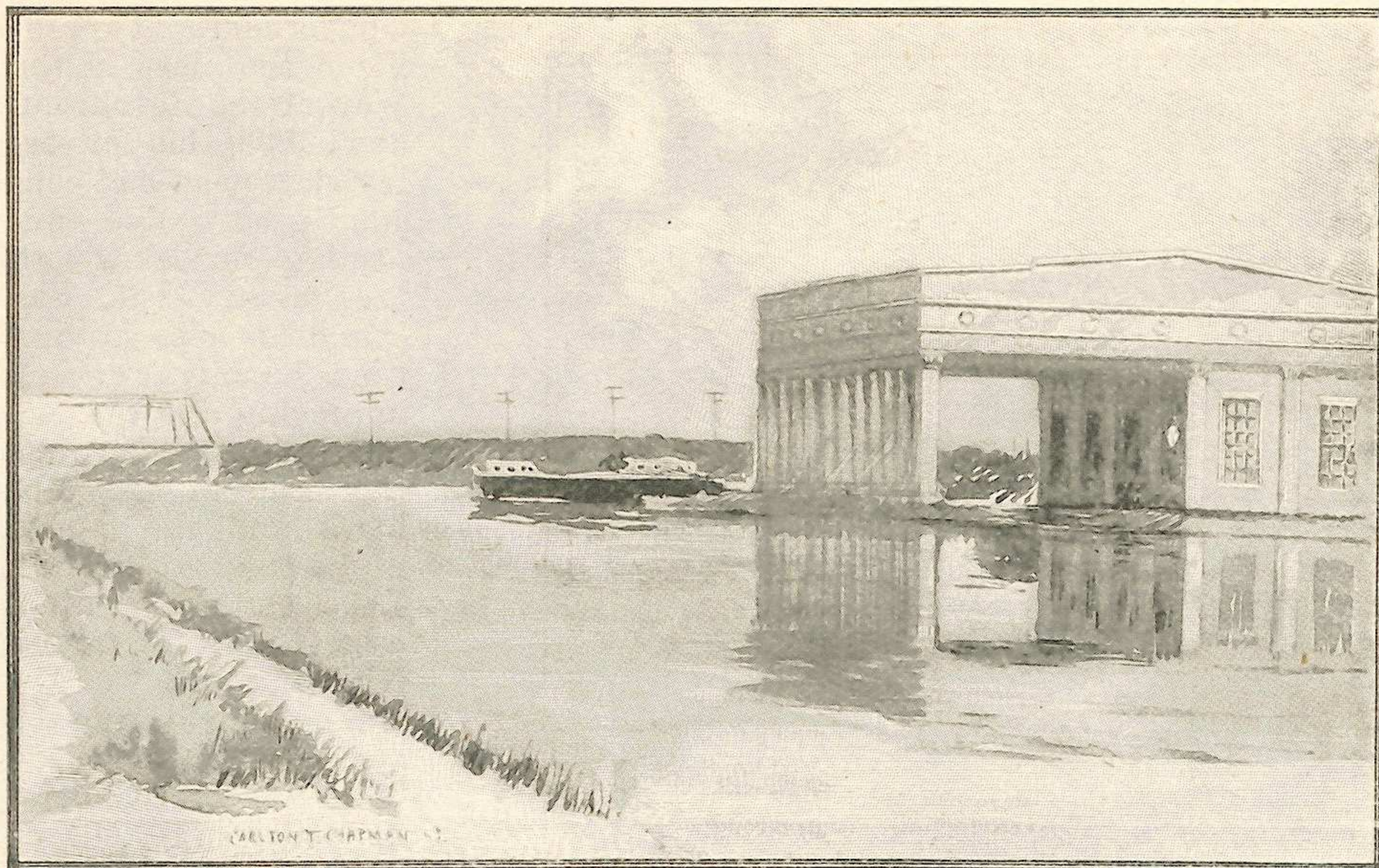


The Canal Office at West Troy.



## WATER-WAYS

### FROM THE OCEAN TO THE LAKES

*By Thomas Curtis Clarke*

**K**ING ALFONSO of Castile contented himself by merely saying, in his royal manner, that if *he* had been consulted, he could have shown God how to make a much better world than this. The men of our day prefer deeds to words.

Africa has been made an island, and it is hoped that South America soon will be. While enthusiasts are talking of making Lake Erie, or the St. Lawrence, flow into the Hudson, the men of Chicago are actually turning Lake Michigan into the Mississippi.

Such schemes appeal strongly to the imagination; and among that sanguine part of mankind which "listens with credulity to the whispers of fancy, and pursues with eagerness the phantoms of hope" are those who dream of piercing every isthmus by ship-canals.

