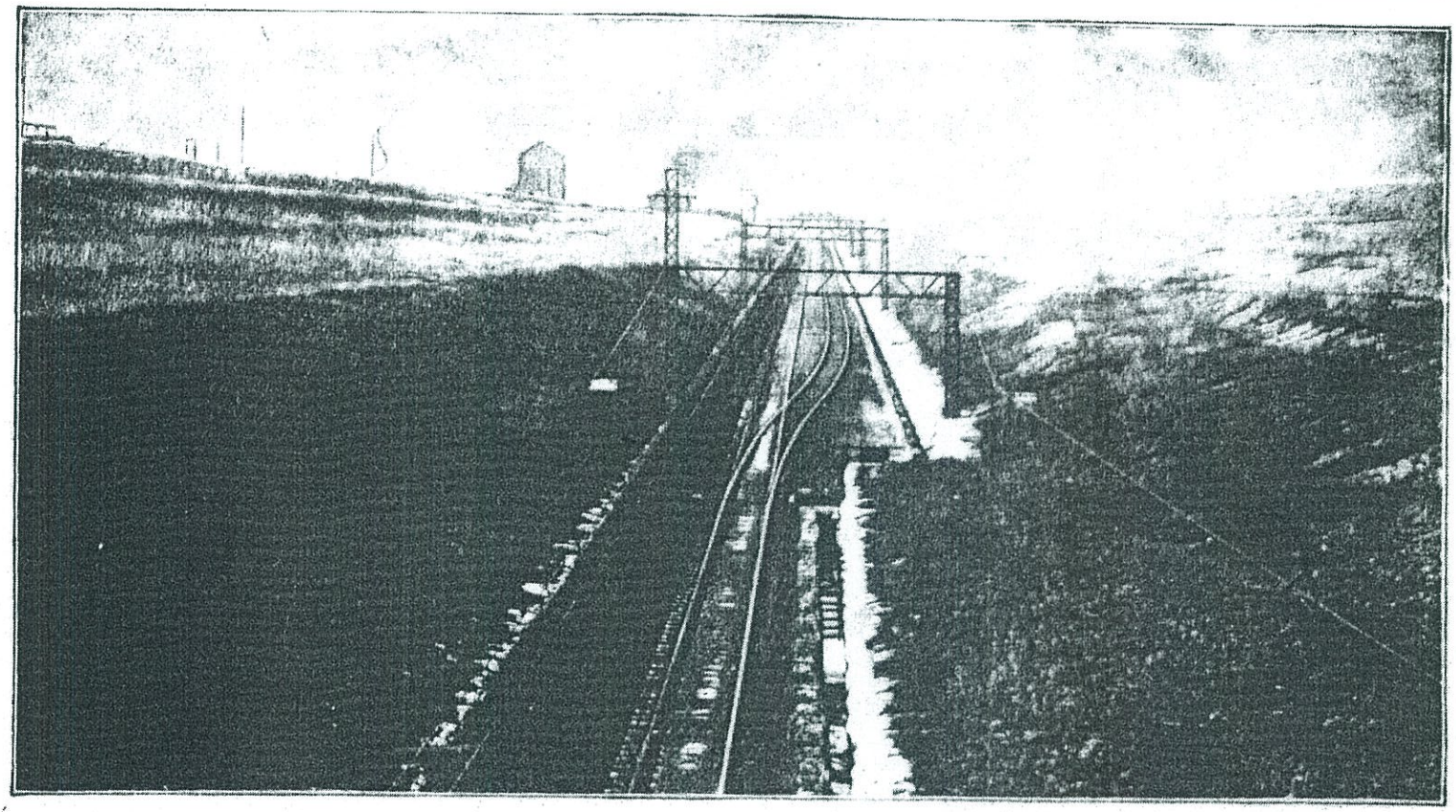


INTERIOR OF ST. CLAIR TUNNEL.



APPROACH TO ST. CLAIR TUNNEL FROM SARNIA.

paratively little increase in temperature above that of the surrounding air. The air for the cooling is taken through a suitably designed shutter located in the side of the locomotive cab, and is distributed through sheet metal ducts installed under the cab floor to the three motors under the cab, and to the transformer. From the latter the air passes either through an opening in the floor of the cab into the open air, or, if desired, into the interior of the cab. In the latter case an appreciable amount of heat can be secured from the main transformer for utilization in heating the cab during cold weather. Motor driven air compressors are also located in the cab. The air brake equipment is of the standard type used for electric cars and locomotives, with the exception of the motors, which are single phase. They are operated by means of an electric controller, which serves to keep the normal air pressure at about 100 lbs. The compressed air is used for the purpose of operating both the automatic and straight air equipment on locomotive and train, and in addition for a variety of minor purposes in and about the locomotive. All of the contactor switches used in controlling the operation of the locomotives are air operated, the air valves being operated by direct current electrical control. This is also true of ringing the bell, blowing the whistle, raising and lowering the trolley, and the application of sand to the tracks.

Speed control of the locomotive is effected by varying the voltage at the terminals of the motors. This is obtained by making connection with various transformer taps by means of the air operated, electrically controlled contactor switches. Electric control of the contactors is effected through the master controller, which in the electric locomotive replaces the throttle valve in the steam locomotive. The current for the master controller is furnished by a small storage battery operating at about 20 volts, the battery in turn being charged by means of a small motor generator set provided for the purpose. The electric controller has 21 points in all, 17 of which are running points. This provides for an increase in the speed of the locomotive from the lowest running speed to the maximum speed by very slight gradations, thus making it possible to maintain a practically constant drawbar pull, while the locomotive is accelerating the train. This is very desirable, in so far as the minimum variation in the drawbar pull while handling the train through the tunnel decreases the liability of breaking the train in two. Particular attention was given this phase of the train operation in designing the locomotive, and the resulting remarkable decrease in the number of breaks in two since the operation with electric locomotives has been inaugurated is a source of great satisfaction. On the master controller is also located the reverse lever, which controls through the electrically operated solenoids the air operated contactors used in reversing the motor connections. Here also are located the push buttons, which serve to raise and lower the trolley, operate the front and rear sanders, reset the circuit breaker, and ring the bell. The ringing of the bell and the application of sand by means of the front and rear sanders are also controlled by electrical devices, thus making it possible for the operator to perform these functions while his two hands are employed in operating the master controller and the air. The balance of the equipment of each locomotive, consisting of the sand boxes, the seats for the drivers, ammeters, voltmeters, wattmeters, the banks of contactors, the preventive resistance coils, circuit breakers, auxiliary storage batteries and motor generator set for charging it, are all installed in a compact manner inside of the cab, and are supported on structural steel work.

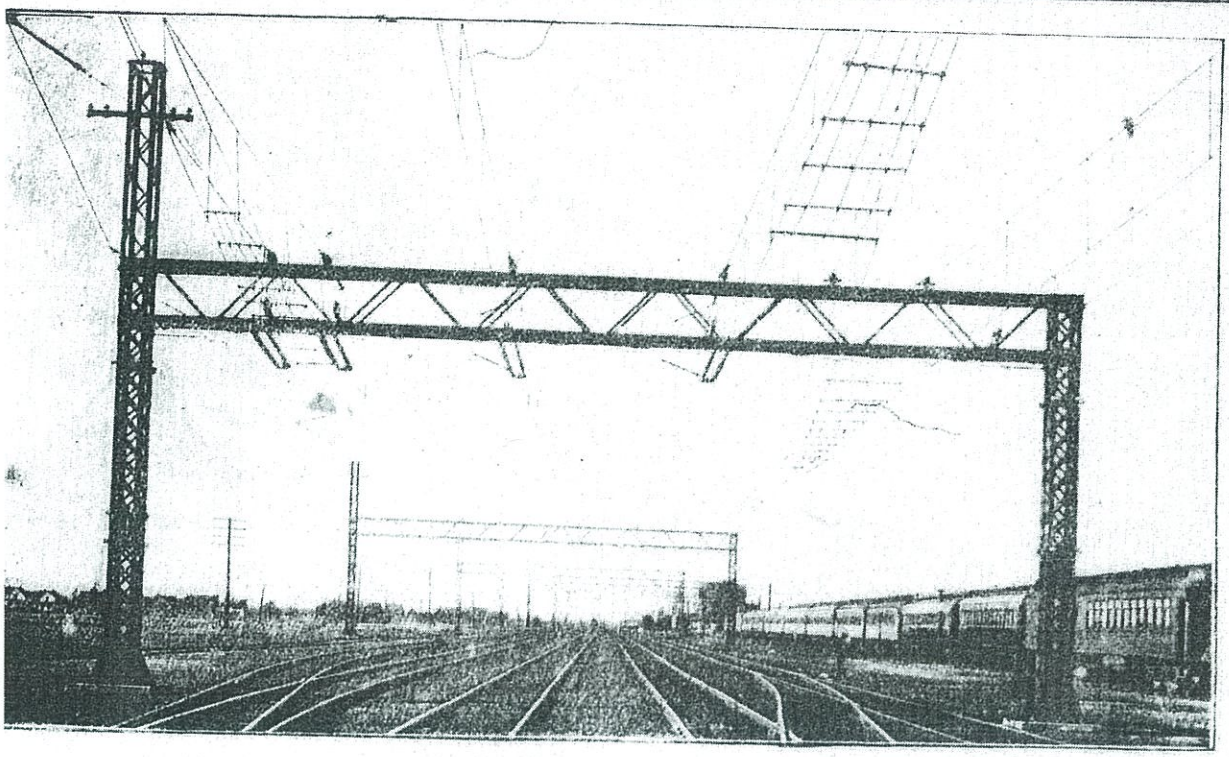
Each half unit is arranged for operation in either direction: air valves, a master controller and ammeter being located at each end of the cab. By means of cable couplings, the control system of two or more half units can be thrown in parallel, thus providing for the operation of any number of half units from any master controller. In this way the two half units are generally operated in the handling of freight train through the tunnel. The passenger traffic can ordinarily be taken care of by a single half-unit.

