CIHM
Microfiche
Series
(Monographs)

ICMH
Collection de
microfiches
(monographies)

Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques

Technical and Bibliographic Notes / Notes techniques et bibliographiques

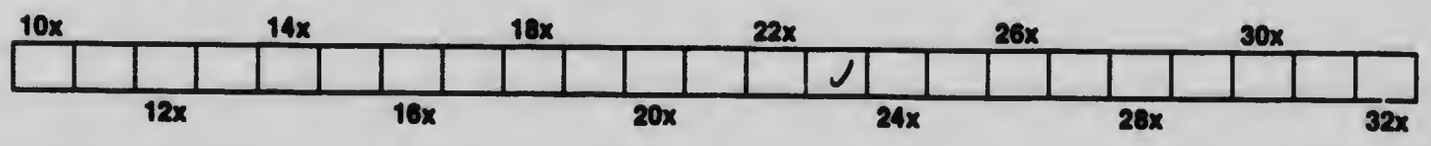
The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming are checked below.

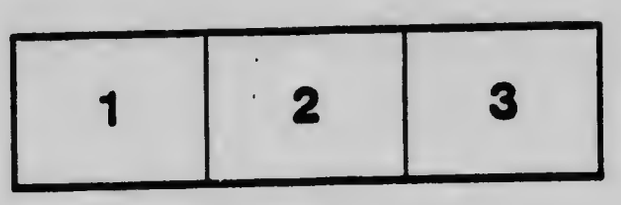
- [x] Coloured covers / Couverture de couleur
- [ ] Covers damaged / Couverture endommagée
- [ ] Covers restored and/or laminated / Couverture restaurée et/ou pelliculée
- [ ] Cover title missing / Le titre de couverture manque
- [ ] Coloured maps / Cartes géographiques en couleur
- [ ] Coloured ink (i.e. other than blue or black) / Encre de couleur (i.e. autre que bleue ou noire)
- [ ] Coloured plates and/or illustrations / Planches et/ou illustrations en couleur
- [ ] Bound with other material / Relié avec d'autres documents
- [ ] Only edition available / Seule édition disponible
- [ ] Tight binding may cause shadows or distortion along interior margin / La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure.
- [ ] Blank leaves added during restorations may appear within the text. Whenever possible, these have been omitted from filming / Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- [ ] Additional comments / Commentaires supplémentaires:

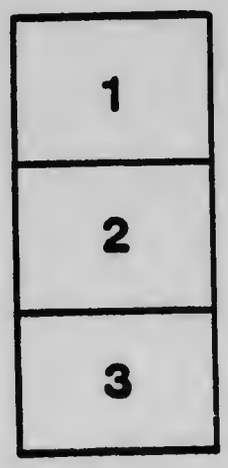
L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

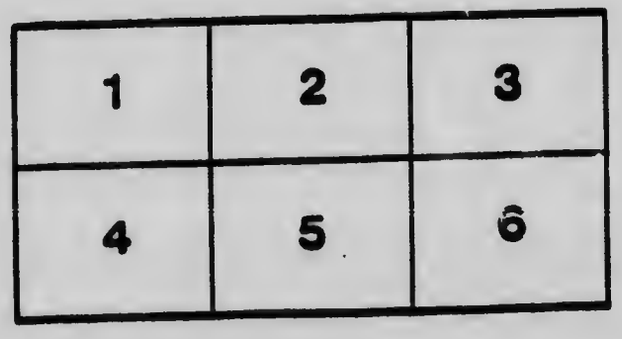
- [ ] Coloured pages / Pages de couleur
- [ ] Pages damaged / Pages endommagées
- [ ] Pages restored and/or laminated / Pages restaurées et/ou pelliculées
- [x] Pages discoloured, stained or foxed / Pages décolorées, tachetées ou piquées
- [ ] Pages detached / Pages détachées
- [x] Showthrough / Transparence
- [ ] Quality of print varies / Qualité inégale de l'impression
- [ ] Includes supplementary material / Comprend du matériel supplémentaire
- [ ] Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image / Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.
- [ ] Opposing pages with varying colouration or discolourations are filmed twice to ensure the best possible image / Les pages s'opposant ayant des colorations variables ou des décolorations sont filmées deux fois afin d'obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below / Ce document est filmé au taux de réduction indiqué ci-dessous.



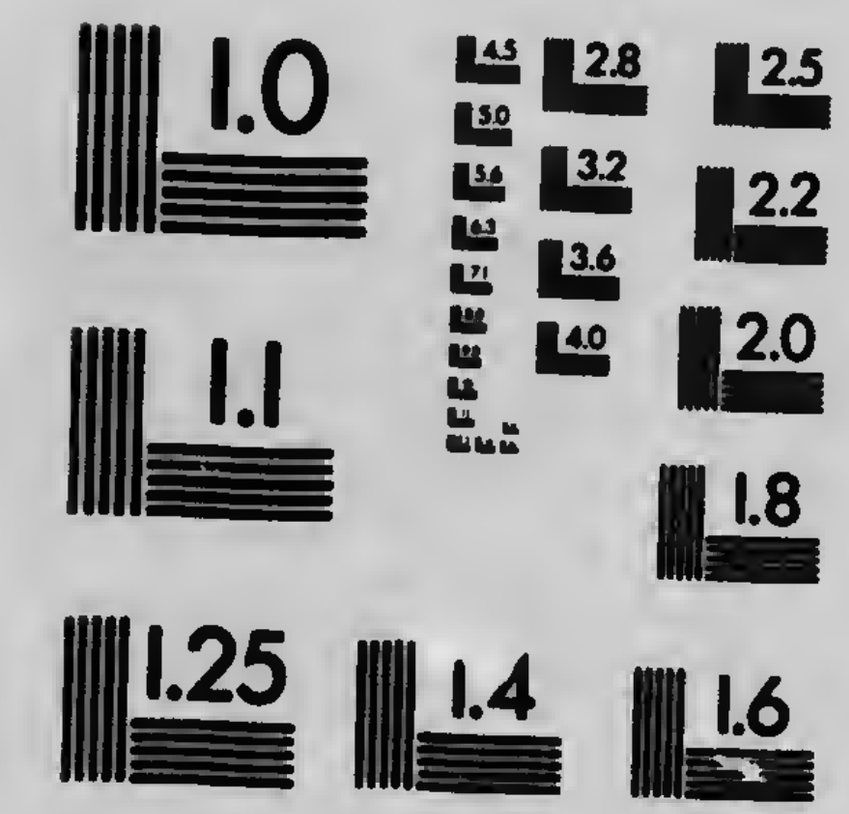






MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



APPLIED IMAGE Inc
1653 East Main Street
Rochester, New York 14609 USA
(716) 482 - 0300 - Phone
(716) 288 - 5989 - Fax

The Canadian Isthmus

... AND ...