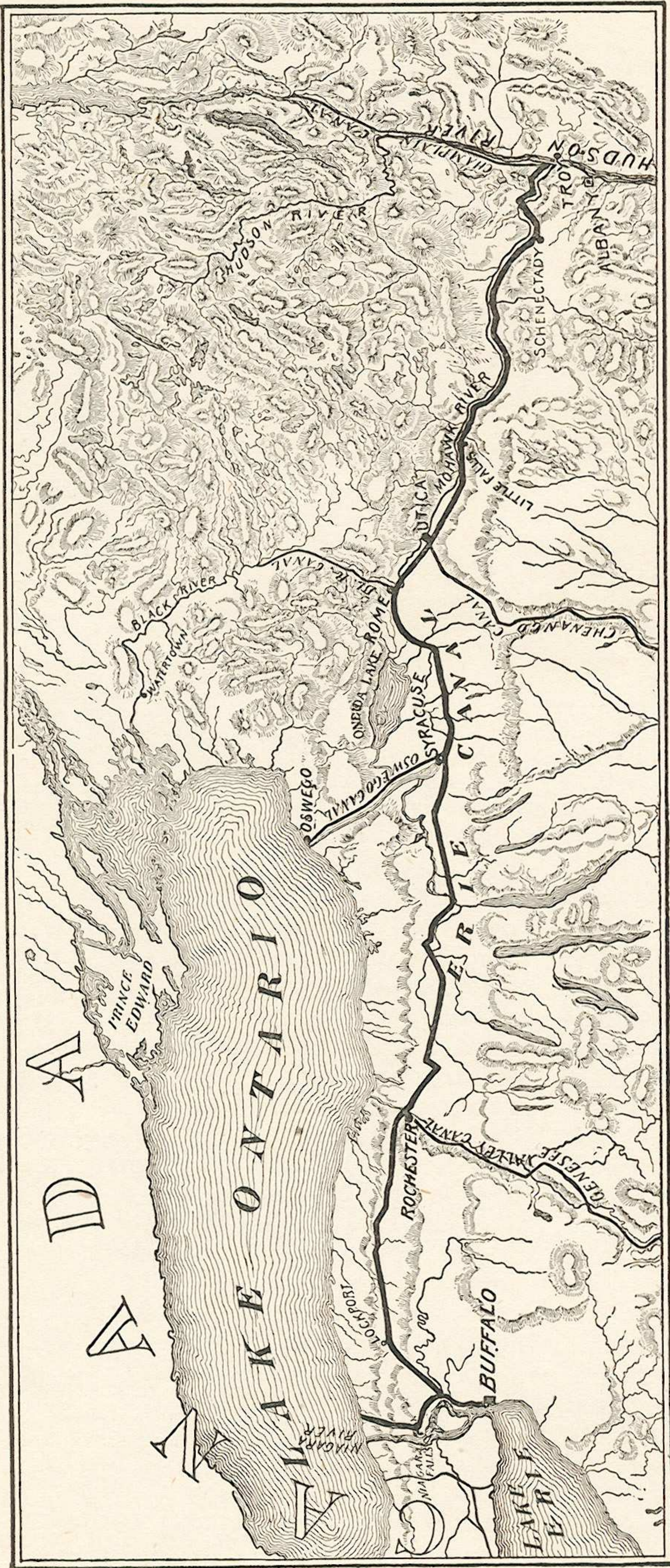
Oriental trade has fascinated the minds of men from the days of Vasco de Gama and Columbus down to the present time. Although the value of

its teas, silks, and other merchandise is great, its tonnage is small, as compared with that of the great lakes of North America.

This is shown by the often quoted comparison between the tonnage passing through the St. Mary's Falls Canal, at the outlet of Lake Superior, and that of the Suez Canal, which is exceeded by the former; although hardly fifty years have passed since Superior was a lonely lake, traversed only by the Indian canoe and the sail-boat of the Mackinac voyageur.

Although everybody appreciates the success of the Erie Canal, few consider what a remarkable piece of engineering it is; leaving, as it does, natural lines of water communication, and creating a purely artificial one.

This grand idea of a canal, directly from Lake Erie to the Hudson, avoiding locking down into Lake Ontario, and back again, seems from the strongest evidence to have been first conceived



A Map of the Country Traversed by the Erie Canal.

Prepared under the supervision of the author, Mr. T. C. Clarke.

by the brilliant mind of Gouverneur Morris. From the close of the War of the Revolution until 1803, this far-seeing statesman had constantly advocated connecting our lakes with the ocean; but, like everybody else at that time, he only proposed improving the old Indian portages between the head of the Mohawk and the mouth of the Oswego River on Lake Ontario; with a second canal around Niagara Falls.

Sometime during the year 1803, Simeon de Witt, Surveyor-General of New York, tells us he spent an evening at a country tavern in the interior of the State with Gouverneur Morris, who unfolded to him his new project of "tapping Lake Erie and leading its waters by an artificial river directly across the country to the Hudson."

The cautious De Witt was rather incredulous, and says he considered this a romantic scheme and characteristic of the man. Next year, however, he mentioned it to Judge Geddes (afterward one of the engineers of the Erie Canal), who was much interested and says: "the idea of saving so much lockage by not descending into Lake Ontario made a lively impression on my mind, by which I was prompted on every occasion to inquire into the practicability of the project."

Among others to whom Judge Geddes

mentioned this plan, was an energetic person named Jesse Hawley. He was so much interested that he went all over the proposed route, and, having satisfied himself of its practicability, wrote many letters in the newspapers to influence public opinion. In one of these letters, printed in the *Ontario Messenger* at Canandaigua, in 1807, he actually describes the route of the Erie Canal, as well as any one could do to-day.

The only difference between it and the real canal is, that both Morris and Hawley proposed to feed the canal entirely from Lake Erie. From motives of economy this was not done, and trouble has always been caused from a want of water on the middle division of the canal, which is fed from local streams.

As we ride in a railway train through the rich valleys of central New York it is plainly to be seen that here is an easy route for a canal. When Mr. Hawley struggled through the mud, there were few roads and bridges, and the country was mostly covered with dense woods. For his efforts he deserves the highest praise.

The glory of the building of the Erie Canal belongs to De Witt Clinton, whose political strength and determined energy enabled him to complete it in spite of all opposition and difficulties. Nothing can rob him of the proud title of "Father of the Erie Canal." The names of Wright and Geddes, the original engineers, and that of Hawley, the volunteer engineer, should not be allowed to pass into oblivion. None of these men were trained as engineers, and they had never built any canals, but their strong practical sense carried them through; they learned as they went along, and their work does them the greatest credit.

The original Erie Canal was but a small ditch, forty feet wide and four feet deep, and only able to pass boats of seventy-six tons. Its original cost when opened in 1825 was a little over seven millions of dollars, or about one-third of the cost of the State Capitol at Albany. Its success was so great that it could not do the business that offered; and from 1846 to 1862 it was enlarged, or rather reconstructed, being widened to seventy feet and deepened to seven. Its locks were enlarged to pass boats of two hundred and fifty tons burden, and doubled, so that boats could pass in both directions without detention.

No public work has ever produced such important results. Besides building up the State and City of New York, and making it what it was before the introduction of our railway system, the actual cost of the Erie Canal in money has been much more than repaid.