The current is collected from the trolley wires suspended at a distance of 22 ft. from the track by means of a sliding bow pantograph trolley. In so far as the trolley wire extends throughout the length of the tunnel, no additional provision has to be made for the collection of current while the locomotive is passing through the tunnel. Electric headlights are provided, as well as lights for the illumination of the interior of the cab and the dials of the indicating instruments. The heating of the cabs is provided for by means of standard electric heaters. Heat is also available for drying the sand stored in sand boxes. In general, the M. C. B. standards have been conformed with in so far as couplers, wheel treads, etc., are concerned. The general dimensions of the half units are as follows:

Length over all	29 ft. [illegible]
Height from top of rail to top of roof	[illegible]
Height from top of rail to top of pantograph box when lowered	14 ft. [illegible]
Width of cab over all	[illegible]
Total weight of locomotive half unit, fully equipped	[illegible]
(This weight is practically evenly divided between drivers.)	
Weight of complete locomotive unit	[illegible]
Length of rigid wheel base	[illegible]
Diameter of driving wheels	[illegible]
Normal speed of train, assuming 2 per cent. grade, miles per hour	[illegible]
Normal speed on level tracks, miles per hour	28

In service it has been found that the locomotives will very readily handle a 1,000 ton train at from 11 to 12 and possibly 13 miles an hour on a 2% grade, thus demonstrating their ability to more than fulfil the specified performance.

The second service to be provided for electrically consists of the pumping necessary for the tunnel approaches from water due to rain storms or melting snow, and the removal of a small amount of condensation and rain water collecting in the tunnel. For this purpose pumping plants have been installed at both tunnel portals, that at the Sarnia entrance consisting of two centrifugal pumps, each capable of delivering 4,000 gallons a minute, driven by direct connected 200 h.p., 3 phase, 25 cycle, 3,300 volt, induction motors, and that at the Sarnia entrance consisting of two 2,500 gallon pumps driven by two 200 h.p. motors of the same type. In addition a 150-gallon pump driven by an induction motor is located in each pump house, these pumps serving to take care of the small amount of water that is constantly finding its way into the drainage wells. The motors in the pump houses are controlled by switches located on suitable panels. Provision is made on the panels for connecting the motor bus bars with either of two feeders leading from the power plant. The centrifugal pumps used in this service are primed by means of the water stored in large discharge pipes. Valves controlling



OVERHEAD WORK, ST. CLAIR TUNNEL TERMINALS.

el. The foundation up to the water table onstructed of mass concrete; the building erstructure is of steel and massive paving ck of dark brown color. The building nmings are of cut stone and concrete. general design of the building is along ple massive lines and presents, upon com- ion, a very attractive appearance.

he foundation footings for the building e carried down at all points into the clay, ch is found underlying all of the surface in the vicinity. They were designed for ring pressure of two tons per sq. ft. All he column footings supporting the coal kers, as well as the footing underneath stack, receive additional support in the of piling, the location on the river bank ing it advisable to take this additional aution. The self-supporting steel stric- is carried on concrete foundation walls and footings. The steel work carries not only the reinforced cinder concrete roof, but in the turbine room the runway for the travelling crane, and in the boiler room the reinforced concrete coal bunkers. The brick building walls are also carried on the concrete foundations, and are built about the steel columns. The walls are finished at the top with a parapet capped with concrete coping. The wood work used in finishing the interior of the offices and turbine room is of mission oak.

The roof is constructed of cinder concrete overlaid with composition roofing. Drainage downspouts are taken down through the interior of the building and discharge into the sewer system.

The interior of the engine and boiler rooms are lined with pressed brick of a light grey color. In the turbine room a wainscoting 8 ft. in height of white enamelled brick is carried around the three sides of the room, in which the brick wall surface is exposed, the front side of the turbine room being given up entirely to the switchboard, the glazed partitions separating the officers' and employes' room, the turbine room and the entrance hallways. All floors are concrete, the building being practically fireproof throughout. The light color of the brick, together with the light grey paint applied to the roof trusses and ceilings, tends to materially enhance the ample natural lighting which is provided for the building by means of a large window area.

The general artificial illumination in the building is taken care of by means of Nernst lamps, eight of which are provided for the illumination of the turbine room, these being suspended from the lower chords of the roof trusses, and two for the boiler room. In addition, nearly 200 incandescent lamps are used for illumination in various parts of the plant. Wall brackets of design to harmonize with the interior finish are used in the turbine room. Chandeliers, wall brackets, and ceiling globes are provided for the lighting in the offices and hallways. Four incandescent lamp clusters are mounted on cast iron pedestals on either side of the two front entrances of the building. Hooded lamps are installed over all side entrances, as well as over the coal-receiving hopper at the rear of the building. All passageways behind and above the boilers, along the pipe lines, as well as those leading to and over the coal bunkers, are well lighted, the lights being controlled by switches located at convenient points.

The water supply for house use in the power

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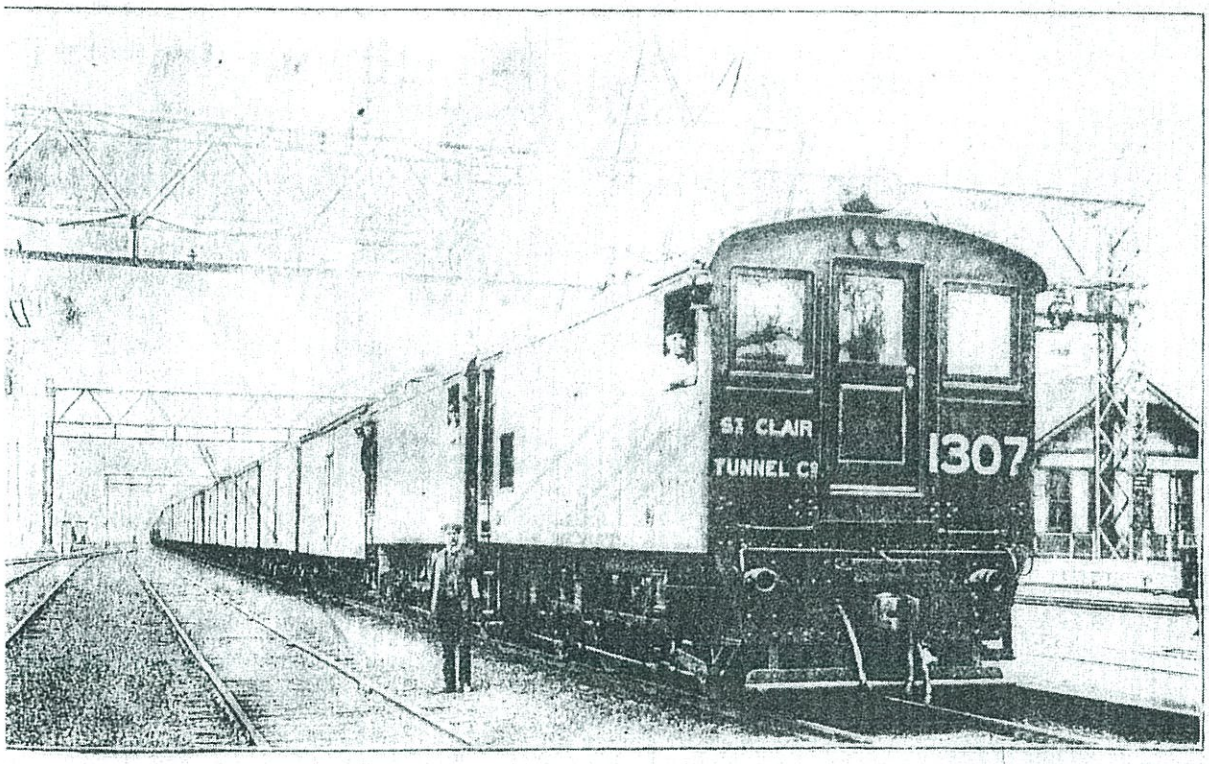
The water supply for house use in the power plant is furnished by a service pump and drawn either from the city water mains or from the St. Clair River as desired. Toilets and lavatories have been installed in connection with the engineer's office and in the turbine room on the basement floor, in the latter of which a shower bath with hot and cold water has been provided for the use of the employes. The necessary heating in the offices has been taken care of by radiators receiving their steam supply from auxiliary header of the power plant. A sewer system has been installed in connection with the building, and connections have been made to fittings in the toilet rooms and to traps installed at various points in the basement floors, as well as to the downspouts, this latter to take the run-off from the roof.



ST CLAIR TUNNEL ELECTRIC LOCOMOTIVE IN TERMINAL YARDS.

Coal is delivered to the plant in hopper cars, which are run over a wooden trestle leading above the receiving hopper, into which it is dumped by gravity. The coal-receiving hopper feeds directly into the crusher, which has a capacity of about 30 tons an hour, and which acts at the same time as a feeder, delivering the coal at a uniform rate to the vertical bucket elevator extending to the top of the building. From the vertical elevator the coal is fed by chutes on to a conveyor belt, from which it is discharged by an automatic tripper arranged to deliver the coal at any point above the bunkers. Slow speed induction motors of the squirrel cage type drive the coal handling apparatus, a 20 h.p. motor being used in the crusher and a 10 h.p. motor installed in the pent house at the top of the building for the operation of the elevator and conveyor. The coal bunkers are constructed of reinforced concrete resting on the steel building columns. The space occupied by them, located in front of and above the boilers, is separated entirely from the boiler room by metal lath partition, thus practically insuring the exclusion of coal dust from the boiler room. In a similar way the coal crusher pit and the coal elevating mechanism are enclosed as completely as possible. Coal for firing purposes is drawn directly from the bunkers, through sheet metal chutes, into the stoker hoppers, which are located in front of the boilers. The ashes are drawn from the grates of the boiler furnaces on to the boiler room floor, where clinkers are broken and delivered through a coarse grating into the ash hoppers which are suspended underneath the floor. From the hoppers they fall by gravity through ash grates into the push cars, and are dumped into an ash chute connecting with the coal elevator. The elevator, when handling ashes, discharges into a spout leading to a small ash bunker at the end of the building. From this bunker they can be delivered by gravity into cars alongside the power plant.

