wood, is rapidly extending in several directions, and in recent years many dwelling-houses of an improved description have been erected. There is an abundant supply of excellent water, brought in pipes from a lake 5 miles off. Epidemics are rare, and the city is very healthy. Of the public buildings the most important are Government House, a substantial and spacious building erected in 1828 by the Imperial Government; the colonial building (1847), containing the chambers of the legislature and Government offices; the athenæum (1877), containing a public hall, library, reading-room, savings bank, museum, &c. The foundation of a new post-office was laid in the same year. The churches are—the Church of England and Roman Catholic cathedrals, St Thomas's and St Mary's (Church of England), St Patrick's, three Methodist churches, St Andrew's Presbyterian church, and the Congregational church. The manufacture of seal and cod oils has long been carried on upon an extensive scale. Of late years other manufactures have been introduced, and have made considerable progress. There are three iron-foundries, two large machine-shops, two boot and shoe factories, a nail-factory, three furniture-factories, two tobacco-factories, soap-works, two tanneries, and a large and well-equipped factory for the manufacture of cables, ropes, twines, nets, seines, &c. The export trade in fish of various kinds, fish oils, seal oil, and seal skins is very large; the greater part of all the imports into Newfoundland also arrives at St John's. The city is not yet (1886) incorporated, the Colonial Board of Works having charge of all civil affairs. The population, which in 1780 was 1605, had in 1801 increased to 3420, in 1812 to 7075, in 1835 to 15,000, and in 1874 to 23,890, and in 1884 it was 28,610 (Roman Catholics, 17,693; Episcopalians, 5741; Methodists, 3715; Presbyterians, 973; Congregationalists, 465; other denominations, 23). The census last mentioned also shows the population of the whole island and Labrador to be 197,589, being an increase of 36,209 since 1874, or at the rate of about 22 per cent. in ten years. The population of the Atlantic coast of Labrador, which is under the jurisdiction of Newfoundland, was 4211,—1347 being Eskimo.

ST JOHNSBURY, a township of the United States, capital of Caledonia county, Vermont, on the Passumpsic river (a tributary of the river Connecticut), about 50 miles south of the Canadian frontier, and on the railway between Boston (205 miles) and Quebec. St Johnsbury is the seat of perhaps the largest scale-factory in the world, which employs about 600 hands and works up 4000 tons of iron per annum. The township contains an athenæum, public library (10,000 vols.), and art gallery. The population has increased from 2758 in 1850 to 4665 in 1870 and 5800 in 1880. The three villages are distinguished as St Johnsbury (3360 in 1880), St Johnsbury Centre, and St Johnsbury East. Founded in 1786, the township received its name in honour of St John de Crèvecœur, French consul at New York, and a benefactor of Vermont.

ST JOSEPH, a city of the United States, capital of Buchanan county, Missouri, on the right bank of the Missouri, 260 miles west by north of St Louis. It is an important railway junction, possessing since 1873 a great road and railway bridge over the river constructed of iron; in the extent of its wholesale business it ranks as the second city in the State; and among its manufacturing establishments are flour-mills, starch-works, boot and shoe factories, pork-packing establishments, waggon-factories, a distillery, &c. Besides a city-hall and market-house, it contains a court-house (1875), an opera-house, a State lunatic asylum (1874), an agricultural and mechanical exposition association, a Roman Catholic cathedral, and five public libraries. The population was 8932 in 1860, 19,565 (1512 coloured) in 1870, and 32,431 (3227 coloured) in 1880.

Founded in 1843 by Joseph Robidoux, a French Roman Catholic, who had settled in the district some years previously as a trader, St Joseph in 1846 was made the county seat, and before 1857, when it received its first city charter, became well known as the great point of departure for emigrants bound for California and the West. During the Civil War, when it was fortified by the Federals, its natural development was considerably checked, but this revived as soon as the struggle was over.

SAINT-JUST, Antoine (1767-1794), French revolutionary leader, was born at Decize in the Nivernais on 25th August 1767. He was educated at Soissons, and showed his character at school as ringleader of a plot to set the school buildings on fire. Saint-Just was caught red-handed in the act of incendiarism, and, refusing to exhibit any tokens of submission, was ignominiously expelled. His education, however, does not appear to have been neglected; and the reports and speeches of his short and stormy political career exhibit not a little scholarship, and in particular considerable acquaintance with ancient history. Intoxicated with republican ideas, Saint-Just threw himself with enthusiasm into the political troubles of his time, had himself appointed an officer in the National Guard, and by fraud—he being yet under age—admitted as a member of the electoral assembly of his district. Ambitious of fame, he in 1789 published twenty cantos of licentious verses under the title of *Organt*, and this work was afterwards reissued under the title of *My Pastimes, or The New Organt*. From that year onwards, however, the open turbulence of his youth gave place to a rigorously stoical demeanour, which, united to a policy tyrannical, uncompromisingly thorough, and pitilessly severe, became the marked and startling characteristic of his life. He now entered into correspondence with Robespierre, who thenceforward became his hero and ideal. Robespierre invited him to Paris, felt flattered by his worship, saw that he suited his purpose, and in a short time the two became hand and glove. Thus supported, Saint-Just became deputy of the department of Aisne to the national convention, where he made his first speech—gloomy, fanatical, remorseless in tone—on 19th November 1792. He had but twenty months to live; but into these he seemed to crowd the life of twenty years. In the convention, in the Jacobin Club, and among the populace his relations with Robespierre became known, and he was dubbed the "St John of the Messiah of the People." Hardly a week passed without the attention of France being arrested by his attitude or his utterances. Both were anxiously watched, as the unfailing indication of the trend of Robespierre's designs. His appointment as a member of the committee of public safety now placed him at the very height and centre of the political fever-heat. In the name of this committee he was charged with the drawing up of reports to the convention upon the absorbing themes of the overthrow of the party of the Gironde, thereafter, when even the "Mountain" seemed to have fallen in pieces, of the Hébertists, and finally, as the tragic sequel to the rupture between Robespierre and Danton, of that denunciation of the latter which consigned him and his followers to the guillotine. What were then called reports were far less statements of fact than appeals to the passions; in Saint-Just's hands they furnished the occasion for a display of fanatical daring, of gloomy eloquence, and of undoubted genius; and —with the shadow of Robespierre behind them—they served their turn. Once a flash of cruel humour lighted up his angry retorts, and it became memorable. Desmoulins, in jest and mockery, said of Saint-Just—the youth with the beautiful cast of countenance and the long fair locks—"He carries his head like a Holy Sacrament."