The Broad, Deep Waterway

THE CANADIAN ISTHMUS

.... AND ....

THE BROAD, DEEP-WATERWAY

CONTENTS.

INTRODUCTION.

There is very much said and written about the amazing possibilities of growth of population and of production in the Canadian northwest; but comparatively little is said, or done, about the necessity of providing transportation facilities between the western and the central provinces. One thing however, is quite certain—unless there is freedom and variety of movement between central and western Canada, the healthy and natural development of each must be retarded. Such facilities must keep pace with growth, or growth will be hindered.

In the following pages, some of the topics that suggest themselves to a thoughtful observer are presented for consideration.

The question of connecting the upper lakes with Lake Ontario and the upper St. Lawrence has often been presented, during the past fifty years, but nobody has found a satisfactory answer until now.

The great advances which have been made in modern steel construction have made it possible to move ships quickly, safely and economically between the widely varying levels of the two water systems, while the new methods of excavation have also made it possible to lessen the cost of removing the immense heaps of earth which separate them.

It is not practicable, however, to open the most favorable route for communication (that via the Nottawasaga valley) without the aid of facilities which would be created by the opening of the more eastern (or Simcoe) route; hence the two routes are combined in the illustrations herewith presented. The western, or Nottawasaga route, will have only one or two lifts with which to overcome the 335 feet variation of level; while the eastern, or Simcoe route, must have three lifts, with 597 feet variation of level.

With these preliminary remarks, the reader is invited to a study of the subjects presented in the following pages.

QUESTIONS FOR DISCUSSION.

Whether it would not be better that the works, to be constructed between Lake Simcoe and Georgian Bay, be such as would carry all classes of traffic, than to confine them to the purposes of a bargeway?

Whether it would be practicable and economical to excavate and remove the sand and gravel in the Oak Ridges by hydraulic methods?

Whether the Spalding method of lifting or lowering ships, between very high and very low water levels, would not be more economical, both in construction and operation, than the Leonardo locks, now in general use?

Whether the shortening of the waterway, and the tripling the tonnage of ship's capacity, between the upper lakes and Lake Ontario, would be beneficial to the industries of Canadian ports upon Lake Ontario and the upper St. Lawrence and to Canadian commerce?

The proposed navigable ship-way from Georgian Bay via the Ottawa River to Montreal is 430 miles long, being the longest artificial water route in the world. Much of it will have narrow, shallow, or crooked channels.

The total rise and fall thereon will not be less than 712 feet—requiring about thirty-five locks.

The average rate of speed through it, including detentions of all sorts, for ships carrying 7500 tons of cargo, would be about four miles an hour—taking 4½ days for the trip.

The Canada Atlantic Railway from Parry Sound to Montreal is fifty miles shorter and can move cargoes in three days less time.

QUESTION. Can such a shipway compete with this railway?

WHICH IS THE BEST WATER ROUTE TO THE SEABOARD?

The above question may best be answered by asking another.

If there were a route upon which the largest ships might cross directly from the southern part of Georgian Bay to the western part of Lake Ontario quickly and safely, would any other water route be worth considering, as a possible competitor for the through transit of freight?

Every fair-minded man will concede that big ships will move with greater speed upon broad and deep waters than they will in narrow, shallow or crooked channels.

Therefore routes that have only short reaches of canals, and have the least hindrances in the shape of locks, are the most favorable for inland commerce.

An attentive study of the route via the Welland Canal shows three defects.

FIRST: Its length.

SECOND: The shallows at the St. Clair flats and at the Lime Kiln crossing.

THIRD: The small size and the great number of locks in the canal itself.

The distance is about as follows:

From Port Arthur to Prescott	1,111 miles
Prescott to Montreal	119 "
Total	1,230 "

Compare this with the short cut via Georgian Bay, where the distance is:

To Prescott	[illegible] miles
To Montreal	[illegible] 9 "
Total	921 "
Saving	309 "

In the nature of hindrances, we find:

FIRST: The slow time on the St. Clair flats, and the shallows and other dangers of the Lime Kiln crossing.

SECOND: Loss of time in Welland Canal locks. This loss, added to longer distance and the other hindrances, is fully equal to two days, as compared with the shorter route, above mentioned. This time should be saved.

Clearly, there is no sense in thus wasting time; it adds to the cost of movement of traffic, even if the locks were large enough, which they are not.

Any new works should be so made that the largest ships can pass through; because they can be operated at a less cost per ton-mile than small ships. The business is of such character that big ships can always find full cargoes. There is no excuse, on that score, for the building of the small ones.

Compare the route via the Ottawa River with one connecting deep and broad waters by short reaches of canals.

The Ottawa route involves between 400 and 500 miles of narrow, shallow and crooked waterways. This being the case, ships would never pass through it as a commercial business. It must have between 700 and 800 feet of rise and fall in locks. This means almost twice as many locks as there are on the Welland Canal.

The slow speed with which big ships could safely proceed in such a waterway, and the numerous locks to be encountered, make it quite likely that the time of an average trip through it would not be less than seven days between Thunder Bay and Montreal.

By the short cut, between Georgian Bay and Lake Ontario, the entire distance between Port Arthur and Montreal should be traversed in less than five days, when proper improvements shall have been made connecting the upper with the lower St. Lawrence.

The rates of freights from Thunder Bay to Montreal should not then be more than fifty cents per ton.

The objection that applies to making a ship canal in the State of New York, between Lake Erie and the Hudson River, would have still greater force when applied to the Ottawa route.

It has been said, and never successfully controverted, that if the Erie were to be made a ship canal, no ship would ever pass through it, as a commercial proposition.

As the Ottawa route would be about 100 miles longer than the Erie, ships would be still less likely to use it.

If it is going to cost $101,000,000 to make a barge canal for 1,000-ton boats out of the Erie, where more than half the distance will be in natural channels, it could not cost less than $150,000,000 to convert the Ottawa route into a bargeway of equal capacity, and to make it large enough for the big lake ships, it would cost fully $250,000,000.

As to the Trent Valley proposition, there is little to say. It will suit the purpose of local traffic, and will, to a certain extent, serve as a regulator of rates of freights in its neighborhood; but it is too long and crooked, and there must be too many locks along its route, to make it available for ships.

If, however, a connection is to be made from Lake Simcoe to Georgian Bay, it should be so built as to enable large ships to come up into Lake Simcoe, and thus serve a double purpose.