Underfeed stokers are installed in the plant, six being used for each battery of two boilers, making a total equipment of twelve stokers. Forced draft is supplied for each battery by a steel plate fan 11 ft. in diameter and 3 ft. 5 ins. wide, driven by 10 x 10 x 10 type B enclosed vertical engine directly connected to the fan shaft. These fans are located in the pit of the turbine room. By means of a special blast grate in the galvanized iron duct leading from the fans to the boilers, either battery of stokers may be supplied from either of the fans. Each battery of stokers is controlled by an automatic regulator, which is driven from the shaft belted to the fan engines. Friction clutches on this shaft supply cross connection for driving either of the regulators from either engine. This driving mechanism, together with the galvanized iron ducts and gates, is suspended from the ceiling of the boiler room basement. On account of the very great variation in the load on the power plant, special precautions were necessary for the control of the fires under the boilers, in order to keep the steam pressure fairly constant. This is accomplished by means of the stoker equipment, which controls the fire automatically, both by regulating the air forced through the stokers and the rate of feeding of coal into the boiler furnaces. This regulation is accomplished by means of a regulating valve, which acts as a throttling valve on the fan engines. The potential piping leading from the regulator is connected to the main steam header between the superheater and the turbine. In case the pressure in the steam lines tends to drop, the regulating valve increases the supply of steam to the fan engine, thus at the same time increasing the amount of air supplied to the boilers, and the frequency of operation of the stockers. In case the boiler pressure tends to rise, the valve decreases the supply of steam to the fanengine, thus decreasing the amount of air and coal supplied to the furnaces. This apparatus is entirely automatic and has been found to control the steam pressure very closely.

The boiler equipment consists of four 400 h.p. Babcock & Wilcox sectional water tube boilers arranged in two batteries of two each, each boiler having three drums 42 ins. in diameter and 23 ft. 4 ins. in length. This results in an unusually wide boiler, the tubes being arranged nine high and 21 wide, in order to secure quick steaming. This requirement is a necessary complement to the automatic stoker control referred to above. In addition the three drums provide storage for a large quantity of heated water available for quick steaming on any decrease in pressure. The boilers are designed to carry 200 lbs. steam pressure, each unit being equipped with two tandem connected 2½-in. blow-off valves, the necessary pressure gauges, water columns, check valves, high and low water lines and other fittings.

The smoke flue, located in the boiler room basement floor, is built of reinforced concrete. The boiler flues open directly down into the smoke flue, which in turn leads in a straight line through the south building wall to the reinforced concrete stack. The height of stack from the top of the smoke flue is 150 ft., or 162 ft. above the basement floor. The inner shell is of standard construction, and the outer shell, which is the same height as the building, has a square exterior, being faced with brick above the grade line to conform with the building construction. Lightning protection has been applied to the stack in the form of standard equipment.

The separately fired superheater is located between two batteries of boilers. The superheater has a capacity to add 200 degrees of superheat to 36,000 lbs. of steam per hour. The superheater is hand-fired, but requires very little additional attention, as it is provided with automatic temperature regulator, which, by admitting air either above or below the fires, serves to control the superheat within narrow limits, approximately 30°. The regulator consists of a thermal coupling installed in the superheater steam outlet, which in turn operates through a relay and solenoid on the by-pass valve of the hydraulic cylinder, the piston of which directly controls the dampers in the air ducts. The regulating device is so adjusted as to provide a superheat of about 100° under actual working conditions, and has been found in operation to very closely control the temperature of the steam, notwithstanding the great variation of load to which the power plant is subjected.

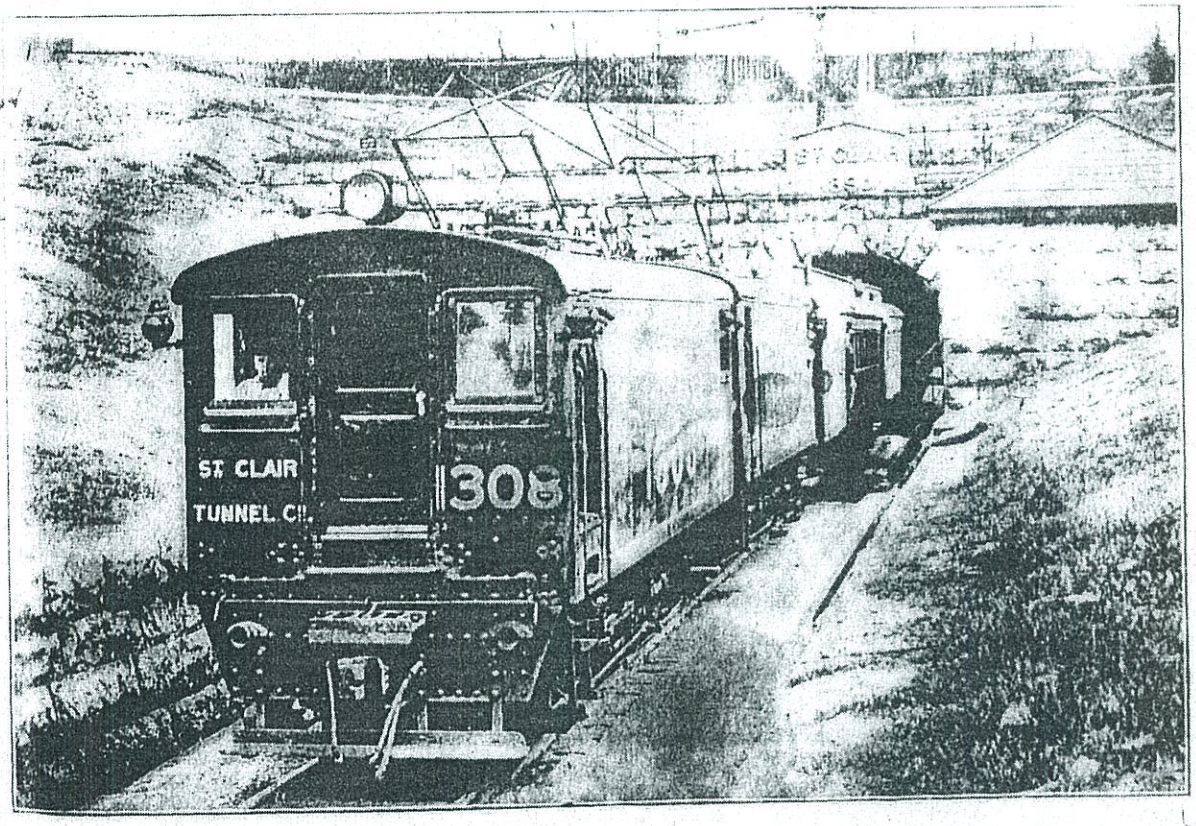
The steam is supplied by the boilers at 200 lbs. pressure, and is delivered through the system of high pressure piping either to the superheaters and thence to the turbines, or through by-pass connections directly to the turbines, steam separators being installed in the piping system adjacent to the latter. The long sweep bends connecting the boiler nozzles with the main header are of 6-in. extra heavy pipe. The short header connecting the two batteries of boilers, in which are located the valves leading to the superheater and turbines, is 8 ins. in diameter, while the lines from the header to the turbines are 7 ins. The fittings throughout are of mild steel, and designed for heavy pressure with superheated steam. All high pressure piping is provided with welded flanges. The necessary drips have been supplied for the proper draining of the high pressure system. An auxiliary header 6 ins. in diameter, operated at 125 lbs., is installed

located in the pit of the turbine room. By means of a special blast grate in the galvan-

pressure gauges, high and low water lines and other fittings.

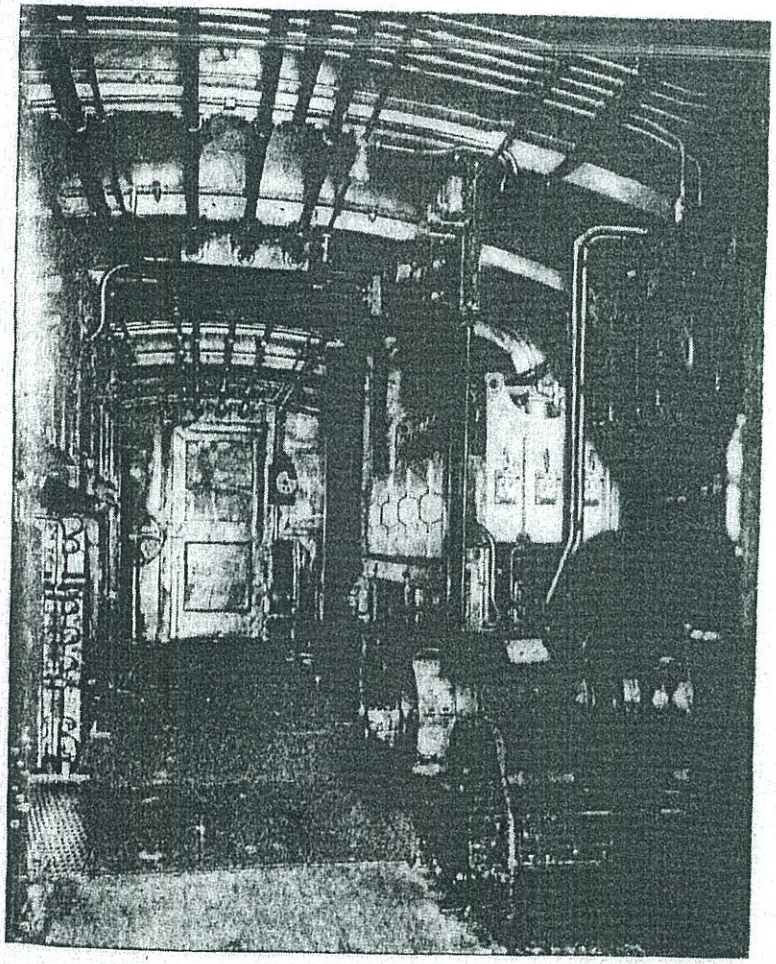
with welded flanges. The necessary pumps have been supplied for the proper draining of the high pressure system. An auxiliary header 6 ins in diameter, operated at 125 lbs., is installed along the boiler room wall at the rear of the boilers. From this header the steam supply is taken to all of the steam auxiliaries in the plant. The free exhaust piping from the back pressure relief valve is of 14-in. spiral riveted steel pipe, extending through the boiler room basement and thence up through the roof. The auxiliary exhaust is made of 8-in. pipe, supported in the boiler room along the fire wall, and receives the exhaust steam from the various auxiliaries in the plant. Steam is delivered by the header to either of the enclosed heaters installed in the boiler room just back of the superheater. A 12-in. oil separator is installed in the exhaust steam line just before it enters the feed water heater. Vertical water tube heaters, each of 700 h.p. capacity, are used. A 4-in. spiral riveted pipe for free exhaust leads from each heater up through the roof.