JAMES BAY
NORTH WEST TERRITORY
MANITOBA
ONTARIO
QUEBEC
MINNESOTA
WISCONSIN
MICHIGAN
ILLINOIS
INDIANA
OHIO
PENNSYLVANIA
NEW YORK
MASSACHUSETTS
CONNECTICUT
NEW HAMPSHIRE
LAKE SUPERIOR
600 Feet above the Sea
LAKE MICHIGAN
LAKE HURON
574 Feet above the Sea
Georgian Bay
LAKE ERIE
L. ONTARIO
234 Ft. above the Sea
ATLANTIC OCEAN
Lake Nipigon
Isle Royale
Apostle Islands
Chicago
Milwaukee
Toledo
Cleveland
Detroit
Buffalo
Toronto
Kingston
Montreal
Quebec
Three Rivers
Albany
Boston
Providence
Hartford
New York
Philadelphia
Harrisburg
Pittsburgh
Columbus
Lansing
Madison
St. Paul
Minneapolis
Duluth
Sandusky
Long Isl.d Sound
Lake Winnipeg
Lac Seul
Red Lake
L. Temiscaming
Ottawa R.
Moose R.
Albany R.
Abitibi L.
Mistassinnie L.
NORTH EAST CONTINUAT.N OF ST LAWRENCE BASIN
Anticosti I.
St. Lawrence River
Chaleur Bay
GULF OF ST LAWRENCE
NEW BRUNSWICK
Deep Green shows altitudes up to 500 feet.
Pale Green 1000
Yellow 2000
Pink above 2000
Water-parting
For Altitude of Lakes, see also note page 182
English Miles
Long. West of Greenwich
90
85
80
75
70
65
50
45
40

"And I," savagely replied Saint-Just, "will make him carry his like a Saint-Denis." The threat was not vain: Desmoulins accompanied Danton to the scaffold. The same ferocious inflexibility animated Saint-Just with reference to the external policy of France. He proposed that the national convention should itself, through its committees, direct all military movements. This was agreed to, and Saint-Just was despatched to Strasburg, in company with Lebas, to superintend operations. It was suspected that the enemy without was being aided by treason within. Saint-Just's remedy was direct and terrible: he followed his experience in Paris, "organized the Terror," and soon the heads of all suspects were falling under the guillotine. The conspiracy was defeated, and the armies of the Rhine and the Moselle having been inspirited by success—Saint-Just himself taking a fearless part in the actual fighting—and having effected a junction, the frontier was delivered. Later, with the army of the North, he wrought similar magical changes in the aspect of affairs. Before the generals he placed the terrible dilemma of victory over the enemies of France or trial by the dreaded revolutionary tribunal; and before the eyes of the army itself he organized a force which was specially charged with the slaughter of those who should seek refuge from the enemy by flight. Success again crowned his terrible efforts, and Belgium was gained for France. Meanwhile affairs in Paris looked gloomier than ever, and Robespierre recalled Saint-Just to the capital. As the storm was gathering Saint-Just gave it direction by mooting the dictatorship of his master as the only remedy for the convulsions of society. At last, at the famous sitting of the 9th Thermidor, he ventured to present as the report of the committees of general security and public safety a document expressing his own views, a sight of which, however, had been refused to the other members of committee on the previous evening. Then the storm broke. He was vehemently interrupted, and the sitting ended with an order for Robespierre's arrest (see ROBESPIERRE). On the following day, 28th July 1794, twenty-two men, nearly all young, were guillotined. Robespierre was one, aged thirty-six; Saint-Just another, aged twenty-six.

In 1800 there was published at Strasburg a work from the pen of Saint-Just entitled *Fragments on Republican Institutions*. It is a crude mixture of his opinions on social and political topics.

ST KILDA, the largest islet of a small group of the Outer Hebrides, Scotland, 40 miles west of North Uist, in 57° 48′ 35″ N. lat. and 8° 35′ 30″ W. long. It measures 3 miles from east to west and 2 from north to south, and has an area of 3000 to 4000 acres. Except at the landing-place on the south-east, the cliffs rise sheer out of deep water, and on the north-east side the highest eminence in the island, Conagher or Conna-Ghair, forms a gigantic precipice, 1220 feet high from sea to summit. According to Professor Judd, St Kilda is probably the core of a Tertiary volcano; but, besides volcanic rocks, it is said to contain hills of sandstone in which the stratification is very distinct.[1] While the general relief is peculiarly bold and picturesque, a certain softness of scenery is produced by the richness of the verdure. The inhabitants are an industrious Gaelic-speaking community (110 in 1851, and 77 in 1881). They cultivate about 40 acres of land (potatoes, oats, barley), keep about 1000 sheep and 50 West Highland cows, and catch puffins and other sea-fowl. Coarse tweeds and blanketing are manufactured for home use. The houses are collected in a little village at the head of the East Bay, which contains a Free church, a manse, and the factor's house. The island is practically inaccessible for eight months of the year.