The cost of the original Erie Canal was \$7,143,789.86; of the enlarged canal was \$31,834,041.30. The State has expended since 1862 in lengthening locks, maintenance, repairs and other improvements \$33,948,761.37. The estimated cost of deepening the canal to nine feet is \$9,000,000 (voted for by the people on November 5, 1895), thus making a total cost of \$72,926,591.73. The total amount received for tolls on the Erie Canal from its opening to the close of 1882, when tolls ceased, was \$120,684,587.35, showing a surplus in its favor of \$47,757,995.62.\*

Meantime, however, our system of railways had been constructed. At first the amount of freight carried by them was small in comparison with that which

\* The above figures are from official sources, having been kindly furnished by the Comptroller of the State of New York in response to inquiry for purposes of this article, and not before published.



De Witt Clinton.

(From the portrait in Colden's Memorial on the Completion of the Canal.)



Benjamin Wright.



James Geddes.

The Two Original Engineers of the Erie Canal.

*From Stuart's "Civil and Military Engineers of America."*

went by canal. While modern inventions have been constantly applied on the railways, the means of transport on the canal stood still for many years.

In 1851 the State engineer of New York stated in his annual report that it would take six double track railways to do the business of the Erie Canal. At that time ten tons, or three hundred and thirty bushels of wheat was a standard car-load, and ten or twelve cars a train-load. Owing to the easy grades of the New York Central, one locomotive could draw twenty cars, carrying about six thousand bushels of grain. Directly alongside, one canal boat, drawn by two sorry mules, carried as large a load.

The great invention of steel rails by Sir Henry Bessemer allowed the use of heavier and more powerful locomotives; and now you may see on the railway beside the canal, one engine drawing forty to fifty cars, and carrying forty to fifty thousand bushels as a train-load.

Conditions have now been reversed; and it would require at least ten canals equipped with the old horse-boats to move the freight tonnage of the New

York Central, West Shore, and Erie railways, which in 1893-94 was 45,442,000 tons as against 4,275,662 tons by canal. This larger amount of freight is carried by rail, notwithstanding the cost by all rail from Chicago to New York is often more than double that by lakes and canal. The railway cars move five times as fast as the canal boats, and work twelve months, against seven months of open navigation. This enables merchants to take a quick advantage of the markets at all seasons.

The same thing holds good all over the United States. Mr. T. J. Vivian, Statistician of the United States Census of 1890, states the total movement of freight by vessels, steamers, and barges, as

	Tons.
Great Lakes . . . . .	53,424,432
Mississippi and tributaries . . . . .	29,405,046
Atlantic and Pacific Coasts . . . . .	80,817,251
All canals . . . . .	20,747,932
Total . . . . .	185,394,661

Poor's Manual reports for the same year a total movement of freight by rail of 620,000,000 tons.



Cornelius Vanderbilt.

(To whose introduction of extra tracks on the New York Central was due the decline of freight rates between 1870 and 1875.)

*From the steel engraving on the Railroad Stock Certificates, by permission of the New York Central & Hudson River Railroad.*

Notwithstanding the less tonnage of the canals they have been great regulators of rates. The cost of conveyance of a bushel of wheat (or of flour reduced to bushels) between Chicago and New York has fallen from  $12\frac{7}{10}$  cents by lake and canal in 1857 to six to seven cents in 1893; and by all rail from  $38\frac{6}{10}$  cents in 1857 to  $14\frac{6}{10}$  cents in 1893, and the end is not yet.

The amount saved in transportation of grain alone through the State of New York by the Erie Canal during the last thirty years is at least two hundred millions of dollars.

There is no higher authority on railway transportation than Mr. Albert Fink, and he is reported to have said that the trunk lines could well afford to

keep the Erie Canal open at their own expense as a regulator of freight rates, if it could not be done in any other way. We shall see however that there is no danger of the Erie Canal being closed; and that all it wants is the application of modern methods of transportation to bring it back to its old standard.

After the completion of the enlargement in 1862 single boats of two hundred and forty tons burden, drawn by horses or mules, were used. In 1877 a plan was adopted of coupling two boats together, called "double headers," which required no increase of men and but two more horses. This reduced the cost of transport by doubling the cargo.

In 1874 steam-towing was introduced, being encouraged by the offer of a premium of \$100,000 by the State, which was paid to the successful boat. A steam tow-boat now draws generally three consorts, besides carrying some cargo herself. This increases the cargo to over nine hundred and thirty tons, and has further reduced rates, so that the owners of the horse-boats find it difficult to make a living, and reserve enough money for depreciation and repairs.

An experiment was lately tried which may give them relief—that of electric towing. A cable suspended from poles on the bank carried a trolley, supplied with current from a second wire, and controlled from the boat, which is

- Diagram showing*
1. Tonnage Erie Canal 1855 to 1894
  2. " Welland " " "
  3. New York Trunk Railways " "
  4. Freight rates by lake & canal, Chicago to N.Y. 1855 to 1894
  5. " " by R.R. " " " "