The condensing water is obtained from the St. Clair River, a concrete intake provided with structural steel grid and woven wire screen being installed along the dock line.



ELECTRIC LOCOMOTIVE AND PASSENGER TRAIN EMERGING FROM ST. CLAIR TUNNEL.

ors have been installed in the plant. The machines are designed to operate at a normal voltage of 3,300 volts, with a frequency of 25 cycles per second. They are 3-phase machines, but are further required by the specifications to furnish their full rated load of 1,250 kw. single-phase current. The turbines are approximately 37 ft. over all, 6 ft. wide, and



INTERIOR OF ELECTRIC LOCOMOTIVE, ST. CLAIR TUNNEL.

make, contains 10 panels, and is made up as follows: One panel on which is mounted the regulator, the voltmeters, frequency meter, and synchroscope; two panels, one of which controls the two steam-driven exciters, the second of which controls the motor-driven exciter; one panel for the control of the current supply for power and light in the plant; two panels for the control of the two turbo-generators; one panel for the locomotive feeder; one for the pumping feeders; one for the power and light feeders; and one for the control of the arc light circuits. All of the high-voltage oil switches are located on structural steel frame work in the switch room directly behind the switchboard, no high tension current being brought to the switchboard itself. Direct current at 125 volts is supplied for excitation, this being controlled from the main switchboard. The power plant lighting current is supplied as alternating current, through step-down transformers installed in a high tension compartment underneath the switchboard room, by means of which the 3,300-volt current is transformed to 110-volt for lighting distribution in the plant. By means of a special switch the lighting system can be transferred from the secondary of the transformer to the exciter bus bars. The switchboard panels are provided with standard apparatus, such as the operating engineer all information necessary in actual running of the plant.

A hand-power travelling crane of 15 tons capacity is installed on runways in the turbine room, by means of which all parts of the equipment in the room can be conveniently handled.

Construction and Operation of Electrified System.—The entire electrical equipment has been in preliminary operation during the larger part of the year 1908. The work of construction was done without any material interference with the traffic through the tunnel. The greatest difficulty was experienced in carrying out that part of the installation located in the tunnel proper. For this purpose the tunnel was given over to the contractor for construction purposes for two 2-hour periods each day during the time that actual construction was in progress in the tunnel. The construction of the overhead work in the yards was carried out without any serious interference with the ordinary traffic of the road, and the power plant construction, being entirely removed from any of the properties operated by the tunnel company, was not subject to any interference on account of railway operation.

The problem of transferring the operation of the tunnel from steam to electricity gave rise to another problem which was successfully solved by the mutual co-operation of the representatives of the tunnel company and the contractor. No attempt was made to make a sudden transfer, but every precaution was taken, not only to thoroughly test out all electrical equipment before attempting to use it in regular service, but also to allow ample time in which to thoroughly familiarize all those connected with the operation of the equipment with their work. Steam locomotive engineers were trained in the use of the electric locomotives. The force required for maintenance of the locomotives and for maintenance and operation of the power plant were secured and assigned their

From the intake the water flows through an 18-in. tile to the cold-wells located below the centrifugal circulating pumps in the pit of the turbine room basement. Water is delivered from each of these by the circulating pump through the condenser, and is discharged into the hot well below the condensers. From the hot wells the water flows through an 18-in. pipe into a sump under the boiler feed pumps. These pumps deliver the water through the feed water heater to the boilers. Excess water in the pumps is discharged through an 18-in. tile pipe emptying into the river. A 3-in. Worthington water meter is connected between each of the feed pumps and the heater. The city water supply is connected to each feed pump by a 3-in. tap. In addition, the suction of the feed pumps may be connected to the cold water intake, thus making three sources of supply for the boiler feed water.

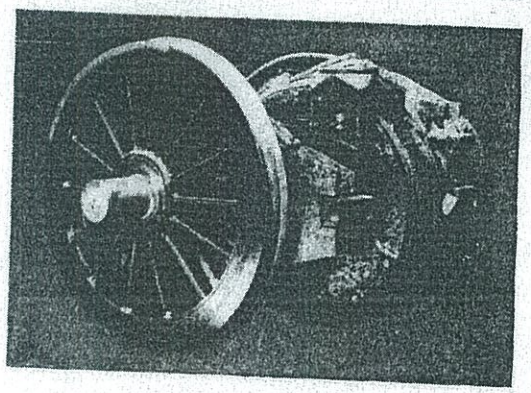
Each battery of boilers is fed by a 12 x 6 x 10 duplex outside, end-packed Worthington boiler feed pump. In addition water is provided for various other purposes, such as cooling the lubricating oils in the turbines, supplying the glands of the turbines, for hose connections in and about the power plant, all of this being supplied by a small service pump, drawing supply from one of the cold wells. The discharge pressure on the water system supplied by this pump is maintained by a pressure-regulating valve at about 75 lbs. A connection containing a check valve is made from the city mains to this piping. In so far as the city pressure is carried at about 45 lbs., the entire water supply will be furnished normally by the service pump. In case, however, the service pump should fail to operate, the necessary water supply will be forced in from the city mains through the check valve.

Two Westinghouse Parsons turbo-generators have been installed in the plant. The machines are designed to operate at a normal voltage of 3,300 volts, with a frequency of 25 cycles per second. They are 3 phase machines, but are further required by the specifications to furnish their full rated load of 1,250 kw. single-phase current. The turbines are approximately 37 ft. over all, 6 ft. wide, and 8 ft. high, and designed to operate at 1,500 r. p. m. The generators are cooled by means of air drawn through the coils by vanes installed on the rotor. A speed limit device is arranged to cut off the supply of steam in case the speed of the turbine exceeds a predetermined value.

Barometric jet condensers with 30-in. inlet have been installed in connection with each of the steam turbines. A 36-in. exhaust pipe connects the exhaust outlet of the turbine with reducing fitting attached to the condenser head. A 14-in. automatic relief valve is installed in connection with the exhaust fitting, and connected to the free exhaust piping. The cooling water for each condenser is furnished by a 10-in. volute pump driven by 7 x 9 vertical engine. The rotative straight line vacuum pumps, 8 x 6 x 12 in dimension, are supplied in connection with each condensing equipment. The dry vacuum pumps are located on the turbine room floor alongside the condensers, while the circulating pumps are located in the open pit in the turbine room basement, where they are in plain view from the turbine room floor.

Two steam-driven exciters have been installed in the plant, each of 25 kw. capacity, this being sufficient to provide excitation for a single turbine. In addition a motor-driven exciter of 40 kw. capacity is installed, and is ordinarily used in the operation of the plant, the two steam-driven exciters being for additional security so far as continuity of service is concerned. The generators of the steam-driven exciters are of the Westinghouse make, and are driven by Westinghouse vertical type engines. Both generator and motor of the motor-driven exciter are of Westinghouse manufacture, the motor being 3 phase, 3,300-volt, of the squirrel cage induction type.

The switchboard, also of Westinghouse make, contains 10 panels, and is made up as follows: One panel on which is mounted the regulator, the voltmeters, frequency meter, and synchroscope; two panels, one of which controls the two steam-driven exciters, the second of which controls the motor-driven exciter; one panel for the control of the current supply for power and light in the plant; two panels for the control of the two turbo generators; one panel for the locomotive feeder; one for the pumping feeders; one for the power and light



MOTOR AND DRIVING WHEELS, ELECTRIC LOCOMOTIVE, ST. CLAIR TUNNEL.

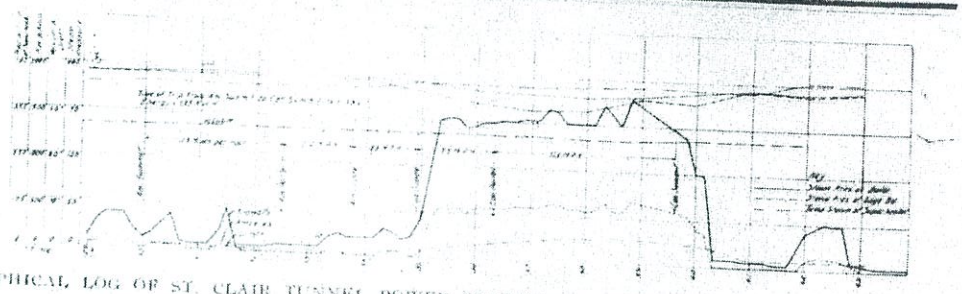
ammeters, voltmeters, and indicating wattmeters. Recording wattmeters have been installed as well, and so located as to measure the output of the plant required for the various kinds of service, namely, the locomotive service, pumping service, and lighting service. The voltage control of the generators is provided for by the installation of a Tirrill regulator, which controls the voltage of the locomotive phase. The lighting load is carried on this phase as well, and is thus free from the large voltage variations that are liable to occur on the other phases. The station for the operating engineer is directly in front of the switchboard, from which point all the electrical indicating instruments, as well as the switches used in the operation of the plant are accessible. On the opposite side of the turbine room, facing the switchboard, is a gauge board, on which are installed the various gauges, both indicating and recording, giving full information with regard to the operation of the boiler plant. This arrangement brings to the immediate view of the operating engineer all information necessary in actual running of the plant.

A hand-power travelling crane of 15 tons capacity is installed on runways in the turbine room, by means of which all parts of the equipment in the room can be conveniently handled.