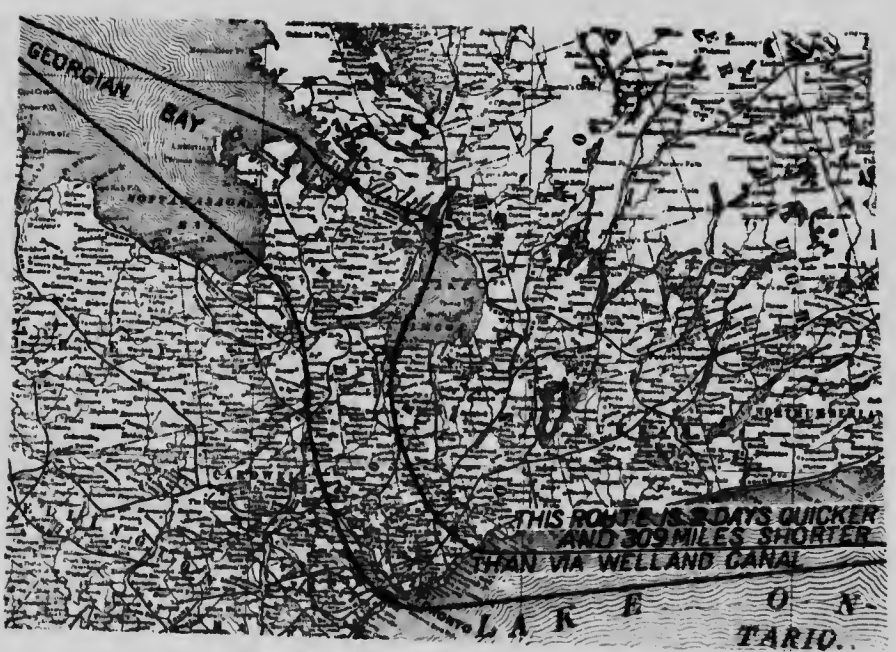
One very short portage, operated by water power, would suffice to raise (or lower) ships between the Huron and Simcoe Lake levels. By thus forming a link in the short cut to Lake Ontario, both purposes would be served. Barges would then be saved the trouble and expense of descending to Georgian Bay and returning therefrom, because ships could be loaded or unloaded upon Lake Simcoe, at the place where the Trent Valley line would meet that lake.

Any grant of aid, from the Dominion, to the greater waterway could be conditioned upon the completion and successful operation of this piece of work. This course would assure the government against any risk or doubt of the availability of the new methods for raising and lowering ships, that are to be exploited thereupon.

The government would, meanwhile, be spared the necessity of spending money upon this part of the Trent Valley program, and afterwards from the burden of maintaining or operating works that might not return sufficient income to cover such outlays.

The short cut waterway would also afford opportunity for Hamilton Toronto, Kingston, Brockville and Prescott to establish commercial equality with Toledo, Sandusky, Cleveland, Erie and Buffalo. No other route can offer like advantages to these and their neighboring ports on lake and river. Surely, they are entitled to consideration, when Canadian commerce is to be considered.

Lake Erie has been in the lead long enough. Let Lake Ontario and the St. Lawrence now come to the front.



MAP OF THE TWO SHORT-WAY SHIPWAY ROUTES.

FOR A SHORTER AND DEEPER WATERWAY.

Having carefully studied the requirements of the situation and the various conditions prevailing, regarding the transit of ships and the transportation of cargoes, between the Upper Lakes and the seaboard, I do not hesitate to express the opinion that the time has arrived when the heavy burdens now resting upon the shippers of freight can and should be materially lessened.

The largest ships now in use are 450 feet long and 52 feet wide. Such ships could carry 7,000 tons on 20 feet draft of water Ships of this class would be the rule, and not the exception, if facilities were better.

If ships could pass out of Georgian Bay into Lake Ontario, at Toronto, bound to Prescott, for Montreal, 309 miles of distance would be saved, as compared with any route via Lake Erie. Therefore, about the same rate of speed would bring a ship to Prescott, or to Brockville, in the time which is now required to reach either the Welland Canal or Buffalo. A still further advantage would result from the saving of more than half of the time, in the proposed new works, which is now consumed in passing through the Welland Canal.

By the new route and new methods, Prescott would be 68 miles nearer all the ports on the Upper Lakes than Buffalo is now, by water; while Brockville also would be 80 miles nearer. The difference in cost of transportation, in favor of the new route, would be fully $3,000 on a 7,000 ton cargo.

The cost of a canal suitable for the largest ships now used upon the lakes, carrying full cargoes, would be $29,000,000 less upon my system than if it were to be made with locks like the Canadian lock at Sault Ste. Marie. Except as to length and lift, that being 900 feet long and 18 feet lift, my figures are for locks only 470 feet long, with an average lift of 21½ feet.

With suitable surveys and plans, and legislation in its behalf, the matter will command the attention and respect of capital and the business world generally.

FACTS AND ESTIMATES ABOUT COST OF LOCKS.

The Canadian Lock, at the Sault Ste. Marie, is 900 feet long, 60 feet wide, and has a lift of 18 feet.

It cost	$2,246,346.77
The rock excavation cost	201,054.40
Deduct the rock excavation, and we have	$2,045,292.37
If 28 similar locks, with an average lift of 21.5 feet, were to be built on the Georgian Bay route, they would cost, upon the above basis, $2,442,988.06 each, making a total of	$68,603,665.68
If similar locks were to be built, having a capacity for **two** ships 450 feet long at **one** time, they would cost $2,497,277.00 each. This would be a total for 28 locks of	$69,923,756 00
If, on the other hand, such locks were to be built 470 feet long, they would cost on the above basis, $1,275,782.00 each, being a total for 28 locks of	$35,721,896.00

By the use of my substitute, $25,000,000 could be saved out of the **last** item of the above schedule.

HENRY CURTIS SPALDING.

My Canadian patent is dated October 14, 1902

THE TWO ROUTES.

It will be observed that there are two routes between Georgian Bay and Lake Ontario on the accompanying map. It may be said, concerning them, that the Nottawasaga route has one great advantage over that via Lake Simcoe.

It would only be necessary to raise or lower ships through a height of 335 feet, between the two water-levels. Such a lifting or lowering could all be done at a single operation, while the route via Lake Simcoe would require three—one of 131 feet to overcome the elevation between Georgian Bay and Lake Simcoe, and two more, of about 233 feet each, between the Simcoe level and that of Lake Ontario—thus making a necessity for three distinct portages, instead of the one via the Nottawasaga route.

But, as the time required to cut through the Oak Ridges, upon the Nottawasaga route, would be more than twice as long as that on the Simcoe route, because of its far greater length and depth of cutting, it would not be expedient to undertake the task of opening it until the Simcoe route shall have been put into operation. But as the latter will require the creation of a very great hydraulic outfit, as well as many steam-shovels, locomotives and cars, also of steam dredges, scows and tow-boats, it would seem to be better that this great outfit—costing millions of dollars—should be continued in service, and employed upon the larger task, where it could be used with great advantage, than to allow it to be broken up and dispersed, after the lesser work shall have been completed.