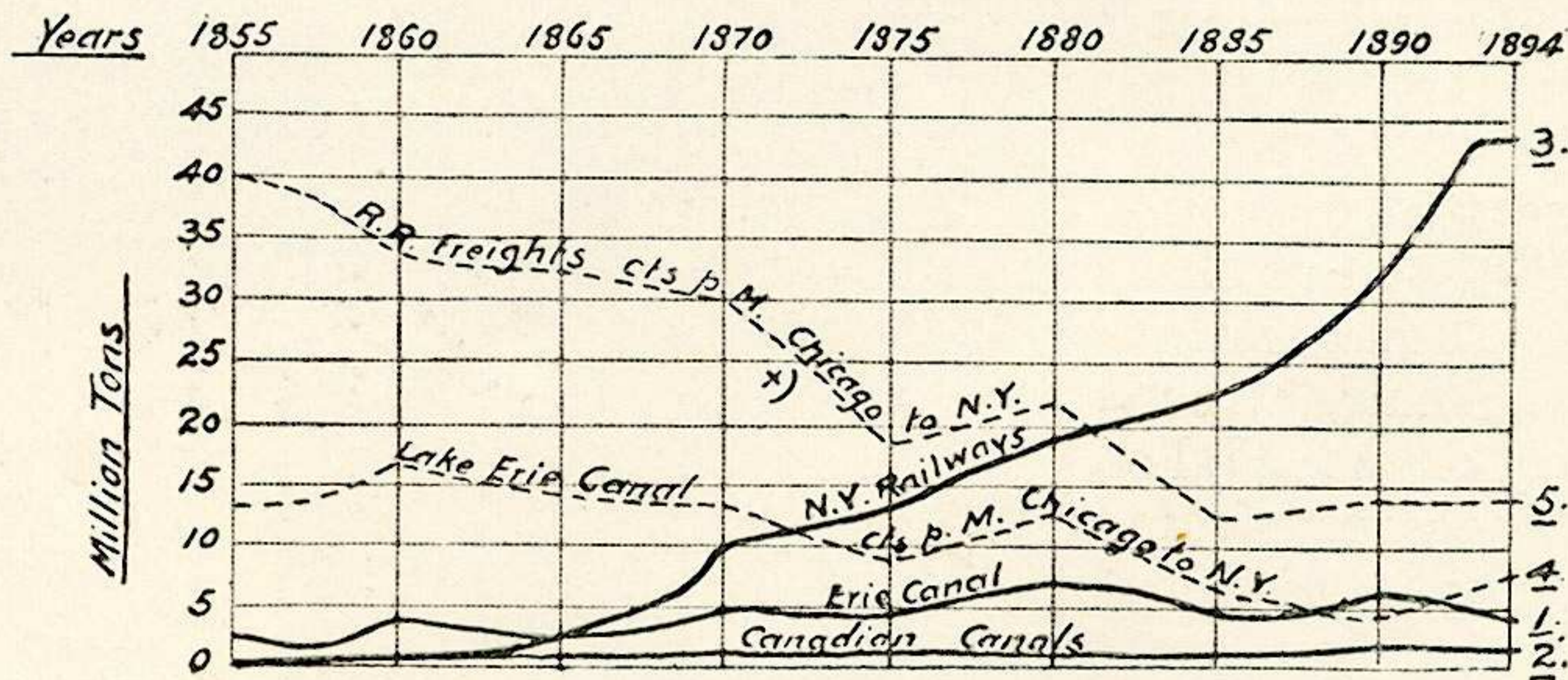


Diagram of Traffic Curves.

(The sharp decline in railway rates (5) between 1870 and 1875 was due to the increased economy resulting from the introduction of the third and fourth tracks on the New York Central by Commodore Vanderbilt.)

hitched to the trolley, and is drawn through the canal, and into the locks. It is hoped that this can be done quicker, and at less cost than by animals. If this electric current can be taken from the dynamos of Niagara Falls, that cataract, after having been so long an obstruction to navigation, will by human ingenuity be forced to help it.

An experiment, so far successful, has lately been tried, which promises very important results. Fleets of steel barges, of a size that will go through the present Erie Canal, and made strong enough to be towed on the lake, are running between Cleveland and New York. There has been no difficulty in getting insurance upon them. The great trouble now is want of depth of water, and when the Erie Canal has been deepened to nine feet, and its few remaining short locks have been doubled in length, the size and strength of such barges can be increased and their decks can be made like those of whale-back boats, so that it will be possible to get insurance over the whole length of the lakes from Buffalo to Chicago and Duluth.

The present cost of transportation of a bushel of wheat from Chicago to New York is about four and three-quarter cents. This includes the cost of elevating grain from steamers at Buffalo, spouting it into canal boats, and trimming cargo. This amounts to over a cent a bushel, or more than one-fifth of the whole cost of carrying it 1,363 miles. To save this heavy tax upon commerce, there has been a loud cry for ship-canal, which would enable steamers to go from the upper lakes to New York, without breaking bulk, and do away with the cost of transshipment.

Considering the very low rate at which freight is now carried on the lakes in vessels of fifteen to sixteen feet draft, it has been supposed that if this navigation could be extended to the ocean, great economy would result. A large lake steamer is a very expensive machine and carries freight economically on account of her considerable speed when in motion, the full cargoes which she gets both ways, and from the short time she is delayed in the few ports where she gets her full cargoes. These conditions would be reversed if she went 350 miles through a canal. She could not move fast. She would be detained by the many locks, and in order to get cargoes she would have to make more stops, and be detained longer in port.

It can be demonstrated by figures that large vessels in a ship-canal, even if free of tolls, cannot compete with fleets of barges also running without transshipment. Before this is shown, it will be well to examine the general questions of the best water-route from the lakes to the ocean.

The first proposition is that New York is the only economical terminal port. The experience of the Canadian canals shows this. They were begun about the same time as the Erie Canal and have been gradually enlarged until they can pass vessels of four times the



The First American Canal-boat, The Chief Engineer, which made the Trip from Rome to Utica, October 22, 1819.

(Built at Rome from a design by Canvass White, and named in honor of Benjamin Wright, the chief engineer of the Erie Canal.)

capacity that can go through the Erie. The distance from Chicago to New York by the Erie Canal and the lakes is 1,363 miles, of which 350 miles is artificial navigation. The distance from Chicago to Montreal is 1,273 miles, of which but seventy is artificial navigation. Owing to these advantages grain was carried from Chicago to Montreal in 1893, for an average rate per bushel of  $5\frac{3}{8}$  cents, while the average rate from Chicago to New York by lakes and canal, during the same year, was  $6\frac{1}{4}$  cents per bushel, and as we have shown the all-rail charge was  $14\frac{6}{10}$  cents.

Notwithstanding the higher cost of the New York route, the tonnage of the Erie Canal in 1893 was 4,275,662 tons, and of the three New York trunk lines of railway over forty-five millions of tons, while the tonnage of the Canadian Welland Canal was only 1,294,823 tons, of which but 663,156 tons went to Montreal, while the rest crossed Lake Ontario and went to New York.