CONSTRUCTION AND OPERATION OF ELECTRIFIED SYSTEM.—The entire electrical equipment has been in preliminary operation during the larger part of the year 1908. The work of construction was done without any material interference with the traffic through the tunnel. The greatest difficulty was experienced in carrying out that part of the in-

duties during the time that the first experimental and test runs were made with the equipment. When everything was in readiness, test runs were made with light locomotives through the tunnel, and later, moderate-size trains were taken through the tunnel as test loads, and finally a limited number of regular trains were handled by the electric locomotives. In this way, by gradually increasing the amount of work done by the electrical equipment, the entire operation was transferred from steam to electricity. The fact that no delays worthy of notice have occurred, either during the time of partial operation, or later, during the time of preliminary electric operation, is worthy of special note, indicating as it does not only the high character of the system so far as design and construction is concerned, but as well the conformity to the operating conditions that must necessarily be made in changing the operation of a division of a railway system from steam to electricity.

Some of the salient features in the operation of the plant may be seen by reference to a typical load curve. This curve is a graphical log of the operation of the plant during the time required for the passage of trains from one terminal to the other. It shows at a glance the power required by the locomotive, and the variation of boiler pressure, forced draft pressure, superheat, etc., during the cycle represented by train movements in the tunnel. The efficiency of all parts of the equipment is fully up to the contract requirements, and in fact in many cases the performance is found to exceed that guaranteed. From the results of preliminary operation it appears that the economies which will be effected by the electrification will be slightly in excess of the attainment estimated at the time the preliminary report on the proposition was submitted. This satisfactory showing, together with the entire elimination of obnoxious gases from the tunnel, is a source



GRAPHICAL LOG OF ST. CLAIR TUNNEL POWER PLANT OPERATION; CONDENSING. RUN NO. 3, MAY 28, 1908. WEIGHT OF TRAIN WITH LOCOMOTIVE, 1,025.5 TONS.

of congratulation to the railway company, together with those connected with the enterprise in an engineering or contracting capacity.

TECHNICAL DATA.

GENERAL		
Length of zone electrified, approximately (miles)		4
Length of single track, approximately (miles)		12
Length of tunnel (feet)		6,032
Maximum grade (per cent)		2
Normal weight of train (tons)		1,000
LOCOMOTIVES		
Number of units per locomotive		2
Number of complete locomotives		3
Weight of complete locomotives (tons)		135
Normal motor capacity (h.p.)		1,500
Normal drawbar pull (pounds)		50,000
Maximum speed (miles per hour)		35
Minimum speed, up 2% grade with 1,000-ton train (miles per hour)		10
PUMPING STATIONS		
Location	Sarnia	Port Huron.
Number of pumping units	2	2
Capacity of units (gal. per min.)	5,500	4,000
Capacity of driving motors (h.p.)	200	100
Voltage of motors (volts)	3,300	3,300
ELECTRICAL DISTRIBUTION SYSTEM		
System adopted	Single phase.	
Type of construction	Single catenary, supported by structural steel bridges.	
Normal voltage (volts)		3,300
POWER PLANT		
Number of turbo-generators		2
Normal capacity of each generator (k.w.)		1,250
Generator voltage (volts)		3,300
Generator frequency (cycles per sec.)		25
Generator speed (r. p. m.)		1,500
Number of boilers		4
Nominal capacity of each boiler (h.p.)		400
Capacity of coal bunkers (tons)		750
Capacity of hand power crane (tons)		15

The foregoing is reproduced, with very slight alterations, from a des[illegible]

vided with railings and passenger car seats, and decorated with bunting. The train proceeded through the tunnel to Sarnia Tunnel station, the trip being most instructive and enjoyable. The air of the tunnel was beautifully clear, the interior of the tube perfectly clean and dry, and the lighting excellent, it being as well lit as any city street at night, which led the Managing Director of THE RAILWAY AND MARINE WORLD, in speaking at the subsequent luncheon, to suggest to Passenger Traffic Manager Davis that moonlight tunnel excursions might be made a popular feature.

The party disembarked at Sarnia Tunnel station, and were conveyed by special train to the town of Sarnia, where they were entertained at luncheon at the Hotel Vendome, E. H. Fitzhugh, Third Vice-President G.T.R., occupying the chair. After the toasts of the King and the President of the United States had been drunk, H. G. Kelley, Chief Engineer G.T.R., proposed the health of Jos. Hobson, Consulting Engineer G.T.R., who received a tremendous ovation on rising to reply. The outstanding feature of the day was the hearty welcome accorded to Mr. Hobson by everyone present, and the recognition of the great work he performed in the original designing and construction of the tunnel, a work of much greater difficulty than its recent electrification. We have reason to know that when the tunnel was projected Mr. Hobson recommended electricity as the motive power, but the management decided in favor of steam locomotives. W. McNab, Principal Assistant Engineer G.T.R., proposed the health of B. J. Arnold, consulting engineer for the tunnel electrification, Mr. Arnold responding and paying a warm tribute to Mr. Hobson, E. A. Sager assistant engineer with B. J.

one terminal to the other. It shows at a glance the power required by the locomotive, and the variation of boiler pressure, forced draft pressure, superheat, etc., during the cycle represented by train movements in the tunnel. The efficiency of all parts of the equipment is fully up to the contract requirements, and in fact in many cases the performance is found to exceed that guaranteed. From the results of preliminary operation it appears that the economies which will be effected by the electrification will be slightly in excess of the attainment estimated at the time the preliminary report on the proposition was submitted. This satisfactory showing, together with the entire elimination of obnoxious gases from the tunnel, is a source

Normal drawbar pull (pounds)		
Maximum speed (miles per hour)		35
Minimum speed, up 2% grade with 1,000-ton train (miles per hour)		10
PUMPING STATIONS —		
Location —	Sarnia.	Port Huron.
Number of pumping units	2	2
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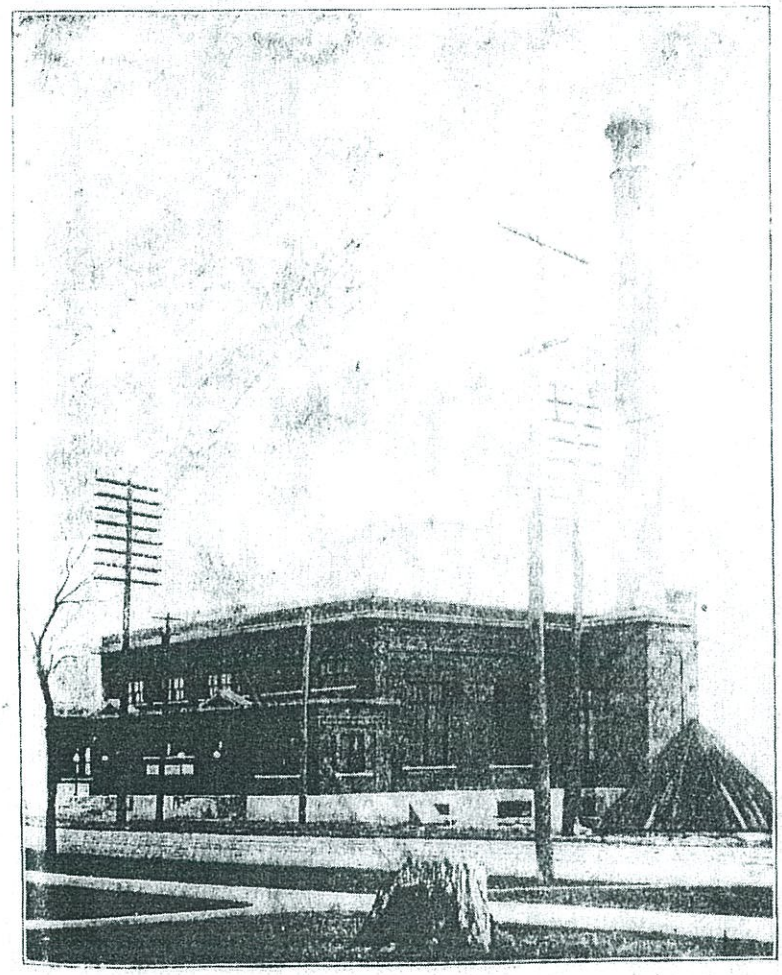
Capacity of driving motors (h.p.)	200	100
Voltage of motors (volts)	3,300	3,300
ELECTRICAL DISTRIBUTION SYSTEM —		
System adopted	Single phase.	
Type of construction	Single catenary, supported by structural steel bridges.	
Normal voltage (volts)	3,300	
POWER PLANT —		
Number of turbo-generators	2	
Normal capacity of each generator (k.w.)	1,250	
Generator voltage (volts)	3,300	
Generator frequency (cycles per sec.)	25	
Generator speed (r. p. m.)	1,500	
Number of boilers	4	
Nominal capacity of each boiler (h.p.)	400	
Capacity of coal bunkers (tons)	750	
Capacity of hand power crane (tons)	15	



ELECTRIC POWER HOUSE, ST CLAIR TUNNEL.

The foregoing is reproduced, with very slight alterations, from a description prepared by F. A. Sager, Assistant Engineer with Bion J. Arnold, consulting engineer for the tunnel company.

The formal inspection of the electrified tunnel and yards and the power plant took place on Nov. 12, when a party of nearly 200, consisting of G.T.R. officials and a large number of guests, including officials of other railways, many engineers, representatives of the Westinghouse companies and of the press assembled at Port Huron, Mich., as guests of the G.T.R. At 1 p.m. they boarded a special train consisting of two electric locomotives and a number of flat cars, which were pro-

The party disembarked at Sarnia station, and were conveyed by special train to the town of Sarnia, where they were entertained at luncheon at the Hotel Vendome, E. H. Fitzhugh, Third Vice-President G.T.R., occupying the chair. After the toasts of the King and the President of the United States had been drunk, H. G. Kelley, Chief Engineer G.T.R., proposed the health of Jos. Hobson, Consulting Engineer G.T.R., who received a tremendous ovation on rising to reply. The outstanding feature of the day was the hearty welcome accorded to Mr. Hobson by everyone present, and the recognition of the great work he performed in the original designing and construction of the tunnel, a work of much greater difficulty than its recent electrification. We have reason to know that when the tunnel was projected Mr. Hobson recommended electricity as the motive power, but the management decided in favor of steam locomotives. W. McNab, Principal Assistant Engineer G.T.R., proposed the health of B. J. Arnold, consulting engineer for the tunnel electrification, Mr. Arnold responding and paying a warm tribute to Mr. Hobson. F. A. Sager, assistant engineer with B. J. Arnold, proposed the Westinghouse Co., R. L. Wilson, Superintendent of Construction for the company, responding. Cy Warman proposed the Mayors of Sarnia and Port Huron, to which they replied. The Press, proposed by W. E. Davis, Passenger Traffic Manager G.T.R., was responded to by J. M. Eastwood, President of the Hamilton Times, and Acton Burrows, Managing Director of THE RAILWAY AND MARINE WORLD.