It must not, however, be assumed that the investment required for construction of the Nottawasaga route will be much greater than the cost of the Simcoe route, because the latter will have caused most of the expense of the outfit needed for the former. Besides this, certain economies would have become possible, in the work upon the Nottawasaga, that would be impossible upon the Simcoe works.

The latter can be operated for traffic in five years after it is begun, and can handle 20,000,000 tons of freight in a single season. When both are ready, their joint capacity will be 60,000,000 tons annually, because the second route will have a double portage—the other should have only single portages.

It may seem as if such a great capacity will not be needed, but all our experience shows that the traffic of the continent is growing by leaps and bounds. The condition has been, in the past, that insufficient facilities have been provided—thus necessitating the raising and expenditure of large sums for making them better. Therefore, it is well to plan for the future, and not waste resources that will be badly needed in a short time.

The following remarks will therefore only apply to the route via Lake Simcoe.

This Route, via Lake Simcoe and Whitby Harbor, is 320 Miles Shorter tha
Lake Erie and the Welland Canal.

REMARKS UPON THE SIMCOE ROUTE.

For the better understanding of the works proposed by me, I will say that the waterways will consist of two divisions.

The first division will be sixteen miles long. The ground is extremely favorable. It will extend from Matchedash Bay (which is an eastern arm of Georgian Bay) to Lake Goughchiching, which is a northern extension of Lake Simcoe.

This division will be very easily constructed It will include a portage about five-sixths of a mile in length, whereon, by means of a marine railway, ships of the largest class now in use upon the lakes can be raised or lowered by water power, through a lift of 131 feet. This constitutes the difference in level between Bay and Lake. Thence the route would be through these two lakes for a distance of about thirty miles to the Holland River, which flows into the southern end of Lake Simcoe. By deepening and straightening this river and its east branch, for about five miles, we come to the Oak Ridge, which is the divide between Lakes Simcoe and Ontario. This is the only serious obstacle in the path of the canal; but, by methods devised by me, the cost of a cutting through it will be diminished at least one-half.

The entire length of the southern division, including canal and river, will be about 31 miles, making a total length of the artificial waterways about 47 miles. There will be only 12 miles of the whole that will have to be cut in solid earth.

The southern division will have two portages, in which the descent from Lake Simcoe to Lake Ontario will be made. Each of these will be about 233 feet lift, and each will be about a mile long. These, also, will be worked by water power. The time consumed in passing these three lifts, in both divisions, will not exceed one-twelfth of the time which would be taken in passing through locks, such as are commonly used on canals, and the economy of the portages in every respect will be far greater than the expenses and wear and tear attendant upon lockages of ships. The saving in cost by my methods, as compared with any heretofore proposed, will be about $30,000 000, and the distance between Lake Simcoe and the St. Lawrence will be 30 miles less than by any other route from Lake Huron, the total saving in distance being fully 300 miles.

There will be nine tracks under each carriage on each of the three short portages upon this route, but there will be two sets of nine each—making eighteen tracks for the support of the two carriages upon the single portage of the Nottawasaga route—thus it will be seen that the latter will have twice as great facilities for the movement of ships as those which will exist upon the Simcoe route.

GEOLOGY.

From the Geology of Canada, 1863, pp. 908 and 909.

ARTEMISIA GRAVEL, OAK RIDGE.

"An extensive spur of gravel from this area to the northeast, constituting what is called 'Oak Ridge.' The ridge appears to be composed wholly of sand and gravel."

The gravel is all well rounded and generally coarse; it often constitutes what might properly be called shingle, being loose and free from any admixture of clay; and it is distinctly stratified."

Further information was obtained from Kivas Tully, C. E., who made canal surveys and exploratory borings of the ridge fifty years ago, also from William J. Hill, Contracting Engineer, ex-M. P. P., President of the York County Mutual Fire Insurance Company, and from W. H. Payne, Meterologist, all of Toronto. They also made examinations of the ridge.

The Morris Canal Company has had, in constant use, for more than seventy-five years, several inclined railway portages, for lifting or lowering its barges. The lift varies from 70 to 105 feet.

The following copy of a letter from one who was its president, until his decease about three years ago, may be interesting at the present time

OFFICE OF
THE MORRIS CANAL AND BANKING CO.

Jersey City, Sep. 1, 1875

TO THE HON. THE POSTMASTER GENERAL,
Dominion of Canada.

Dear Sir: I take pleasure in bearing testimony in behalf of my fellow citizen and neighbor, Mr. Henry C. Spalding. I have known him for many years, during all of which he has been in the advance among his compeers in regard to many things which pertain to the public benefit and advantage. And I know of no man who is his equal in ability, executive talent and persistency in accomplishing whatever he undertakes, even though it be (as has been the case with him) what to most men would seem almost out of the range of possibility.

Very respectfully,

JACOB F. RANDOLPH.

The following endorsement was made upon the back of the foregoing letter, by the Hon. Joseph D. Bedle, who has been a Justice of the Supreme Court and was then the Governor of the State of New Jersey.

I know Mr. Randolph personally and by reputation. He is the President of the Morris Canal Company of this State. I should place implicit confidence in his statements. I am also acquainted with Mr. H. C Spalding but not extensively. I am satisfied that he is deserving of the good opinion Mr. Randolph entertains for him.

Sept. 2, 1875. J. D. BEDLE,

EXPERT OPINIONS.

(Opinions of Four Canadian Engineers.)

The late Kivas Tully was for many years consulting engineer for the Province of Ontario and was engineer of the Toronto Harbor Commission.

(Extract from letter to Mayor Howland.)

KIVAS TULLY, CONSULTING ENGINEER.

To carry out Mr Spalding's scheme, a ship canal on the level of Lake Simcoe would have to be constructed . . . with inclined planes at the northern and southern termini for the conveyance of large ships, which latter, I consider, would be quite practicable, as proposed by Mr. Spalding.

Mr. William H. Law was for many years Engineer of the Peterborough Bridge Works and was since Engineer of the Canada Foundry Company.

(Extract from letter to Mr. Spalding.)

WILLIAM H. LAW, ENGINEER, CANADA FOUNDRY COMPANY.

Dear Sir: Since looking over the blue prints, illustrating your methods of transporting ships over high lands, between two sheets of water, I have become favorably impressed with the feasibility of the devices adopted to secure an equal distribution of the loading, whilst the vessel is moving over a hill or any irregular surface of roadbed.

Nor do I see any reason to doubt the possibility of designing and building suitable trussed platforms, to carry the vessels, no matter what the conditions of loading may be. Or, in other words, a platform can be designed and built to carry vessels, varying in length from 200 feet to 500 feet long, or more, without injury to the vessel or platform.