[1] No trained geologist seems to have visited the island subsequent to Macculloch.

St Kilda, or, as it was originally called, Hirt (Hirth, Hyrtha), seems to have been in the possession of the Macleods for 400 or even 500 years. In 1779 it changed hands along with Harris, and again in 1804 and in 1871 (to Macleod of Macleod). The feudal superior is Lord Dunmore, who receives one shilling of feu-duty. From 1734 to 1742 Lady Grange was confined on St Kilda by command of her high-handed husband (see *Procced. Soc. Scot. Antiq.*, x. and xi.). David Mallet makes the island the scene of his *Amyntor and Theodore, or the Hermit*. See works on St Kilda by Rev. K. Macaulay (1764), L. MacLean (1838), J. Sands (1876 and 1877), and George Seton (1878).

ST KILDA, a watering-place in Victoria, Australia, on the east shore of Hobson's Bay, 3½ miles south of Melbourne, with which it is connected by a railway. The borough had an area of 1886 acres and a population of 11,662 in 1881. The sea-beach is bordered by an esplanade; there is a large public park; and portions of the sea have been fenced-in to protect bathers from sharks. A town-hall, an assembly hall, a library, and the large Episcopal church of All Saints are among the public buildings.

ST KITTS. See ST CHRISTOPHER.

SAINT-LAMBERT, JEAN FRANÇOIS DE (1716-1803), French poet, was born at Nancy in 1716, and died at Paris in 1803. During great part of his long life he held various employments at the court of Stanislaus of Poland, when that prince was established in Lorraine. He also served in the French army, and then betook himself to literature, producing among other things a volume of descriptive verse, *Les Saisons* (wildly overpraised at the time, and now never read), many articles for the *Encyclopédie*, and some miscellaneous works in verse and prose. Saint-Lambert's chief fame, however, comes from the strange fate which made him the successful rival in love of the two most famous men of letters in France, not to say in Europe, during the 18th century. The infatuation of the marquise du Châtelet for him and its fatal termination are known to all readers of the life of Voltaire. His subsequent courtship of Madame d'Houdetot, Rousseau's Sophie, though hardly less disastrous to his rival, was less disastrous to the lady, and continued for the whole lives of himself and his mistress. They survived till the present century as a kind of irregular Baucis and Philemon, illustrating the manners of the vanished *régime*, which had been not unjustly celebrated, and vindicating its constancy from a very general opinion.

ST LAWRENCE. The river St Lawrence[2] in North America, taken in connexion with the great lakes, offers to trading vessels the most magnificent system of inland navigation in the world. Its total length from the source of the St Louis river, which discharges into Fond du Lac at the head of Lake Superior, to Cape Gaspé is 2100 miles. The river St Louis springs from the same spacious plateau in Minnesota that gives birth to the Mississippi and the Red River of the North. The intermediate distances between the source of the St Lawrence and its mouths are shown in Table I. According to the most recent surveys the approximate area of the basin of the St Lawrence is 510,000 square miles, of which 322,560 belong to Canada and 187,440 to the United States. Plate IV. Length.

Lake Superior, the most westerly of the lakes, is the largest body of fresh water in the world. In addition to the river Nipigon, which may be regarded as the chief source of the upper St Lawrence, and the St Louis and Pigeon rivers, which constitute the international boundary, it receives its waters from 200 rivers, draining an aggregate of 85,000 square miles,[3] including its own area of 32,000.

[2] The name given by Jacques Cartier, who ascended the river in 1535 as far as Montreal.

[3] The magnitudes and altitudes of the great lakes are derived from the *Report* of the Canadian Canal Commission, February 1871; the engineering data relating to canals have been mainly obtained from other annual reports published by the Canadian Government and from the annual reports of the chief of engineers, United States army.

TABLE I.—*Distances of Sections of St Lawrence.*

Local Name.	From	To	Sections of Navigation.	Statute Miles. Intermediate.	Statute Miles. Total from Source of St Louis.
....	Source of St Louis river	Fond du Lac	St Louis river	152	152
....	Fond du Lac	Pointe aux Pins	Lake Superior	390	542
Saulte St Mary	Pointe aux Pins	St Joseph's I.	St Mary's river	55	597
St Mary river	St Joseph's I.	Sarnia	Lake Huron	270	867
....	Sarnia	Amerherstburg	St Claire and Detroit river	76	943
....	Amerherstburg	Port Colborne	Lake Erie	232	1175
Niagara river	Port Colborne	Port Dalhousie	Welland Canal	27	1202
....	Port Dalhousie	Kingston	Lake Ontario	170	1372
St Lawrence	Kingston	Prescott	Head of canal section	59	1431
	Prescott	Montreal	St Lawrence Canal section	119	1550
	Montreal ..	Three Rivers	Head of ocean navigation to head of tidal flow	86	1636
	Three Rivers	Quebec	Head of tidal flow to Quebec	74	1710
	Quebec	Cape Chat ..	....	266	1976
	Cape Chat ..	Cape Gaspé ..	Mouth of river St Lawrence	124	2100
....	Cape Gaspé ..	Belle Isle[1] ..	Mouth of the Gulf of St Lawrence	436	2536