After luncheon the party returned through the tunnel by special train, and inspected the power house at Port Huron. In the evening a number of them were entertained at dinner at the Harrington Hotel, Port Huron. Only one toast was proposed, that of the G.T.R. Co., by Acton Burrows, H. Charlton, G.T.R. Advertising Agent, responding.

The whole arrangements for the day's functions were carried through without a hitch, and a most enjoyable time was spent by those who had the privilege of being present.

paratively little increase in temperature above that of the surrounding air. The air for the cooling is taken through a suitably designed shutter located in the side of the locomotive cab, and is distributed through sheet metal ducts installed under the cab floor to the three motors under the cab, and to the transformer. From the latter the air passes either through an opening in the floor of the cab into the open air, or, if desired, into the interior of the cab. In the latter case an appreciable amount of heat can be secured from the main transformer for utilization in heating the cab during cold weather. Motor driven air compressors are also located in the cab. The air brake equipment is of the standard type used for electric cars and locomotives, with the exception of the motors, which are single phase. They are operated by means of an electric controller, which serves to keep the normal air pressure at about 100 lbs. The compressed air is used for the purpose of operating both the automatic and straight air equipment on locomotive and train, and in addition for a variety of minor purposes in and about the locomotive. All of the contactor switches used in controlling the operation of the locomotives are air operated, the air valves being operated by direct current electrical control. This is also true of ringing the bell, blowing the whistle, raising and lowering the trolley, and the application of sand to the tracks.

Speed control of the locomotive is effected by varying the voltage at the terminals of the motors. This is obtained by making connection with various transformer taps by means of the air operated, electrically controlled contactor switches. Electric control of the contactors is effected through the master controller, which in the electric locomotive replaces the throttle valve in the steam locomotive. The current for the master controller is furnished by a small storage battery operating at about 20 volts, the battery in turn being charged by means of a small motor-generator set provided for the purpose. The electric controller has 21 units in all, 17 of which are running points. This provides for an increase in the speed of the locomotive from the lowest running speed to the maximum speed by very slight gradations, thus making it possible to maintain a practically constant drawbar pull, while the locomotive is accelerating the train. This is very desirable, in so far as the minimum variation in the drawbar pull while handling the train through the tunnel decreases the liability of breaking the train in two. Particular attention was given this phase of the train operation in designing the locomotive, and the resulting remarkable decrease in the number of breaks-in-two since the operation with electric locomotives has been inaugurated is a source of great satisfaction. On the master controller is also located the reverse lever, which controls through the electrically operated solenoids the air operated contactors used in reversing the motor connections. Here also are located the push buttons, which serve to raise and lower the trolley, operate the front and rear sanders, reset the circuit breaker, and ring the bell. The ringing of the bell and the application of sand by means of the front and rear sanders are also controlled by foot pedals, thus making it possible for the operator to perform these functions while his two hands are employed in operating the master controller and the air. The balance of the equipment of each locomotive, consisting of the sand boxes, the seats for the drivers, ammeters, voltmeters, wattmeters, the banks of contactors, the preventive resistance coils, circuit breakers, auxiliary storage battery and motor generator set for charging it, are all installed in a compact manner inside of the cab, and are supported on structural steel work.

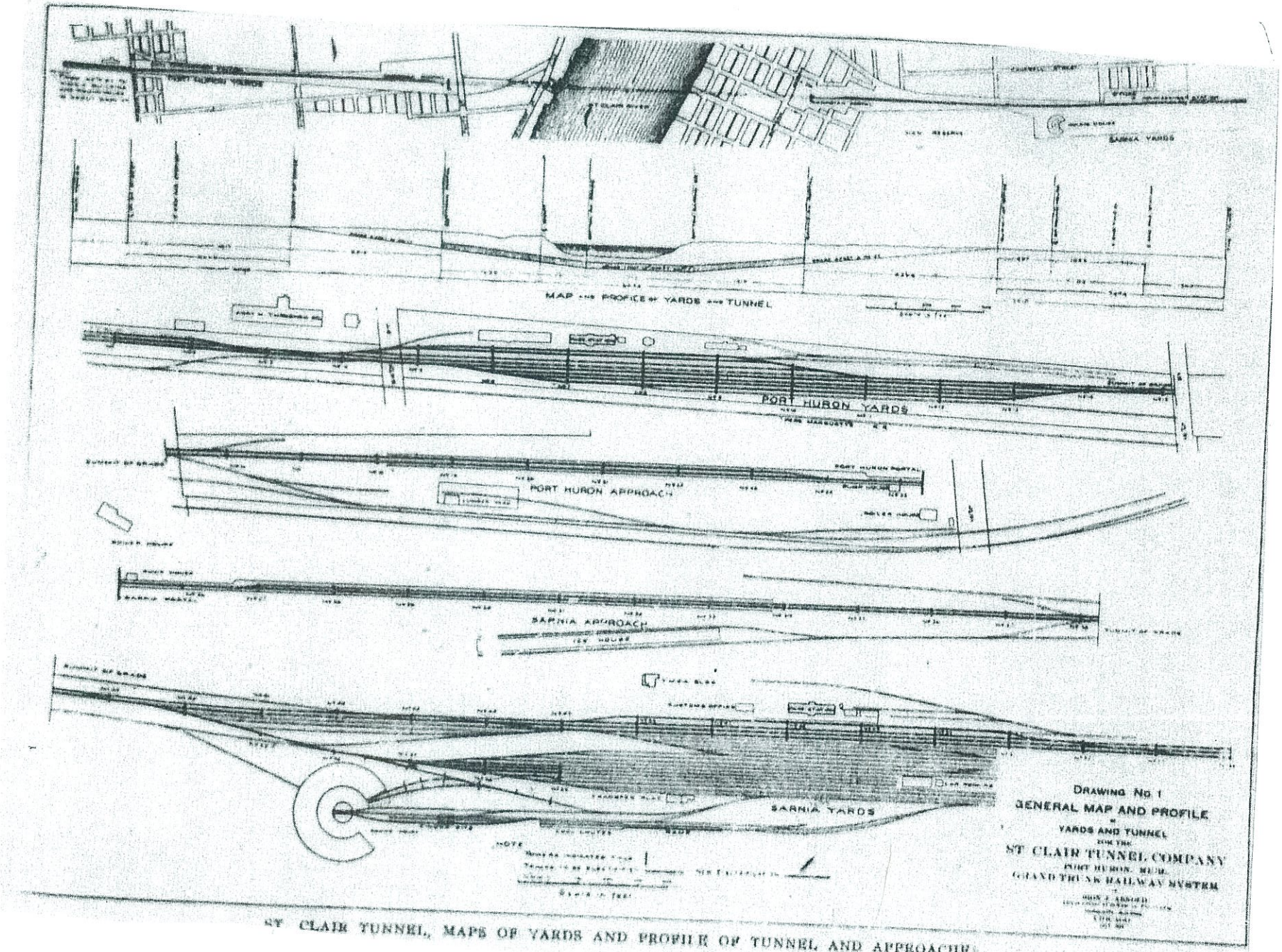
Each half-unit is arranged for operation in either direction; air valves, a master controller and ammeter being located at each end of the cab. By means of cable couplings, the control system of two or more half-units can be thrown in parallel, thus providing for the operation of any number of half-units from any master controller. In this way the two half-units are generally operated in the handling of freight trains through the tunnel. The passenger traffic can ordinarily be taken care of by a single half-unit.

The current is collected from the trolley wires suspended at a distance of 22 ft. from the track by means of a sliding bow pantograph trolley. In so far as the trolley wire extends throughout the length of the tunnel, no additional provision has to be made for the collection of current while the locomotive is passing through the tunnel. Electric headlights are provided, as well as lights for the illumination of the interior of the cab and the dials of the indicating instruments. The heating of the cabs is provided for by means of standard electric heaters. Heat is also available for drying the sand stored in sand boxes. In general, the M. C. B. standards have been conformed with in so far as couplers, wheel treads, etc., are concerned. The general dimensions of the half-units are as follows:

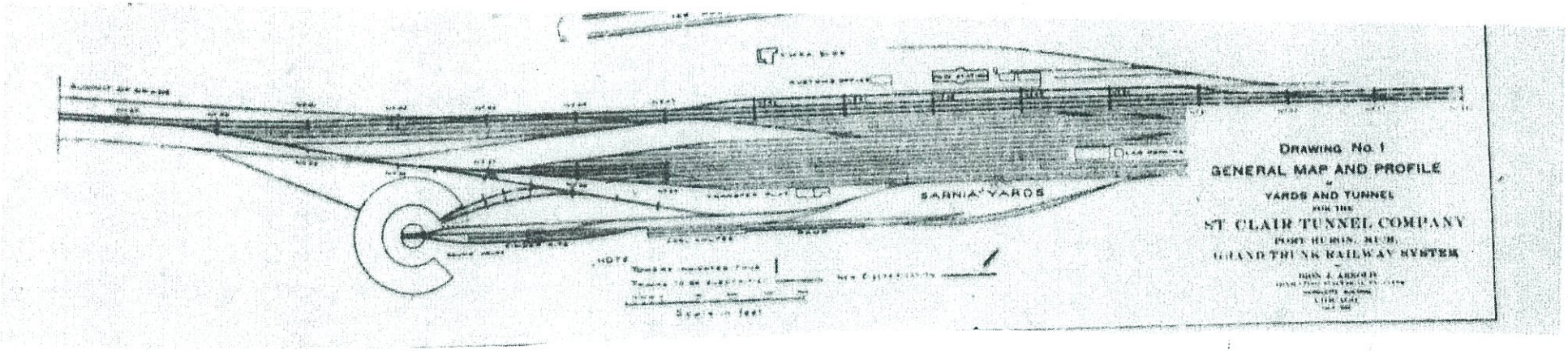
Length over all	23 ft. 6 in.
Height from top of rail to top of roof	13 ft.
Height from top of rail to top of pantograph bow when lowered	14 ft. 11 in.
Width of cab over all	9 ft. 8 in.
Total weight of locomotive half-unit, fully equipped	67½ tons
(This weight is practically evenly divided over three drivers.)	
Weight of complete locomotive unit	135 tons
Length of rigid wheel base	16 ft.
Diameter of driving wheels	62 in.
Normal speed of train, ascending 2 per cent. grade (miles per hour)	14
Normal speed on level tracks (miles per hour)	25 to 30