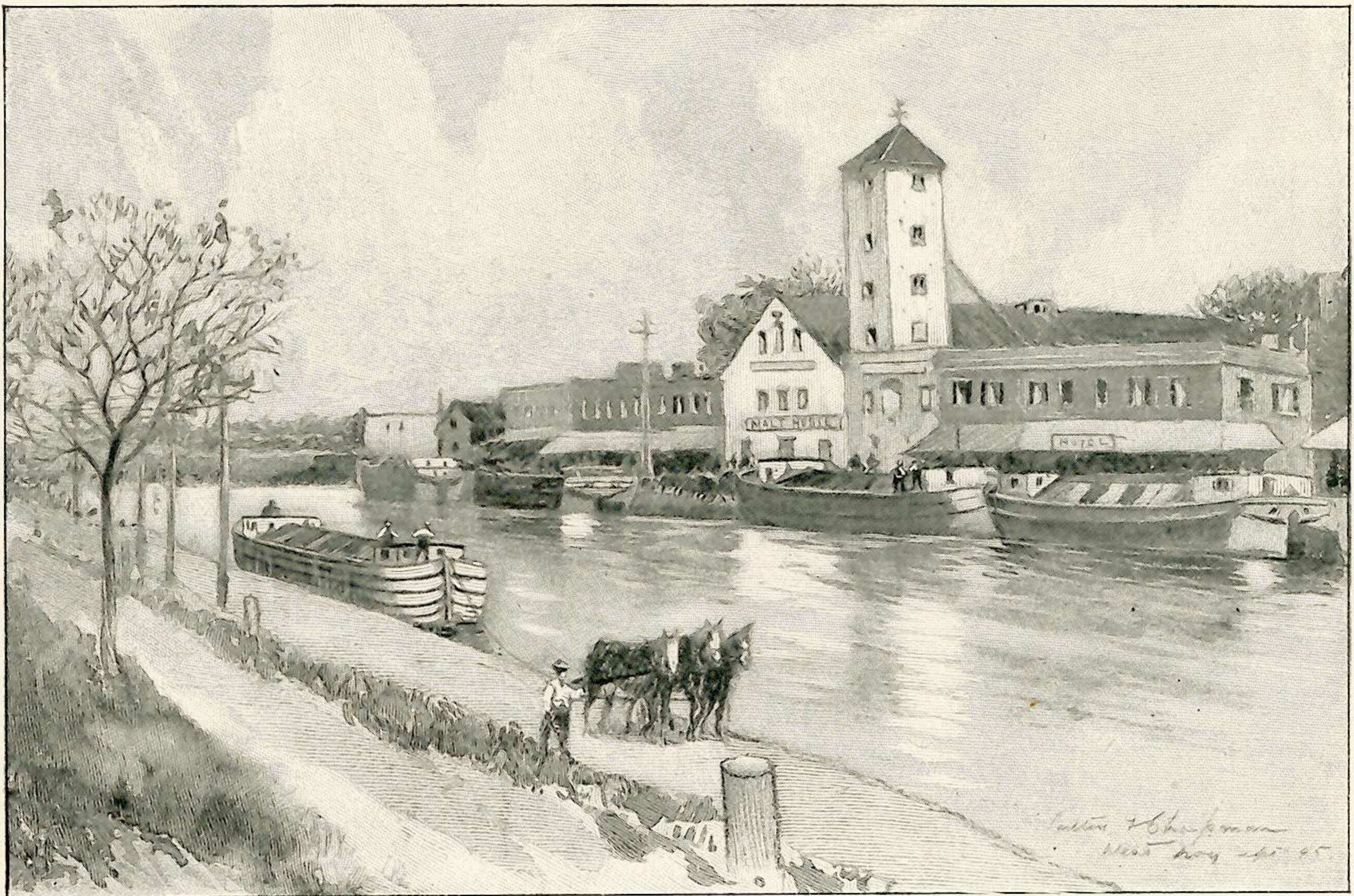
The reason why so much more freight goes to and from New York rather than by the cheaper route to and from Montreal, is because the great part is intended for domestic use and not for ex-

port, and New York is a better market than Montreal.