Its length is 390 miles, its greatest breadth 160, and its mean breadth 80. Its mean depth is 900 feet and its altitude above the sea-level 600 feet. Its coast is generally rock-bound. Numerous islands are scattered about the north side of the lake, many rising precipitously to great heights from deep water,—some presenting castellated walls of basalt and others rising in granite peaks to various elevations up to 1300 feet above the lake. The Laurentian and Huronian rocks to the north along the shore abound in silver, copper, and iron ores. The United States side is generally lower and more sandy than the opposite shore, and is also especially rich in deposits of native copper and beds of red hæmatite iron ores. Both these minerals are extensively worked. Unfossiliferous terraces occur abundantly on the margin of the lake; at one point no fewer than seven occur at intervals up to a height of 33 feet above the present level of the water. Lake Superior is subject to severe storms and the effect of the waves upon the sandstone of the "picture rocks" of Grand Island presents innumerable fantastic and very remarkable forms. The lake never freezes, but cannot be navigated in winter on account of the shore ice. At the west end of the lake, at the mouth of the St Louis, is situated the city of Duluth, a place of considerable importance as the eastern terminus of the Northern Pacific Railway, and of the St Paul and Duluth Railway, which runs to St Paul on the Mississippi, 155 miles south of Duluth.[2]

St Mary's river, 55 miles long, is the only outlet from Lake Superior, and its course to Lake Huron is but a succession of expansions into lakes and contractions into rivers. St Mary's rapids, which in a distance of half a mile absorb 18 feet out of the total fall of 22 feet between the two lakes, are avoided by a ship canal, constructed in 1855.

As originally built, the canal was 1 mile long, had a width of 100 feet at the water line and a depth of 12 feet. The locks were two in number, combined, each 350 feet in length, 70 in width, with a lift of 9 feet. At the time the canal was made these dimensions were sufficient to pass any vessel on the lakes fully laden, but by 1870 it became necessary to provide for more rapid lockage and for the passage of larger vessels. Accordingly the old canal was widened and deepened, and a new lock constructed, 515 feet long and 80 wide,—the width of the gates being 60 feet, the lift of the lock 18, and the depth of water on the mitre sills 17. There is now everywhere a navigable depth of 16 feet from Lake Superior through St Mary's Falls Canal and St Mary's river to Lake Huron. In 1883 the registered tonnage passing the canal was 2,042,295 tons,—the annual increase of tonnage during the previous fifteen years having averaged 107,313 tons. The United States Government engineers have already presented a project for still further improvements, namely, to replace the old locks by one only with a length of 700 feet and a width of 70, and with a depth of 21 feet on the sill.

Lake Huron is 270 miles long and 105 broad and has an area of 23,000 square miles (the area of its basin, including the lake, being 74,000), a mean depth variously stated at from 700 to 1000 feet, and an altitude above the sea of 574 feet. Georgian Bay on the north-east lies entirely within the region of Canada, whilst Thunder Bay and Saginaw Bay on the west and south-west are in the State of Michigan. The north and north-east shores of Lake Huron are mostly composed of sandstones and limestones, and where metamorphic rocks are found the surface is broken and hilly, rising to elevations of 600 feet or more above the lake, unlike in this respect the southern shores skirting the peninsulas of Michigan and south-western Ontario, which are comparatively flat and of great fertility. As in Lake Superior, regular terraces corresponding to former water-levels of the lake run for miles along the shores of Lake Huron at heights of 120, 150, and 200 feet; and deposits of fine sand and clay containing freshwater shells rise to a height of 40 feet or more above the present level of the water. At several places these deposits extend to a distance of 20 miles inland. The chief tributaries of the lake on the Canadian side are the French river from Lake Nipissing, the Severn from Lake Simcoe, the Muskoka, and the Nottawasaga, all emptying into Georgian Bay; and on the United States side the Thunder Bay river, the Au-Sable, and the Saginaw.

Lake Michigan is entirely in the territory of the United States. It has a maximum breadth of 84 miles and its length is 345 miles from the north-west corner of Indiana and the north part of Illinois to Mackinaw, where it communicates with Lake Huron by a strait 4 miles wide at its narrowest part. Its depth is variously stated at from 700 to 1800 feet. Its altitude above sea-level is 578 feet. Its basin is 70,040 square miles in area, of which the lake occupies 22,400. Five of its tributaries are from 135 to 245 miles in length. The country round Lake Michigan is for the most part low and sandy. The rocks are limestones and sandstones of the Sub-carboniferous groups, lying in horizontal strata and never rising into bold cliffs. Along the south shore are Post-tertiary beds of clay and sand lying a few feet above the level of the lake, the waters of which probably at one time found their way by the valleys of the Illinois and the Mississippi into the Gulf of Mexico. Lake Michigan

Chicago (population, 503,185 in 1880) is situated at the south-west angle of the lake. In the receipt and shipment of grain and pork it is the largest market in the world. In 1883 12,015 vessels with a tonnage of 3,980,837 tons cleared from the harbour. Comparing the decades of 1864-73 and 1874-83 the total export in quarters of wheat and corn from Chicago was as follows:—

	Lake.	Rail.	Total.
1864-73	43,884,196	6,328,337	50,212,533
1874-83	66,265,175	27,342,140	93,607,315
	110,149,371	33,670,477	143,819,848

In 1883 the export of grain by the lakes amounted to 6,850,722 quarters (of which 68·1 per cent. were shipped direct to Buffalo and only 6·3 per cent. to Kingston and Montreal) as against 3,146,000 sent by rail. The first appropriation for the harbour of Chicago, made in 1833, was expended in cutting a straight outlet from the Chicago river into the lake. The available depth was only 2 feet, but since then the harbour accommodation has been extended, by means of piers, dredging, and a breakwater, to accommodate vessels of 14 feet draught.