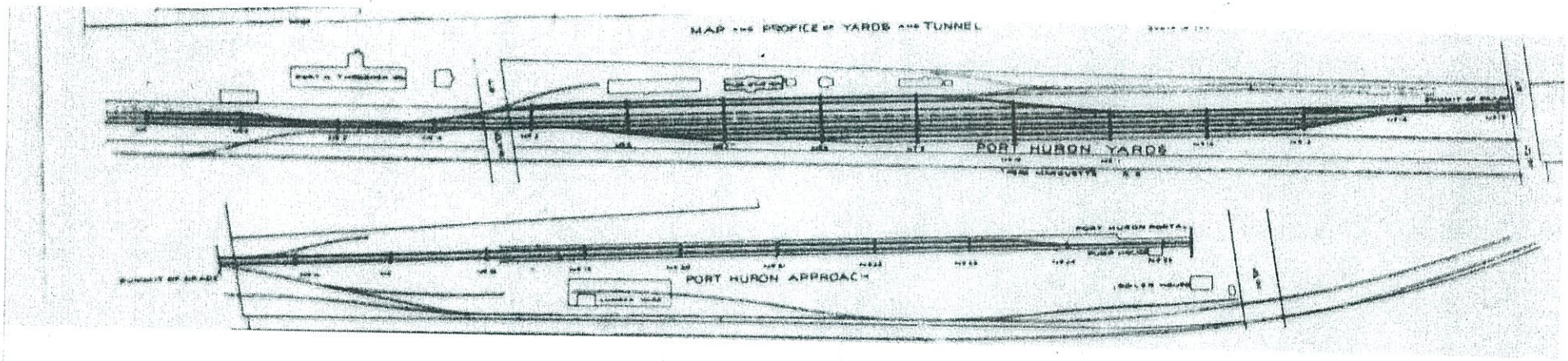
In service it has been found that the locomotives will very readily handle a 1,000-ton train at from 11 to 12, and possibly 13 to 14 miles an hour on a 2% grade, thus demonstrating their ability to more than fulfil the specified performance.

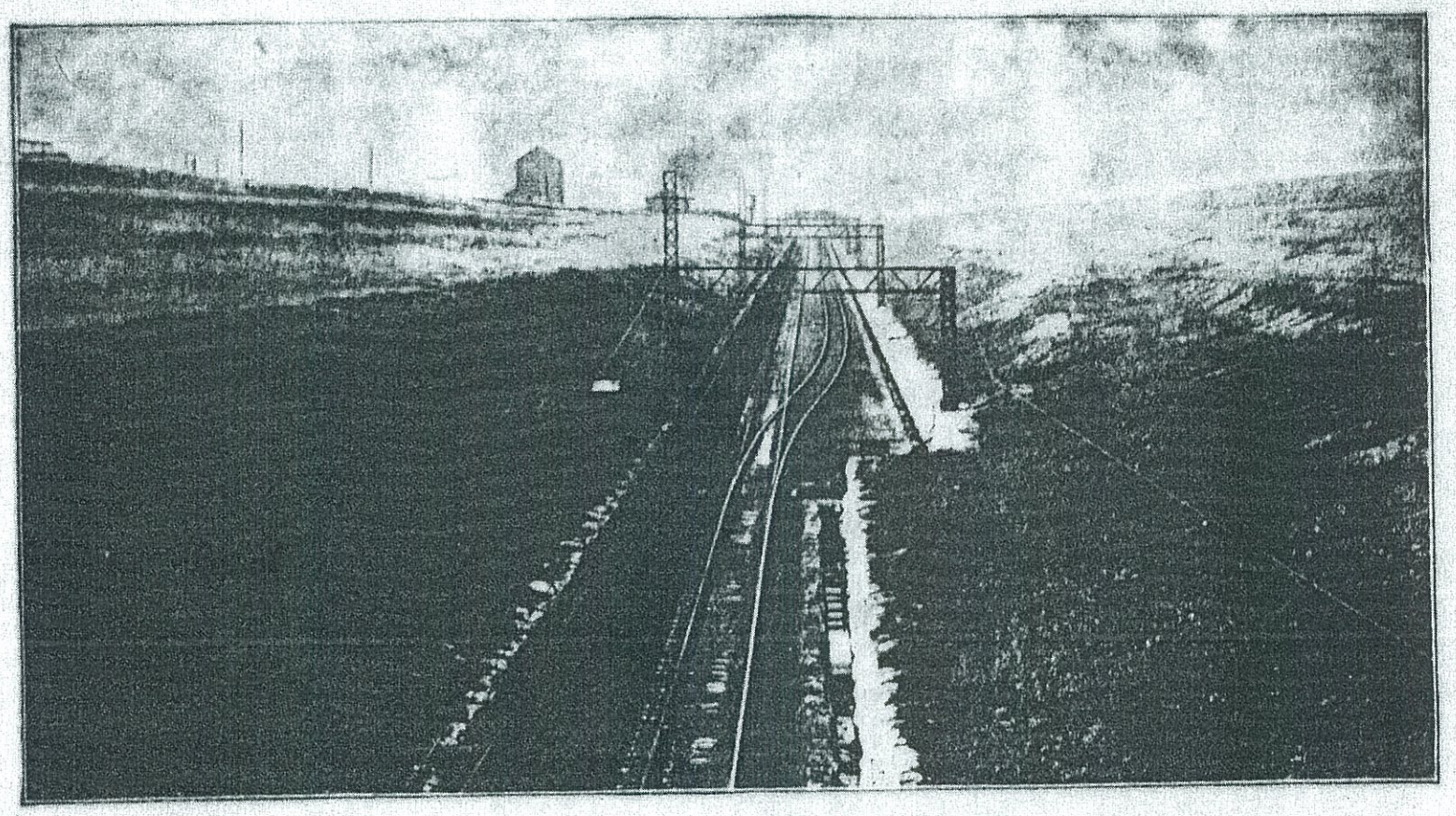
The second service to be provided for electrically, consists of the pumping necessary to free the tunnel approaches from water due to rain storms or melting snow, and the removal of a small amount of condensation and seepage water collecting in the tunnel. For this purpose pumping plants have been installed at both tunnel portals, that at the Port Huron entrance consisting of two centrifugal pumps, each capable of delivering 4,000 gallons a minute, driven by direct connected, 100 h.p., 3-phase, 25 cycle, 3,300-volt, induction motors, and that at the Sarnia entrance consisting of two 4,500 gallon pumps driven by two 200 h.p. motors of the same type. In addition a 150-gallon pump driven by small induction motor is located in each pump house, these pumps serving to take care of the small amount of water that is constantly finding its way into the drainage wells. The motors in the pump houses are controlled by oil switches located on suitable panels. Provision is made on the panels for connecting the motor bus bars with either of two feeders leading from the power plant. The centrifugal pumps used in this service can be primed by means of the water stored in the large discharge pipes. Valves controlling the



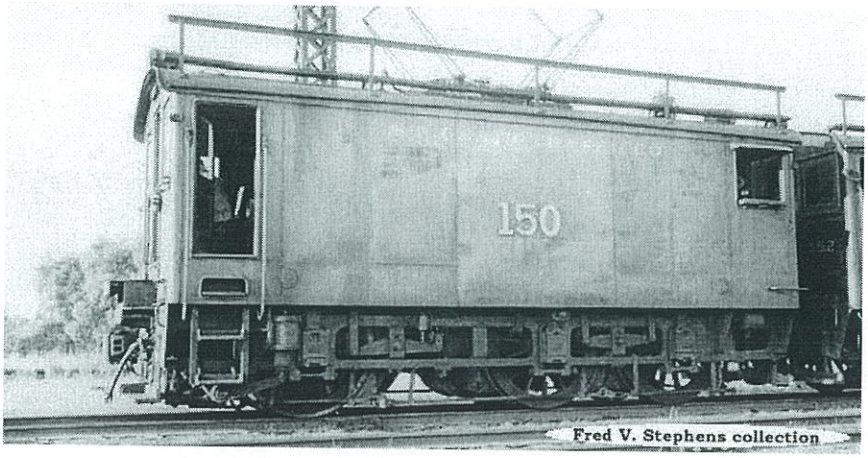
ST CLAIR TUNNEL, MAPS OF YARDS AND PROFILE OF TUNNEL AND APPROACHES.


SARNIA YARDS
DRAWING No. 1
GENERAL MAP AND PROFILE
OF
YARDS AND TUNNEL
FOR THE
ST CLAIR TUNNEL COMPANY
PORT HURON, MICH.
GRAND TRUNK RAILWAY SYSTEM


MAP AND PROFILE OF YARDS AND TUNNEL
PORT HURON YARDS
PORT HURON APPROACH



APPROACH TO ST. CLAIR TUNNEL FROM SARNIA.



ST. CLAIR TUNNEL COMPANY 150

St. Clair Tunnel 150 was one of six electric locomotives purchased new in 1907 to electrify the St. Clair Tunnel Company. Locomotives 1305-1309 were delivered in 1907 while 1310 was delivered in July 1908. They were rated at 750 hp with a starting tractive effort of 33,000 lbs. operating on 3300 volts AC. Length of the locomotive was just under 30 feet. Originally numbered 1310, 150 was renumbered 2660 in 1910, 9150 in 1923 and 150 in 1949. It was scrapped in April 1959 at Hamilton, Ontario.