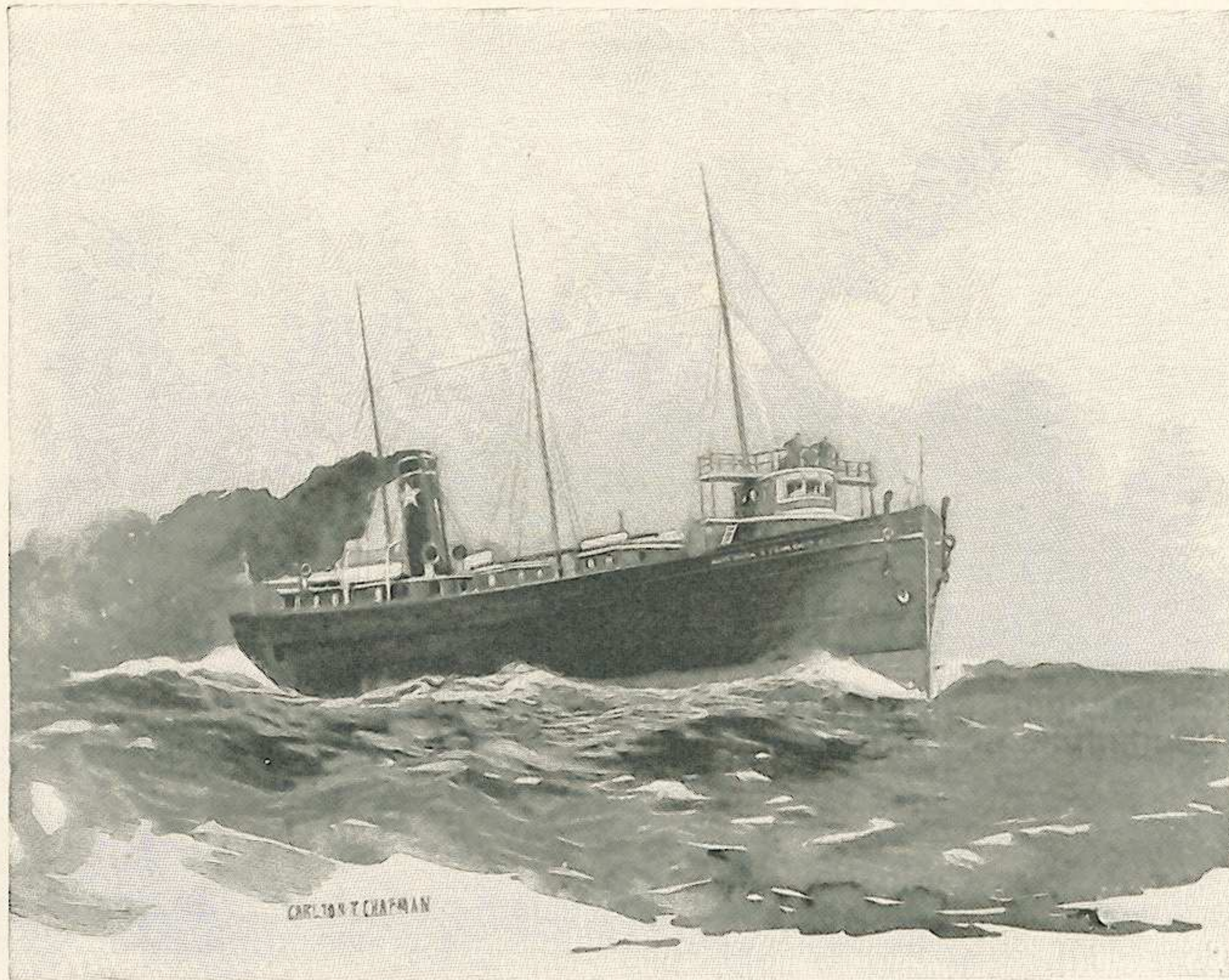
The second proposition has been well expressed by Mr. Cooley, the engineer of the Chicago drainage canal — that “the line of export must follow the line of domestic transportation.” That is to say, that in order to carry grain at least cost from the lakes to the ocean, it is necessary to follow a route that will give as large cargoes as possible. Hence the route must pass through Lake Erie, and by the rich and growing cities of Detroit, Cleveland, and Buffalo, and those along the Erie Canal.

This rules out the Canadian routes, such as the Toronto and Georgian Bay, and the Ottawa canals, and also the proposed conversion of the Champlain Canal to a ship-canal. Whatever merit they may have from an engineering standpoint is entirely overbalanced by the fact that they run through a district which can furnish but very little freight in either direction.

We have said that fleets of barges, able to run on the lakes and the canal, without transshipment, can beat large lake steamers on a ship-canal, and it can be proved by figures. The yearly ex-



A View of the Erie Canal at West Troy.



A Typical Lake Freight Steamer.

penses of one of the largest class of lake steamers, including interest at ten per cent. on the cost of the ship, is about one hundred and twenty thousand dollars. Running at a speed of 13 miles an hour in the lakes, and at 7 miles an hour through a ship-canal in the State of New York, and allowing for detention at locks and 13 days in port, she could make her round trip between Chicago and New York and return in 26 days, or 8 trips per season. One-eighth of \$120,000 is \$15,000, and we will assume that half of it is earned by carrying grain East, and half from miscellaneous freight going West. Her full capacity at 20 feet draft would be 7,000 tons, or 233,500 bushels of grain, and the rate would have to be  $3\frac{22}{100}$  cents per bushel to earn \$7,500.

The lake ports would have to be deepened to 21 feet, and the canal would have to be at least 25 feet deep to allow her to move 7 miles an hour. The cost of such a ship-canal would not be less than two hundred millions of dollars.

If the Erie Canal were deepened to 9 feet, and its few remaining short locks doubled in length, a fleet of four steel barges, 180 feet long,  $17\frac{1}{2}$  feet wide, and loaded to  $7\frac{1}{2}$  feet draft, could carry 80,000 bushels of grain. They

could move 6 miles an hour on the lakes and on the Hudson River, and 4 miles an hour on the canals, and adding the time of detention at locks and 13 days in port, they could make their round trip from Chicago to New York and back in 36 days, or 6 trips per season. The yearly expenses would be \$24,000, also including interest on the cost of the fleet, or \$4,000 per trip. To earn half of that, or \$2,000, from her cargo of grain, her rate would be  $2\frac{1}{2}$  cents per bushel, or

nearly three-fourths of a cent less than by ship-canal.