The harbour works at Chicago, as well as at other lake and river ports, are constructed simply of cribs or boxes, composed of logs 12 by 12 inches, filled with stone, and joined to each other, after they have finally settled down, by a continuous timber superstructure raised a few feet above the level of the water. On this plan breakwaters, piers at the mouths of rivers, and wharves have been built within the last sixty years at the most important points along the shores of the St Lawrence lakes, as well as at most of the river harbours communicating with the Atlantic; and experience has proved that no cheaper and better system could have been devised for such localities.

The St Lawrence leaves Lake Huron by the St Clair river at Sarnia, and after a course of 33 miles enters Lake St Clair, 25 miles long, and terminating at the head of the Detroit river, near the city of Detroit in Michigan. Eighteen miles farther on the St Lawrence, with a descent of 11 feet, enters Lake Erie. The navigation through the St Clair river is easy throughout, but in Lake St Clair there are extensive sandbanks covered with a depth of water varying from 6 to 10 feet. Previous to 1858 much inconvenience was experienced in navigating the lake owing to its insufficient depth; but at the end of that year the Governments of the United States and Canada dredged a canal through the bed of the lake, which is of soft material, to a minimum depth of 12 feet, with a width of 300 feet. This channel has since been deepened to 16 feet over a width of 200 feet, and works are now in progress to deepen the rocky shoal called the "Lime-Kiln Crossing" in the Detroit river to 18 feet, to enable vessels drawing 15 feet to pass with safety from lake to lake in stormy weather.

The peculiar features of Lake Erie are its shallowness and the clayey nature of its shores, which are generally low. The south shore is bordered by an elevated plateau, through which the rivers, which are without importance as regards Lake Erie, have cut deep channels. The mean depth of the lake is only 90 feet and its maximum depth 204. Owing to its shallowness it is easily disturbed by the wind, and is therefore the most dangerous to navigate of all the great lakes. Its length is 250 miles and its greatest breadth 60. The area of the basin of Lake Erie is 39,680 square miles, including 10,000 square miles, the area of the lake. Its waters are 564 feet above the sea and 330 above Lake Ontario. The extreme difference observed in the level of the lake between 1819 and 1838 was 5 feet 2 inches, but the average annual rise and fall (taken on a mean of twelve years) is only 1 foot 1½ inches. The mean annual rainfall is 34 inches. The navigation of Lake Erie usually opens about the middle of April and closes early in December. Besides the Erie and the Welland Canals, the lake has two other great canal systems on its south shore,—the Ohio and Erie Canal, from Cleveland to Portsmouth, and the Miami and Erie Canal, from Toledo to Cincinnati.

Buffalo (population, 171,500 in 1883) is situated at the north-east angle of Lake Erie, and is therefore much exposed to the violence of south-west winds, in which direction the lake has a "fetch" of 200 miles. Thus more than ordinary care has been taken to provide safe harbour accommodation for the large fleets of vessels constantly arriving at Buffalo from the upper lakes. The Buffalo river, which has been made navigable for more than a mile, is protected at its mouth by a breakwater, 4000 feet long, built at about half a mile from the shore. The harbour thus formed allows of the entrance of vessels of 17 feet draught as against 13 in 1853. Not only is the port situated at the head of the Erie Canal and within an hour's sail of the Welland Canal, but it is the western terminus of the New York Central, Erie, and several other railways. The possession of these exceptional advantages has constituted Buffalo the great commercial centre of the inland seas of North America. For the six years ending 1883 the yearly average shipments of wheat and corn received by lake at Buffalo, by the Erie Canal, and by rail from elevators was 5,555,000 quarters by canal and 2,320,000 by rail, or 70·20 and 29·80 per cent. respectively. There are 38 elevators in the city, comprising storage, transfer, and floating elevators, with a combined storage capacity of 1,125,000 quarters and a daily transfer capacity of 333,000 quarters. During the ten years ending 1883 the annual average number of lake vessels arriving and departing from Buffalo Creek numbered 7438, the aggregate tonnage was 4,165,098 tons, and the average size of craft 560 tons.

In 1883 the enrolled tonnage of the United States vessels for the northern lakes, and the enrolled registered tonnage of steam and sailing vessels in the province of Ontario, including tugs and barges on the Ottawa river and barges at Kingston, were as follows (Table II.):—

	United States. No	United States. Aggregate Tonnage.	Canada. No.	Canada. Aggregate Tonnage.
Sailing vessels	1373	310,454	452	44,000
Steam vessels	1149	304,649	352	64,000
	2522	615,103	804	108,000

Freight propellers are now rapidly doing away with sailing vessels, or causing them to be converted into barges or consorts. The rapid increase in their tonnage capacity has been remarkable. In 1841 there was only 1 freight propeller with a tonnage of 128 tons; in 1850 there were 50 with an average of 215 tons, in 1860 there were 197 with an average of 340 tons, and in 1880 there were 202 with an average of 689 tons.