S. Allen Cooney is from Prince Edwards County, Ont.

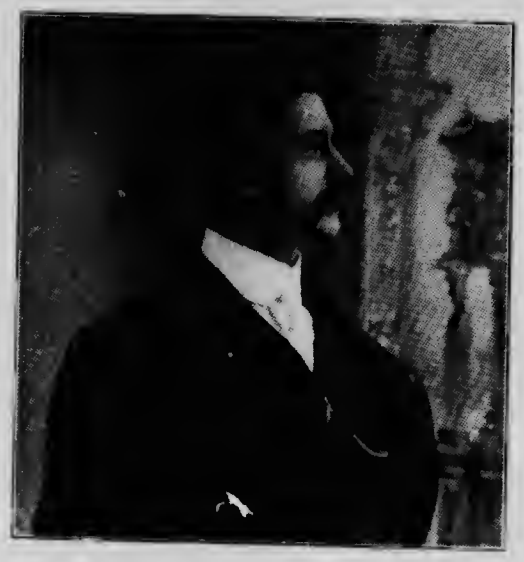
(Extract from a letter to Mayor Howland.)

JOHN A. ROEBLING'S SONS COMPANY OF NEW YORK.

S. A. COONEY, ENGINEER.

Dear Sir: At the request of Mr. H. C. Spalding, a gentleman with whom the writer has been personally acquainted for a number of years, we write to say that we have watched with considerable interest the drawings in connection with his marine railway, for the transportation of ships and canal boats from one water level to another, without the use of locks.

From the writer's knowledge of same, we believe it to be a very great achievement, and mechanically the entire outfit seems to be a thorough success.



S. ALLEN COONEY.

Hon. Trevannion W. Hugo was from the vicinity of Kingston, Ont. He is a well known Consulting Engineer, who has also served the city of Duluth for three terms as School Commissioner and two terms as Mayor.

He says:—

Referring to the scheme of Mr. Henry C. Spalding of New York City, who has it in mind to connect Georgian Bay with Lake Ontario by means of a canal and portages over which he would convey boats of large size on an apparatus which he has invented for that purpose: Mr. Spalding sent me some time ago, and I now have in my possession, a copy of the patents covering this invention, and from all that I have been able to learn in the matter, after as careful a study as I could give it, I am of the opinion that the scheme is feasible; and with a few slight modifications which may be demanded after actual trial, that there should be no difficulty in accomplishing that which he has set out to perform.

I have known Mr. Spalding for some time, as he resided here, and he is a gentleman of infinite resource and brains, and I have an idea that what he starts out to perform, he is able to carry through. I think we in Duluth would be interested to know that such a scheme as you suggest is in process of development; and wishing you every success, I remain,

Yours respectfully,

T. W. HUGO.

(Extract from report, published in the "Toronto Daily Star," August 4th, 1903, of an interview with Sir William Van Horne.)

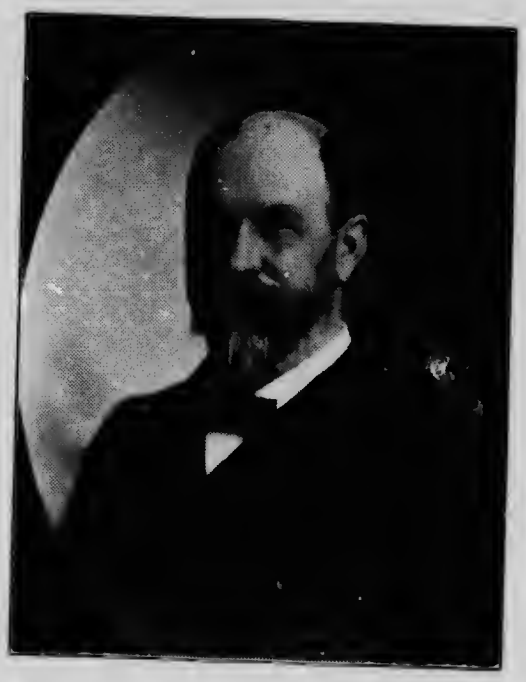
He said: "But no all-rail route, unless forced by strenuous conditions explicitly understood, can afford to despise or to dispense with the water route provided by the Great Lakes. The harvests of the Canadian West will never be brought to the Atlantic seaboard by an all-rail route voluntarily, and I say this confidently and for publication, if you think proper."

Can the Hydraulic Balance Lock be made available for large ships or for very high lifts?

The successful experiment at Peterborough with the balance lock, on a lift of 65 feet, with a lock of dimensions suitable for a small canal barge, has caused a renewal of the above inquiry.

As this question was carefully considered by the writer, some ten years ago, before he finally settled upon the Marine Railway Lift as the only really available method for performing such a service, it may not be amiss to recount some of the difficulties which were then found to exist.

While a movable lock, suitable for a canal barge of 200 feet in length and 25 feet in width, may be raised or lowered upon a central piston, where



TREVANNION W. HUGO.

Member of the American Society of Mechanical Engineers.

the total weight of boat and cargo, to be moved, is less than 1,500 tons, it is quite another matter when a ship 450 feet long and 52 feet beam, with a total weight of 12,000 tons (7,500 tons cargo and 4,500 tons ship) is to be lifted or lowered. In the latter case, the lock must have several supports, placed at considerable distances apart. It was found that there must be no less than six pistons under one ship; that these must be placed in two parallel rows, three in each row; that the transverse distance between the rows must be 40 feet, and that the longitudinal between the central and end pistons could not be less than 150 feet.

If the whole load were to be carried upon one central piston, the tremendous overhang, fore and aft, each of 235 feet, could not be supported, because the weight of water and the enclosing lock, inclusive of ship and cargo, would not be less than 32,000 tons, besides the piston.

Obviously, such a load must be carried upon a series of supports.

The question then arose whether such supports could be made to move synchronously. If unequal pressures were to supervene, derangements of the mechanism would be probable—with resulting disaster.

The problem of providing means for keeping six pistons in alignment proved to be unsolvable, when the expansion or contraction of the lock structure was taken into account. The result must be, that either the pistons would become cramped and stuck in the cylinders, or else something must break, with consequent wrecking of the apparatus.

After more than five years study of these difficulties, without finding any satisfactory solution, the writer was forced to recur to the earlier studies of the Marine Railway methods, wherein it became possible to overcome every obstacle, and to lift or lower these great loads through heights varying from 130 to 335 feet, in a single operation, successfully.

Even if it were possible to confront the foregoing difficulties with a balance hydraulic lock, the very great heights through which movement would be required render it impracticable to make and operate pistons and cylinders of such tremendous length.