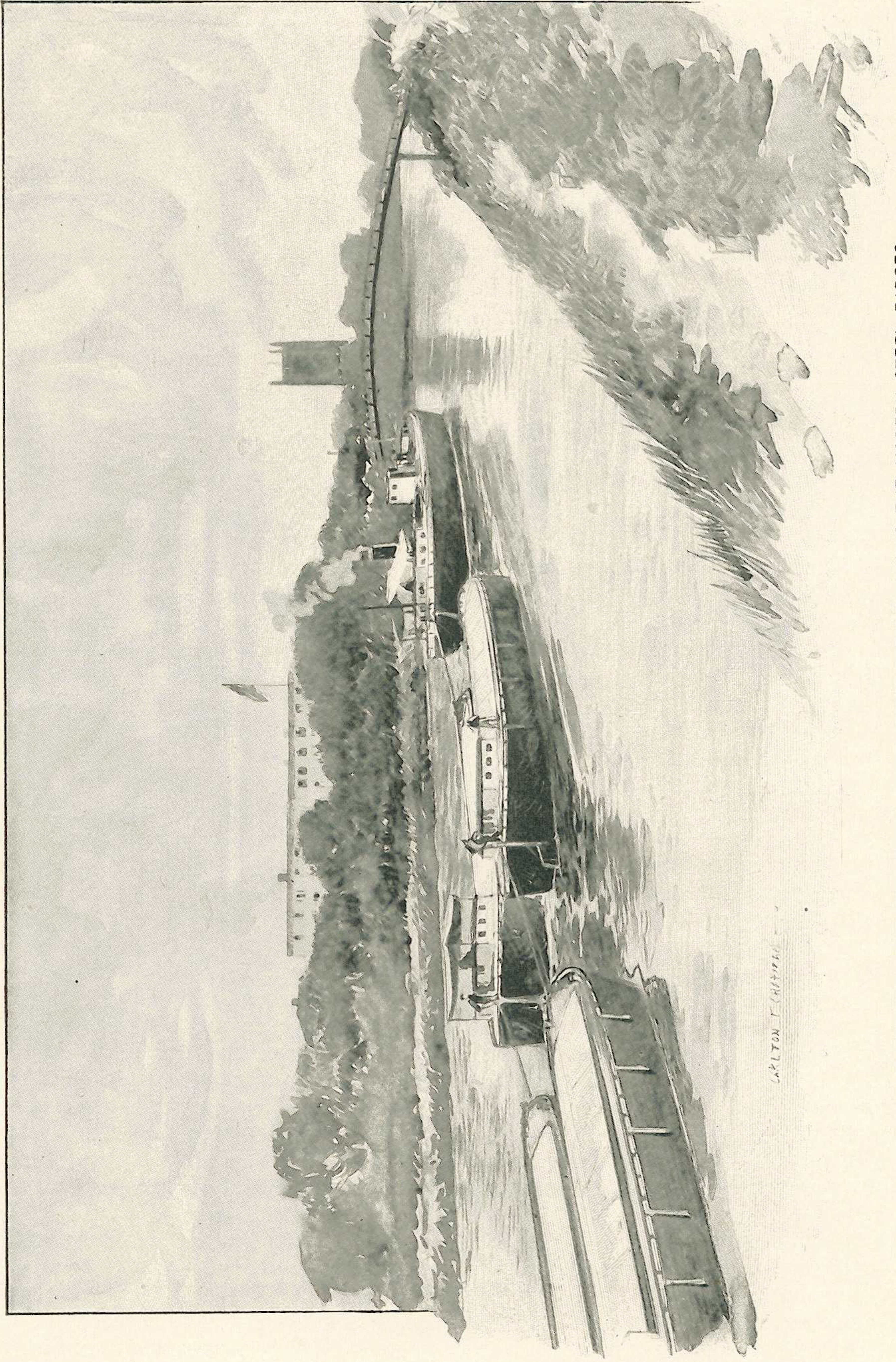
The total cost of deepening the Erie and Oswego Canals to 9 feet, and the Champlain to 7, is estimated at \$9,000,000. If these calculations are true—and their correctness depends only upon whether insurance can be got upon barges that can run on canal and lakes—they lead to some very far-reaching results.

First: It is not necessary to expend two hundred millions or more to build a ship-canal along the line of the Erie Canal. It would be wise to build a ship-canal around Niagara Falls on our own territory, to allow lake vessels to reach the Lake Ontario ports, from which freight could be transshipped by canal and rail. The cost of this has been estimated, from careful surveys of the United States Engineers, at from twenty-five to thirty millions, according to depth.

Second: Chicago would gain everything she wants if her drainage canal was only ten or twelve feet deep. Barges could then go to New Orleans without spending great sums in trying to deepen the Mississippi beyond ten or twelve feet. They could go to New York, with only the small cost of deepening the Erie Canal.

Third: It would be possible to build





A VIEW OF THE ERIE CANAL, NEAR WEST TROY, SHOWING THE MODERN STEEL BARGES.

a barge canal of these dimensions from Lake Erie to the Ohio, while a ship-canal is visionary. There are other places where similar canals could be built, such as along our Atlantic coast.