The Erie Canal connects Lake Erie with the Hudson river at Troy and Albany and with Lake Ontario at Oswego. The movement of freight of all kinds by the canal was 3,602,535 tons in 1873, and 3,587,102 in 1883, and the average annual movement from 1874 to 1883 was 3,447,464 tons. This canal was constructed in 1825 by the State of New York, for the passage of vessels of 60 tons; but by the year 1862 it was sufficiently enlarged to allow of the passage of vessels of 240 tons. The dimensions and capacity of the canal and its two principal feeders are given in Table III.:— Canal

Locality.	Length in Miles.	Size of Canal. Width on Surface.	Size of Canal. Width on Bottom.	Size of Canal. Depth of Water.	No. & Size of Locks. No. of Locks.	No. & Size of Locks. Length.	No. & Size of Locks. Width.	No. & Size of Locks. Rise of Lockage.
		Feet.	Feet.	Feet.		Feet.	Feet.	Feet.
Buffalo to Albany	351	70	56	7	72	110	18	655
Oswego to Syracuse ..	38	70	56	7	18	110	18	155
Lake Champlain to Albany	66	59	35	6	29	100	18	180
Albany to New York by the Hudson river	455 / 145							

The cost of construction, maintenance, and management of the 455 miles of canal up to 30th September 1873 amounted to £17,460,000. A project has for some time been under serious consideration for the enlargement of one tier of the present locks and the deepening of the canal so that between Buffalo and Albany there would nowhere be a less depth than 8 feet. The estimated cost of this work is about £1,600,000.

The Welland Canal flanks the Niagara river and is 27 miles in length from Port Colborne on Lake Erie to Port Dalhousie on Lake Ontario. It was opened in 1833 for the navigation of small vessels and was first enlarged in 1844. Vessels, however, continued to increase in size until in 1860 there were 341 with an aggregate tonnage of 143,918 tons which were unable to pass through the enlarged canal. In 1870 the number that could not pass had increased to 384, with an aggregate tonnage of 194,685 tons; in 1880 to 460, with an aggregate tonnage of 287,342 tons; and in 1883 (notwithstanding the completion of the second enlargement in 1882) to 557, with an aggregate tonnage of 398,808 tons. The cost of the canal including its maintenance up to 30th June 1883 was $20,859,605. Its dimensions are now as follows:—number of locks, 25; dimensions, 270 by 45 feet; total rise of lockage, 326½ feet; depth of water on sills, 12 feet. The movement of freight of all kinds by the canal was 1,330,629 tons in 1873 and 827,196 in 1883, and the average annual movement for the decade ending 1883 was 986,441 tons. This serious falling off in traffic is partly due to the numerous competitors by lake and rail which have sprung up during the last ten years for the transportation of products to the east, but principally to the deepening of the channels and harbours of the upper lakes, a work that has encouraged the construction of

[1] The distance from Belle Isle to Liverpool is 2234 statute or 1942 geographical miles.

[2] Lake Nipigon is situated 50 miles to the north of Lake Superior, into which it drains by the river Nipigon; it is still very little known except from the report of Professor Bell of the Geological Survey. It is 313 feet above the level of Lake Superior, and in some parts is upwards of 500 feet in depth. The lake is thickly studded with islands; its shores are undulating and sometimes hilly; and owing to its numerous indentations its coast-line measures 580 miles.

a class of vessels that cannot make use of the Welland Canal even after its last enlargement. In order to meet this strong competition the Government of the Dominion of Canada was called upon still further to deepen the canal so as to allow the passage of the largest existing lake vessels without lightering; and in 1886 contracts were concluded for deepening it to 14 feet.

The Niagara river flows from Lake Erie to Lake Ontario in a northerly direction. Its width between Buffalo and Fort Erie (the site of the international iron-trussed railway bridge; see sketch map of Niagara river in vol. xvii. p. 472) is 1900 feet and its greatest depth 48. At this point the normal current is 5½ miles an hour,—the extreme variation in the level of the river when uninfluenced by the wind being only 2 feet. During south-west gales, however, the water occasionally rises as much as 4 feet in a few hours, and at such times the current attains a maximum velocity of 12 miles an hour. Two miles below the bridge the river is divided into two arms by Grand Island, at the foot of which they reunite and spread over a width of 2 or 3 miles. The river then becomes studded with islands, until about 16 miles from Lake Erie, after a total fall of 20 feet, it narrows again and begins to descend with great velocity. This is the commencement of the rapids, which continue for about a mile with a total descent of 52 feet. The rapids terminate in the great cataract of Niagara, the fall of which on the American side is 164 feet and on the Canadian side 150 feet. The falls are divided by Goat Island, which rises 40 feet above the water and extends to the very verge of the precipice, where the total width of the river, including the island, is 4750 feet. The Horse-Shoe Fall on the Canadian shore is 2000 feet long, and the depth of water on the crest of the fall is about 20 feet. The American fall is only one-half that length, and discharges less than one-fourth the volume of the Horse-Shoe Fall. United, they discharge nearly 400,000 cubic feet per second or 41,000,000 tons per hour. The upper layer of the escarpment down which this enormous mass of water leaps consists of hard limestone about 90 feet thick, beneath which lie soft shales of equal thickness, which are continually being undermined by the action of the spray, driven violently by gusts of wind against the base of the precipice. In consequence of this action and that of the frost, portions of the incumbent rock overhang 40 feet, and often, when unsupported, tumble down, so that the falls do not remain absolutely stationary in the same spot. Sir C. Lyell in 1842 came to the conclusion that the cataract was receding at an average rate of 1 foot annually, "in which case it would have required 35,000 years for the retreat of the falls from the escarpment at Queenstown to their present site." From the foot of the falls to Queenstown, a distance of about 7 miles, the river descends 104 feet through a gorge from 200 to 300 feet deep and from 600 to 1200 feet wide. Midway in this deep defile the turbulent waters strike against the cliff on the Canadian side with great violence, and, being thus deflected from west to north, give rise to the dangerous eddy called the "Whirlpool." The escarpments end abruptly at Queenstown, where the waters suddenly expand to a great width, and finally, 7 miles farther on, tranquilly flow into Lake Ontario.