If the lifts were to be divided into shorter ones, the detentions incident to the locking and the unlocking of ships so many times would add materially to the disadvantages of such a system.

It has been objected to the Marine Railway, that shipmasters and ship owners, or their customers, would not take the risks.

But the answer to this is to be found in the plan of special insurance against such risks. Such insurance must be provided by the canal corporation, directly or indirectly.

It is a small wonder that they did object to the Chignecto Railway. There was too little attention given to making the track and carriage safe. The methods adopted seemed to invite disaster.

In our case, all four of the lifts, on the two routes combined, the length of movement would be only one third of the distance proposed on the Chignecto, and the precautions against accident are very much greater than those that were apparent in that project.

COMPETITION.

A glance at the sketch profiles on the accompanying page will make it apparent that there can be no possible competition, for through traffic, from the Trent Valley bargeway, as against the proposed short cut canals.

The Nottawasaga route is, by far, the most desirable of the two latter. The fact that it would take ten years to cut through the Oak Ridge on that route, while only half of that time would be required on the Simcoe route, indicates that the latter should be the first one to be constructed.

It must not be forgotten that, for either of them, there must be used a great hydraulic plant, an extensive dredging outfit, as well as steam shovels and also railways and construction trains, with a total cost of three and a half to four millions of dollars, in order to do this work with economy and dispatch. But, when the lesser task is accomplished, the same outfit, with small additions and alterations, would still be available for the other and more important work. It goes without saying that, when such an outfit has once been created, it would be better to keep it in use for fifteen years than to throw it aside after five years of service.

In this alone an important economy would be effected.

It is probable that both the Simcoe and the Nottawasaga routes will be needed for the rapidly growing commerce of the continent.

It is likewise important to note that the northern division of the Simcoe route from Georgian Bay to Lake Simcoe would serve a double purpose. While it would become a link in the chain of short-cut waterways to Lake Ontario, it would supply better facilities for the Trent Valley bargeway than could be obtained if a work suitable only for a bargeway should be constructed between Lake Simcoe and the Bay.

It is very apt to be the case that the greater includes the lesser—certainly it would be true in this instance.

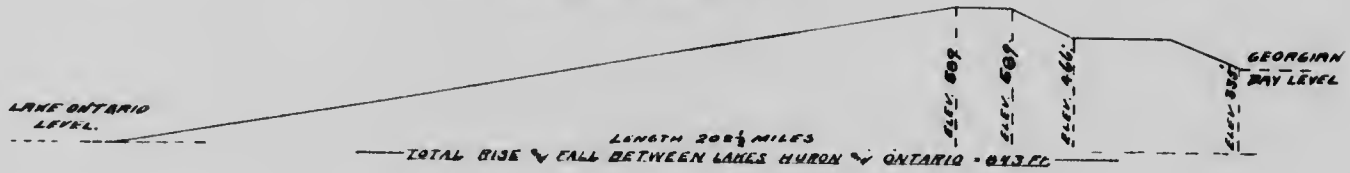
There need be no fear that competition with any route via Hudson's Bay would seriously affect traffic by the proposed short-cut waterways, for three reasons.

FIRST: That northern route could only be used for 100 days in the year, while the route via the Great Lakes is open 210 days. Much of the time difference in favor of the latter is at the season when the greatest pressure, for moving food stuffs, is felt.

SECOND: The very important traffic in Canadian coal, and manufactures of all sorts, would never go by that route from any of the Eastern Provinces. Their needs should be considered.

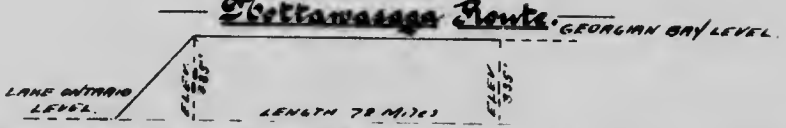
While it is likely that the Sault Ste. Marie will, ultimately, obtain its coal supply from the Albany River coal fields, and Manitoba will be supplied from the Saskatchewan mines, there would still be room for the Nova Scotia product at other points, because of the relative cheapness of water transportation, on large ships.

Trent Valley Route.



Simcoe Route.

Nottawasaga Route.



COMPARISON OF THE LENGTHS AND LIFTS OF THE THREE PROPOSED WATER ROUTES BETWEEN GEORGIAN BAY AND LAKE ONTARIO.

It will be found that the routes which can supply freights both ways will command the business. Besides, it seems likely that Canadian producers and forwarders in the East will not relish the idea that British products are to oust them from a western market, because of the Hudson's Bay route. They will see to it that shipments from Europe, via Hudson's Bay, obtain no advantage over them.

THIRD: Anybody who has attentively studied the accounts of perils, because of fogs, drifting Greenland icebergs, and the great fields of Arctic ice which accompany them from the circumpolar regions and are encountered by the hardy Newfoundland sealers, along the coasts of Labrador, will appreciate the difficulties of traffic between the Atlantic Ocean and Hudson's Bay. But people who ride a hobby ignore all such things; just as those of the Trent Valley, the Ottawa River or the Welland route advocates do, when mounted upon each of their favorite steeds.

It has been said that competition is the life of trade. While competition with the big ships on the short cut canals is not likely to amount to much for reasons stated, it is well to open the railway routes from the Sault Ste. Marie and from Winnipeg to Hudson's Bay and also from Edmonton to the Klondike, notwithstanding difficulties attendant upon their construction. The great lumber, mineral and fishing businesses that await them are sufficient reasons why these regions should be opened up to Canadian enterprise.

The same also applies to railways from both Quebec and Montreal to James Bay.

Anything that tends to develop commercial activity ought to receive cordial welcome and suitable encouragement.

Although Hudson's Bay may become an important factor in Canadian trade it can never become a favorite for European commerce.

There have been, in many quarters, opinions expressed that ships could serve as lake carriers and transatlantic carriers also.

Such opinions are based upon superficial knowledge—experts have expressed opinions directly opposite.

Ships built, equipped and manned for lake carriers are entirely unsuited for oceanic voyages. Ships suited for navigating the "roaring forties" could not profitably enter upon the lake traffic. They are of a different type, in very many respects, and a type intended for both uses would not be profitable for either.

This fad is sure to die out, when submitted to the test of actual practice; just as the prevalent idea, that no matter how long an artificial waterway may be, nor how many locks would be required upon it, if it is made big enough for ships to pass through they will use it. The truth is, that only short reaches of artificial waterways, connecting deep and broad natural waters, are at all available for big ships. Anybody who expects anything else is sure to be grievously disappointed, if such works are ever constructed.

Montreal is, and must continue to be, the head of navigation, in Canada, for ships suited to the transatlantic carrying trade, no matter what projects are set on foot, for combining lake with ocean carriage.