It should be observed that all these

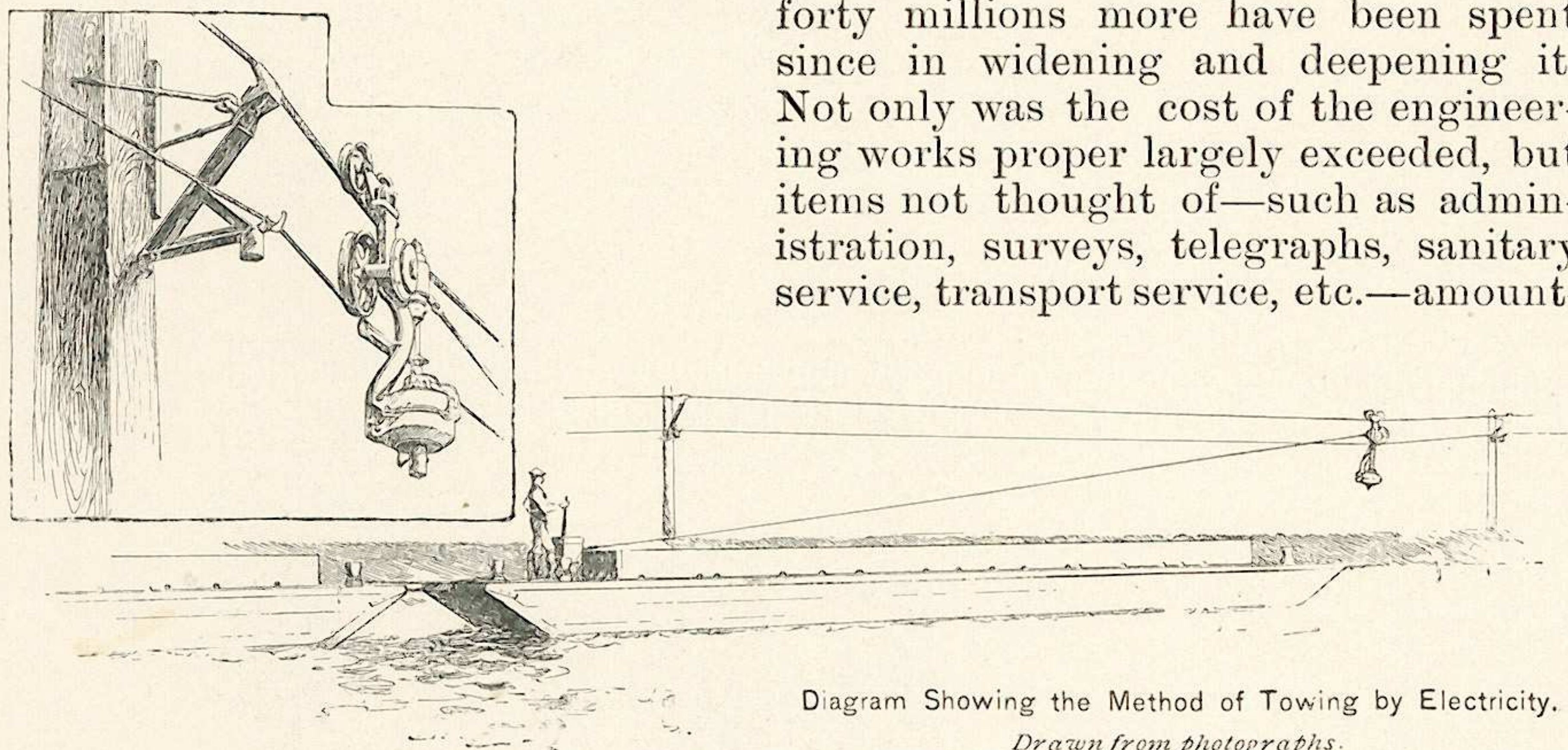


Diagram Showing the Method of Towing by Electricity.

*Drawn from photographs.*

internal water-ways will do our railway system no harm. Anything that vastly increases commerce during seven or eight months of the year, must be advantageous to railroads who can monopolize it during the rest of the year.

We have considered the question of domestic canals only, as the amount of exports, now not exceeding one-fifth of the whole amount transported, would not justify the cost of a ship-canal to give unbroken navigation from the lakes to the ocean.

When the time comes that such a canal must be built, there is but one place where it can be built for any reasonable expenditure, and that is along the St. Lawrence River from Montreal to Lake Ontario, that lake being connected with Erie by a ship-canal around Niagara Falls. We shall then have to face the difficulties of its running through a foreign country as best we can.

If the United States Government now had millions of surplus revenue, such as she once had, and which we hope she will have again at no late date, it would not be a great extravagance to build the canals we have described, and the canal at Nicaragua also. But in the present condition, it would be well be-

fore committing ourselves to the Isthmian or any other ship-canal scheme to look back and see what has been the past history of ship-canal.

The estimated cost of the Suez Canal was \$40,000,000. Its cost when opened for traffic was \$92,000,000, and nearly forty millions more have been spent since in widening and deepening it. Not only was the cost of the engineering works proper largely exceeded, but items not thought of—such as administration, surveys, telegraphs, sanitary service, transport service, etc.—amount-

ed to forty per cent. of the original estimates, or \$26,000,000. It pays so well that these mistakes have been forgotten, and the Semitic shrewdness of Beaconsfield, in acquiring the Khedive's shares for England, has been fully justified.

The insufficient estimates of the Suez Canal did not warn the enthusiastic De Lesseps when he provided capital for his Panama Canal. His engineering commission estimated its cost at \$153,400,000, which he cut down to \$128,000,000, at the meeting of the American Society of Civil Engineers in 1879, saying, in his airy way, that he was a diplomate and not an engineer.

We all have heard of the melancholy result. After eight years of work, one hundred and seventy-eight millions of dollars had been spent, to raise which three hundred and fifty millions of capitalization and obligations had been incurred. The difficult part of the work, the great Culebra cutting, had only been scratched—and nothing done toward controlling the Chagres River—while the money had nearly all been spent. The younger De Lesseps and others were fined and imprisoned, and the old man, bankrupt in fame and fortune, was spared the humiliation of

further punishment only on account of his great age and past services.

Englishmen are considered more practical than the French and less likely to be led away by sentiment, and Manchester men are not less shrewd than other Englishmen. They started to build a ship-canal to turn Manchester into a seaport. It was but twenty-seven miles long and had only four locks.

The estimated cost, including the purchase of the existing Bridgewater Canal, was fifty million dollars, and the cost when opened for traffic was seventy-seven millions. This vast increase is stated to have been due "chiefly to items which were unexpected and unprovided for." The canal is not finished yet and the city of Manchester, which has provided the greater part of the capital, will have to provide the rest.

With three such portentous warnings before the financial world, it is not strange that capital declines to invest in any more ship-canal, but calls upon Uncle Sam to put his hand in his pocket and build them for general benefit — as a military necessity — or any other reason that may seem to justify the expenditure.

As to the Nicaragua Canal, it would certainly be gratifying to national pride to have Americans succeed where the French have made such a disastrous failure. Without discussing the questions of commercial or military necessity three things are worth considering :

First : That if the United States builds this canal, they should own the territory through which it passes, by

purchase outright from Nicaragua. Perhaps here is a use for some of the silver that is hoarded in our treasury.

Second : That there should be no underestimating the cost. All the various contingent items, so foolishly overlooked in the instances quoted, should be liberally provided for.

Lastly : The United States should make it a free canal, with no tolls except sufficient for maintenance, and open to all nations both in peace and in war. This should be her gift to the world.

Looked at in this generous way, we need not consider the question of the number of vessels that would pass through it, or the tolls that they could pay. We do say that the amount of commerce that passes the Suez Canal, and would pass the Nicaragua Canal, is insignificant in proportion to the domestic commerce of the lakes.

The amount of freight passing through the Detroit River last year is more than double that which would pass both Isthmian canals, and it is increasing much faster than that would do.

The wealth of the Orient appeals to the imagination ; but the more prosaic products of our own land—the grain, the lumber, the ores, the coal, and the myriads of manufactured articles which float down the Great Lakes, and through the rich valleys of central New York,\* far exceed in importance and in value

The wealth of Ormus and of Ind,  
Or where the gorgeous East with richest hand  
Showers on her kings barbaric pearl and gold.

\* The writer believes that the recent vote of the people of New York to deepen the canals is nearly as important a decision as the original vote to construct them.