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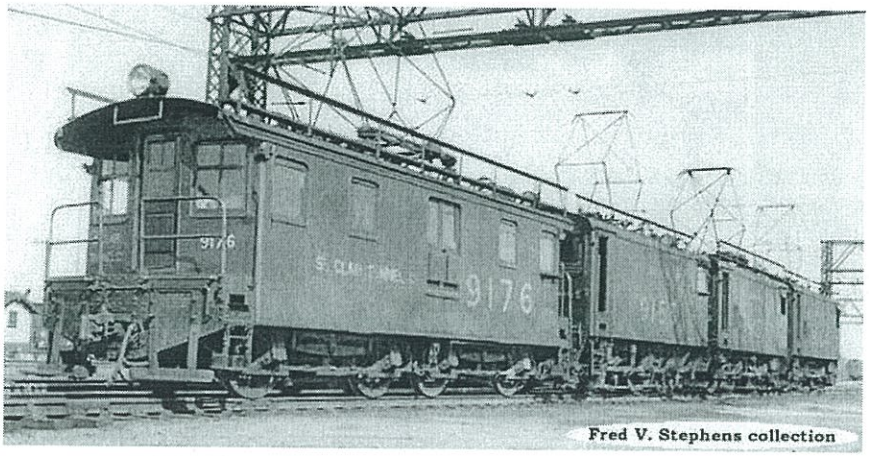

Fred V. Stephens collection

ST. CLAIR TUNNEL COMPANY 9176 with 9153, 9156 and 9154

In 1927, the Chicago, South Shore & South Bend Railroad *(formerly the Chicago, Lake Shore & South Bend Railway)* converted its power from AC to a 1500 volt DC system. It was decided not to convert locomotives 505-506, but put them up for sale. They were purchased by the St. Clair Tunnel Company in March 1927 where they became road numbers 9175-9176. These were rated at 700 hp with a starting tractive effort of 36,000 lbs. Length of the locomotive was just over 39 feet. 9176 remained in service until electric operations ceased and was scrapped at Hamilton, Ontario in April 1959.

This undated view is believed to have been taken in Sarnia.

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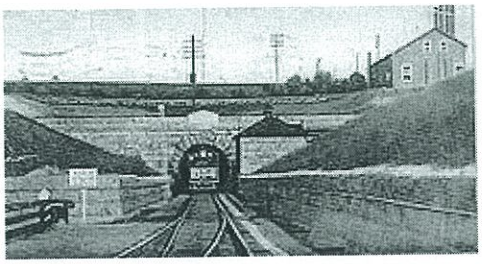
Coordinates: 42°57′30″N 82°24′38″W

St. Clair Tunnel

From Wikipedia, the free encyclopedia

The **St. Clair Tunnel** is the name for two separate rail tunnels which were built under the St. Clair River between Sarnia, Ontario and Port Huron, Michigan. It was the first full-size subaqueous tunnel built in North America.[3] (By full-size it is meant that it allowed a railroad to run through it.)

St. Clair Tunnel



View of the original tunnel (closed in 1994) from a 1907 postcard

Overview	
Official name	Paul M. Tellier Tunnel (second tunnel)
Location	St. Clair River between Port Huron, Michigan and Sarnia, Ontario
Coordinates	42°57′30″N 82°24′38″W
Operation	
Opened	1891 (first tunnel) 1994 (second tunnel)
Closed	1994 (first tunnel)
Operator	Canadian National Railway
Technical	
Length	6,025 feet (1,836 m) (first tunnel) 6,129 feet (1,868 m) (second tunnel)
No. of tracks	Single (each tunnel)

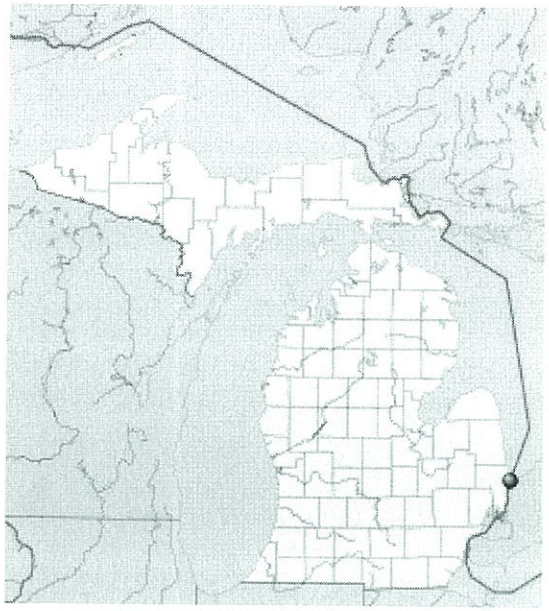
Contents

First tunnel (1891-1995)

The St. Clair Tunnel Company opened the first tunnel in 1891. The company was a subsidiary of the Grand Trunk Railway (GTR), which used the new route to connect with its subsidiary Chicago and Grand Trunk Railway, predecessor to the Grand Trunk Western Railroad (GTW). Before the tunnel's construction, Grand Trunk was forced to use time-consuming rail ferries to transfer cargo.

The tunnel was an engineering marvel in its day and designed by Joseph Hobson.[4] The development of original techniques were achieved for excavating in a compressed air environment. The Beach tunnelling shield, designed by Alfred Ely Beach, was used to assist workmen in removing material from the route of the tunnel and left a continuous iron tube nearly 7,000 feet (2,100 m) long.[5] Freight trains used the tunnel initially with the first passenger trains using it in 1892.

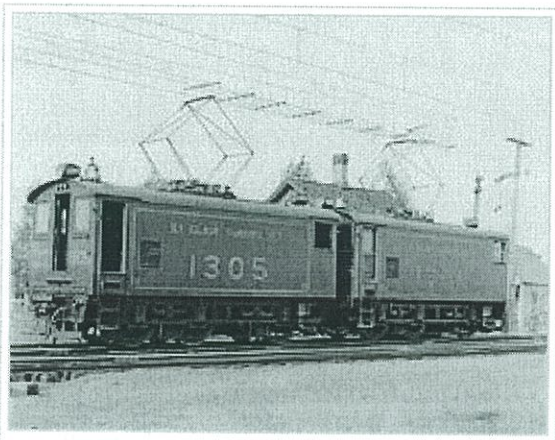
The tunnel measured 6,025 feet (1,836 m) from portal to portal. The actual width of the St. Clair River at this crossing is only 2,290 feet (698 m). The tube had a diameter of 19 feet 10 inches (6.05 m) and hosted a single standard gauge track. It was built at a cost of $2.7 million.



Location on a map of Michigan

U.S. National Register of Historic Places	
Designated	October 15, 1970[1]
Reference no.	70000684
U.S. National Historic Landmark	
Designated	April 19, 1993[2]
Built	1889
Architect	Beach,Alfred; Hobson,Joseph
Governing body	Private

Locomotives



Electric-powered St. Clair locomotive, at Port Huron.

Steam locomotives were used in the early years to pull trains through the tunnel, however concerns about the potential dangers of suffocation should a train stall in the tunnel led to the installation of catenary wires for electric-powered locomotives by 1907. The first use of electric locomotives through the tunnel in regular service occurred on May 17, 1908.[6]

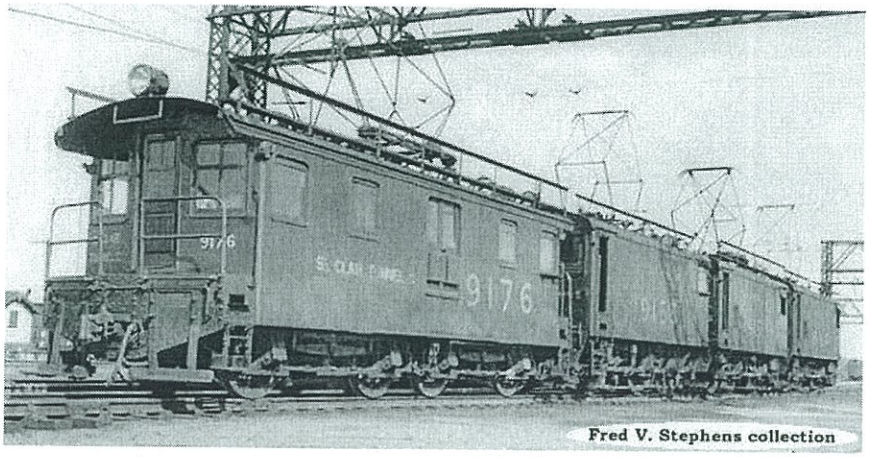
In 1923, the GTR was nationalized by Canada's federal government, which then merged the bankrupt railway into the recently formed Canadian National Railway. CN also assumed control of Grand Trunk Western as a subsidiary and the tunnel company and continued operations much as before.

The electric-powered locomotives were retired in 1958 and scrapped in 1959 after CN retired and scrapped its last steam-powered locomotives on trains passing through the tunnel. New diesel-powered locomotives did not cause the same problems with air quality in this relatively short tunnel.

Freight cars

After the Second World War, railways in North America started to see the dimensions of freight cars increase. Canadian National (identified as CN after 1960) was forced to rely upon rail ferries to carry freight cars, such as hicube boxcars, automobile carriers, certain intermodal cars and chemical tankers, which exceeded the limits of the tunnel's dimensions.

The tunnel was designated a Civil Engineering Landmark by both the Canadian and the Societies of Civil Engineers in 1991.[3]



Fred V. Stephens collection

ST. CLAIR TUNNEL COMPANY 9176 with 9153, 9156 and 9154

In 1927, the Chicago, South Shore & South Bend Railroad *(formerly the Chicago, Lake Shore & South Bend Railway)* converted its power from AC to a 1500 volt DC system. It was decided not to convert locomotives 505-506, but put them up for sale. They were purchased by the St. Clair Tunnel Company in March 1927 where they became road numbers 9175-9176. These were rated at 700 hp with a starting tractive effort of 36,000 lbs. Length of the locomotive was just over 39 feet. 9176 remained in service until electric operations ceased and was scrapped at Hamilton, Ontario in April 1959.

This undated view is believed to have been taken in Sarnia.

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