(COPY.)

THE BOARD OF TRADE OF THE
CITY OF TORONTO.

F. G. MORLEY,
Secretary & Superintendent.

July 5, 1905.

H. C. SPALDING, Esq.,
168 West 85th Street, New York.

Dear Sir: At Mr. R. C. Steele's request I give you below copy of resolution adopted by the Council of this Board re. Georgian Bay Canal.

Yours faithfully,
F. G. MORLEY.

"RESOLVED, that this committee, having discussed the matter of granting a charter to the Canadian Canals Corporation, recommends to the Council of this Board the desirability of constructing a canal between Georgian Bay and Lake Ontario as shown on the plan furnished by Henry C. Spalding."

A SHORT HISTORY OF THREE GENERATIONS OF ENGINEERS.

"Of no use are the men who study to do exactly as was done before, who can never understand that to-day is a new day."—EMERSON.

THE FIRST GENERATION.

In the year 1810 Samuel Spalding entered the service of the United States Government as a maker of musket barrels, wherein he made such a reputation that he was invited in 1818 to take up the same work in a private armory. After six years in the latter, he left the business and in 1824 started the first manufactory of buttons on American soil, with building and machinery planned and constructed by himself.

Two years later, he bought a mill-site, upon which he built a dam and water-wheels, for a machine-shop and factory. Near the latter he built dwellings for his work people.

The button factory, machine-shop, mill and dwellings were built of bricks, made in a brick-yard that he established for the purpose, at a date when almost all such structures were made of wood.

In 1828 he had the business in full operation, producing webbing for surcingles, and similar uses, from the raw cotton.

Like the button works, it was the pioneer, on this side the Atlantic. Every part of the outfit was designed by him, and built on his own premises, under his own supervision.

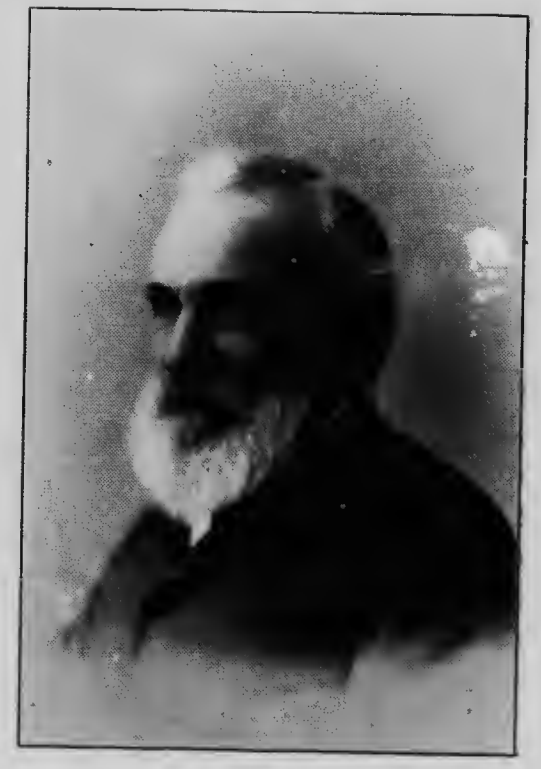
The button works was discontinued after his decease, because there was nobody to carry it on, but the webbing business has been added to, from time to time, until there were seven mills, all devoted to that industry. It was the first in America to make elastic webbing and is still a great concern.

THE SECOND GENERATION.

Henry Curtis Spalding, the youngest son of Samuel Spalding, had the run of these works all through his boyhood. Experience gained at that impressionable age, as well as the inherited tendency, has influenced all his after life.

He was apprenticed to a silversmith, where he learned the art of making spoons, spectacles and thimbles; but the destruction of the works by fire left him free, at 18, to enter a factory for making brass clocks.

After he had learned that art, he entered an optical works, wherein he became acquainted with the production of nautical, astronomical and surveyors' instruments. The old type of Morse telegraph instruments, which are now curiosities, seldom seen, were also made there.



HENRY CURTIS SPALDING.

Afterwards he went into a concern where he made wire-drawing machines and bolt and nut making machinery. Next he worked at making looms, of all sorts, for light and heavy work, both cotton and woolen—plain and fancy weaving. Then he began the making of engine-lathes and iron-planing machines. From these he went to sword and cannon making.

Leaving these, he made and set up a Fourneyron turbine water-wheel. This wheel, after 25 years service, was lifted o ıt of the wheel pit, and the wheel-pit and tail-race were deepened by blasting, to obtain more power, and the old wheel restored to the pit—the owners declaring that it was even then better than any of the new wheels.

From this work he went into the United States Government service in the same establishment where his father had begun. There he made muskets and the tools and machines for their production. Next he went to making revolving fire-arms and the designing and making special tools and machines for making them. Next he invented and made automatic machines for turning wood into prismatic forms. But he was soon drafted into the work of designing and constructing special tools and machinery for a new sewing machine factory. After which he designed and made an entirely new type of sewing machine for Elias Howe—the sewing machine inventor.

To illustrate his thoroughness, it may here be told that none of the many special tools and machines designed by him for use in the manufacture of arms and sewing machines were ever changed. They were all continued in use as long as there was occasion for them.

But he soon turned aside from Mechanical Engineering into another direction. He planned six great bridges, to connect together the three principal islands upon which the present city of New York is situated.

His plans were shown in 1864, at the Sanitary Fair in Brooklyn. Two of these bridges are now completed, the third is under construction, the fourth is already provided for—a tunnel is substituted for the fifth, the sixth is now under discussion and must soon follow.

The subject of a ship canal, between Cayuga Lake and Lake Ontario, was next taken into consideration. This project was soon enlarged to include a shipway from Cayuga Lake via the Susquehanna and Delaware rivers to Philadelphia, with intermediate inclined plane marine railway portages, to connect its several navigable sections.

The project received the support of eminent citizens of the States of New York, New Jersey and Pennsylvania; but the powerful opposition of the Delaware shad-fishery interests and the mill-owners along the Oswego river prevented the obtainment of the necessary franchises in the three States.

Besides these obstacles, the method for moving ships upon inclined railway portages had not then been devised. This caused the abandonment of the project.

While this subject was still under consideration, he was requested by the canal engineers of the State of New York to advise them about the

removal of obstructions to navigation of the Hudson River which existed for twenty miles below Albany, which consisted of numerous shoals, along a very crooked channel. These were a serious impediment to navigation. Jetties, on the plan proposed by him, were constructed that in one season straightened and deepened the channel in such a manner that where there had been only six feet of depth at low water, in an uncertain channel, a constant depth of fourteen feet, in a straight channel, was obtained at a cost of about $100,000.