About one-third of a mile below the cataract a carriage-road suspension bridge (built in 1869 by Mr Samuel Keefer) spans the river with a single opening of 1190 feet, at a height of 190 feet above the water; and 2 miles lower down Roebling's celebrated railway and road suspension bridge (completed in 1855) crosses the river at a height of 245 feet above the water with a single span of 800 feet. In November 1883 a double-track railway three-span iron and steel cantilever bridge, situated about 100 yards above Roebling's bridge, was completed for the New York Central and Michigan Central Railways. The total length of the bridge is 910 feet and that of the centre span 470 feet. The height from the water to the level of the rails is 239 feet.

Lake Ontario is the easternmost and smallest of the great lakes of the St Lawrence system. Its basin drains 29,760 square miles, including the lake surface of 6700 square miles. The length of the lake is 190 miles, its greatest width 52 miles, its mean depth 412 feet, and its elevation above the sea 234 feet. It never freezes except near the shore. Its chief tributaries are the Trent on the north shore and the Genesee and the Oswego on the south shore, and its chief ports, Toronto, the capital of Ontario, 32 miles north of Port Dalhousie, at the foot of the Welland Canal; Oswego, at the south-east angle of the lake; and Kingston, at its north-east extremity, 52 miles north of Oswego.

Trent river navigation is a term applied to a series of reaches which do not, however, form a connected system of navigation, and which in their present condition are efficient only for local use. The series is composed of a chain of lakes and rivers extending from Trenton, at the mouth of the Trent on the Bay of Quinté, north shore of Lake Ontario, to Lake Huron. The new works (which will have locks 134 feet by 33 feet with a depth of 5 feet on sill) will give communication between Lakefield, 9½ miles from Peterboro, and Balsam Lake, the headwaters of the system, opening up a total of about 150 miles of direct and lateral navigation.

The port of Oswego has been in direct communication with the Hudson river since 1822, by means of a canal of small capacity as far as Syracuse, and thence by the Erie Canal to Troy and Albany. It is now proposed by the United States Government to enlarge this route under the name of the Oneida Ship Canal, so that vessels arriving from the Welland Canal with cargoes of 50,000 bushels of wheat may be able to tranship them at Oswego into steam barges holding 25,000 bushels, or into barges to be towed with a capacity of 28,000 bushels. The length of the proposed route by the Oneida Lake and Durhamville is 200 miles, with a lockage of 609 feet; and its estimated cost, including 20 ascending and 47 descending locks (each 170 by 28 by 8½ feet), is $25,213,857. The Government of the Dominion of Canada has also under consideration the following projects to connect the St Lawrence with Lake Huron:—(1) the Ottawa and Georgian Bay Canal, from Montreal, by the Ottawa and Lake Nipissing, to French river; (2) the Toronto and Georgian Bay Canal, by way of Lake Simcoe; (3) the Hur-Ontario Canal, from Hamilton to Lake Huron, near Port Franks.

Kingston, being the port of transhipment for Montreal of three-fourths of the grain that arrives from the upper lakes, is a place of some commercial importance. Formerly lake vessels were sent from Chicago to Montreal through the St Lawrence canals without breaking bulk. But it was afterwards found cheaper to transfer grain at Kingston, and to send it down the St Lawrence in barges, the cost of such transfer being only half a cent per bushel. Kingston is also at the south terminus of the Rideau Canal, which connects it with the city of Ottawa. Kingston to Montreal.

This canal, 126 miles long, has 33 locks ascending 292 feet and 14 descending 165, and admits vessels 130 by 30 feet drawing 4½ feet of water. It was constructed in 1826-32 by the British Government at a cost of about $4,000,000, chiefly with a view to the defence of the province, but since the opening of the St Lawrence canals it has become of comparatively little importance as a means of transport,—the distance from Montreal to Kingston being 68 miles longer by the Rideau and Ottawa Canals than by the St Lawrence.

Almost immediately after leaving Kingston, that part of the St Lawrence commences which is called the Lake of a Thousand Islands. In reality they number 1692, and extend for 40 miles below Lake Ontario. At this point the Laurentian rocks break through the Silurian, and reach across the St Lawrence, in this belt of islands, to unite with the Laurentian Adirondack region in the State of New York. Near Prescott, a town on the Canadian side about 60 miles below Kingston, begins the chain of the St Lawrence canals proper, which were constructed to overcome a total rise of 206½ feet,—the number of locks being 27 and the total length of the six canals 43½ miles.