This was the pioneer work on this side of the Atlantic, and the success which was there obtained was followed up by Captain Eads with the jetties at the mouth of the Mississippi River, where the use of the same principles succeeded in obtaining a deep water channel where shoals had, theretofore, obstructed the navigation.

The need of better facilities for suburban passenger traffic west of the city of New York was next presented to his attention by several citizens, with the request that he find a solution of the difficulties; whereupon he made surveys, obtained franchises, and, with his associates, accomplished the task. In the course of this work, he projected and carried through the biggest railway cutting in the world. It was made through successive layers of glacial drift, quicksand and rock. This was a tough proposition to tackle, but the outcome fully justified it, because it is now one of the busiest lines of railway in America. There were steam drills, pumping, hoisting and locomotive engines, also steam shovels, making a total of twenty-two steam engines, of various types, and hundreds of men, employed upon this work, which was pushed day and night for two years.

About this time, at the request of the Secretary of the Navy, he made a report on the methods to be pursued in cutting the Darien Canal, which had then been recently surveyed.

Not long afterwards he projected a line of swift, light-draft steamships, to be devoted to carrying cabin passengers, the mails and valuable parcels between Canada and Ireland, in which eighty per cent. of the daily trips, each way, were to be made in four days and ten per cent. in five days. He succeeded in obtaining the support of the Canadian and the United States Post Office departments, but the British Postmaster-General, Lord John Manners, negatived the proposition.

When Lord Carnarvon, the Colonial Minister, was asked to interpose he promised to do so, if requested by the Dominion Government. But as this was at a period when the Mackenzie Administration wanted other things from the Home Government, they could not interfere in that way, although strongly in favor of the project—which had strong support among experts and financiers.

Afterwards he went to Russia, where he was consulted about the transcontinental railway, which was then under consideration. He advocated the southern route, through Turkestan. This was regarded with so much favor, that the biggest bridge in the world was built, upon his advice:

that across the Volga at Samara. It was built for the purpose of joining together the European and Asiatic railway systems.

Although it was finally decided to push ahead with the northern or Siberian route, in the first instance, the southern or Turkestan has since been extended eastward to Chinese Turkestan. This will, in the end, be the principal thoroughfare to the East, being more direct, and having many other advantages over that through Siberia.

While engaged in these studies, he became impressed with the fact that great areas in western Asia, formerly the home of the peoples who now inhabit Europe, had become desiccated and uninhabitable because of the loss of equilibrium between rainfall and evaporation, and that the same calamity was threatening southeastern Europe. Further examination showed that the only remedy for this state of things was to be found in restoring the water areas which, in past years, had furnished the requisite surfaces for evaporation, and thus supplied to the clouds the moisture for a greater rainfall.

He found that by excavating an artificial strait between the Black and Caspian seas, it it would not only fill up and thus enlarge the water areas, but would supply means whereby the world's shipping could gain access to Moscow in Eastern Europe and to Orenburg in Western Asia.

These conclusions were shown to the Russian Government and were made the subject of an essay, published in the London Times, which attracted world-wide attention.

He afterwards formulated plans for ship navigation between Cronstadt and Riga in the North, and the Black Sea, at the South.

Later on, after returning to America, he took up the subject of subways for trolley railways and tunnel railways for the steam lines under Boston. These are now partly built and still others are under advisement, as the outcome of his labors in that behalf, in which he was the pioneer in America.

The great West had, however, so strongly attracted him that he went to Minnesota, where he formulated plans and conducted many surveys for bringing the Red River and the Upper Mississippi into navigable connection with Lake Superior.

It was while engaged in studies of these operations that he perfected the methods (now patented in the United States and in Canada) by which large barges and large ships can be safely, expeditiously and economically raised or lowered between very high and very low water-levels, and which he now proposes to utilize, in a short-cut shipway between Georgian Bay and Lake Ontario.

Since he has considered the need and importance of such a work, he has changed and revised the conclusion which he expressed in a report to the New York State Canal Commissioners made at their request a few years ago about the desirableness of enlarging the Erie Canal, but not about the methods proposed by him.

EDWARD H. SPALDING.

Many other works and enterprises have occupied his time and attention. Among these were the mining and reduction of copper ores, coal mining and iron mining. Such is the brief record of engineering experiences which have, with science and literature, filled up a busy and eventful life.

THE THIRD GENERATION.

Edward H. Spalding is the eldest son of Henry Curtis Spalding.

He began his work as an assistant engineer in the field upon the railway system which was projected and supervised by his father and in which he soon became proficient.

But at the age of twenty he set sail for Peru, where he was employed by the late Henry Meigs to lay out the summit division of a railway line across the Andes. The line of survey was through a pass where, at the elevation of 15,600 feet, in the torrid zone it snowed every month in the year. He planned the tunnel, at the elevation of 15,200 feet, through which the Lima and Oroya railway now runs.

When the survey was completed, as the health of Mr. Meigs had broken down, he returned to his home, where he was occupied a short time in engineering work. He followed his father to Russia, where he became his father's assistant. After the return of his father from Europe, he accepted a situation as chief engineer of a petroleum distillery. But, having been invited to participate in the construction of a railway in Mexico, he came back to America. He served in Mexico upon several railway and other engineering works for more than ten years, and until he was summoned to Minnesota, as assistant to his father in the canal survey.

Since then he has been employed by the United States Government upon harbor improvements and by several railway companies in laying out new lines.

He is now employed by the United States Steel Corporation in laying out and constructing branch railways to the new mines that are so frequently opened in the Mesaba region and in looking after the trackage requirements of the multitude of mines that ship many millions of tons of ore annually. These things are more than enough to tax brain and endurance of any man.

Chester M. Spalding, the youngest son of Henry Curtis Spalding, was bred as a merchant in a great importing and commission mercantile house in New York City.

But as he grew towards manhood his inherited proclivity for engineering caused him to devote his evenings and his holidays to the study of engineering, until his employer, an eminent merchant, finally advised and assisted him to devote himself to that occupation (wherein he began with

CHESTER M. SPALDING.

Member of the American Society of Mechanical Engineers.

building machines for compressing air—afterwards he made machinists' tools), and in which he has already distinguished himself as a designer of many mechanisms, among which are a computing machine, for calculating numbers, the Harris-Corliss steam engines, the Howell Automobile Submarine Torpedo, and many others. He has been employed, for several years, by the General Electric Company at their great works in Schenectady, where he has lately been actively concerned in making the plans for the extensive railway system now under construction for the New York Central and Hudson River Railway terminals, at and near New York City, wherein electro-motors are to take the place of the steam locomotives in moving all the great passenger traffic which finds its outlet there.

A century of effort and of achievement of this family is drawing to a close, but it seems likely that the record will not be completed until long afterwards.