The canals are called, in the order of their descent, the "Galops," "Rapid Plat," and "Farran's Point," with an aggregate length of 12½ miles (the three forming with their intervening 15 miles of river navigation what is called the Williamsburg Canals), the "Cornwall," 11½ miles long, the "Beauharnois," connecting Lakes St Louis and St Francis, 11½ miles long, and the "Lachine," 8½ miles long. The locks of the first five canals, constructed in 1845-48, are 200 feet in length, with a depth of from 7 to 10 feet on their sills at exceptionally low water, and, with the exception of the "Galops" and "Cornwall," which are 55 feet wide, their width is 45 feet. The Lachine Canal was begun in 1821 and completed in 1824 for the navigation of vessels drawing 4½ feet, but it was not until 1843-48 that it was widened and deepened to the dimensions of the upper canals. It has lately been still further enlarged, and is already provided with locks 270 by 40 feet, with an available depth of 14 feet. The canal was closed on 1st December 1882 and opened on 1st May 1883,—the navigation having been interrupted as usual by the ice for a period of five months. The cost to the provincial and Dominion Government of the six canals, including their maintenance to 30th June 1883, was $14,454,508. The five upper canals are now being enlarged to the dimensions of the improved Lachine Canal.

Near Cornwall, on the left bank, 50 miles below Prescott, the intersection of the parallel of 45° determines the point where the St Lawrence and its lakes (Lake Michigan excepted), having been an international boundary from the head of Lake Superior, become exclusively Canadian. Immediately below Cornwall the river flows through Lake St Francis, which has a length of about 30 miles and a width varying from 2 to 5 miles. In the long reach of the river below the lake it has been calculated by the Canadian canal commissioners that the mean volume of water discharged is 510,000 cubic feet per second. Ten miles below the foot of Lake St Francis, near the head of the island of Montreal, the river flows into Lake St Louis, which receives the main body of the Ottawa river, a small fraction of whose waters is delivered into the St Lawrence at the foot of the island 35 miles lower down the stream.

The Ottawa river, which is 600 miles long, drains 60,000 square miles, and contributes a volume of 90,000 cubic feet per second to the St Lawrence, of which it is the largest tributary. Between Lake St Louis and the city of Ottawa, the capital of the Dominion, and perhaps the largest market for lumber in the world, the St Anne's lock (23½ miles from Montreal), Carillon Canal, Chute-à-Blondeau Canal, and the Grenville Canal (63½ miles from Montreal) have been constructed, and are now enlarged to 200 by 45 feet, with a depth of 9 feet on their sills, except the Chute-à-Blondeau Canal, whose single lock has still its original dimensions of 130 by 32 feet with only 6 feet on its sill. The total lockage between the Lachine Canal and Kingston by the Rideau Canal (the entrance to which is 119½ miles from Montreal) is 509 feet (345 rise, 164 fall) and the number of locks is 55. On the upper Ottawa—the Culbute Canal and L'Islet rapids—there are two locks 200 feet long, 45 wide, and 6 deep, with a lift of 18 to 20 feet. The cost of the Ottawa canals, including the Rideau Canal, to 30th June 1883 was $9,126,125.

After leaving Lake St Louis the St Lawrence dashes wildly down the Lachine rapids, a descent of 42 feet in 2 miles, and 8 miles farther on, after passing beneath the 25 spans of the Victoria Tubular Railway Bridge, which has a length of 9144 feet, reaches the quays of Montreal, 198 miles below Kingston. In the beginning of the present century vessels of over 300 tons burden were unable to reach the city, but by deepening Lake St Peter and the shoals in the St Lawrence between Quebec and Montreal the latter has been made accessible to vessels of 4000 tons burden and drawing 25 feet of water. Work is being steadily continued and will not cease until a depth of 27½ feet is attained, so as to enable the largest vessels afloat to reach the long stretch of new deep-water quays. In 1883 the tonnage of the 660 sea-going vessels which visited the port was 664,263 tons, of which 605,805 belonged to 264 steamships, so that only 9 per cent. of the freight arriving from sea was carried in sailing vessels. The St Lawrence has an average width of 1¾ miles for 46 miles from Montreal down to Sorel on the right bank, at which point it is joined by the Richelieu river, a tributary that drains 9000 square miles.

The Richelieu river is made navigable from its mouth to Lake Champlain, a distance of 81 miles to the United States boundary, by a dam and lock at St Ours, half a mile long (14 miles above Sorel), and a canal of 12 miles in length 32 miles further up the river, known as the Chambly Canal. These give a navigable depth of 7 feet, allowing vessels 114 feet long, 23 broad, and drawing 6½ feet of water, to pass through the canal from end to end. The cost of the works to 30th June 1867 was $756,249. The total length of navigation between Montreal and New York by the Richelieu Canal, Lake Champlain, the Champlain and Erie Canal, Albany, and the Hudson river is 456 miles. The Richelieu Canal, which already carries a freight of 350,000 tons annually, is to be enlarged, and a canal is to be constructed from Lake St Louis at Chaughnawaga, above Lachine, to St Johns on the Richelieu river, in connexion with the Chambly Canal, to connect the St Lawrence with Lake Champlain by a new channel, which it is proposed should have the same dimensions as the improved Welland Canal. The cost of the proposed Chaughnawaga Canal, which would have a length of 32 miles and a lockage of only 29 feet, is estimated at $5,500,000.

Immediately below Sorel the river flows into Lake St Peter, 20 miles in length by 9 in width, through which prior to 1851 no vessel drawing more than 11 feet could pass. Since then a cutting 300 feet wide has been dredged to a depth of 25 feet. At Three Rivers, 86 miles below Montreal, the St Lawrence first meets the tide and receives from the north the waters from the St Maurice, which drains about 16,000 square miles. Nearing Quebec, the river, which maintains an average width of 1½ miles from Lake St Peter, narrows into a width of three-quarters of a mile at Cape Diamond, on the left bank, 160 miles below Montreal. The depth here is 128 feet and the rise of spring tides 18 feet.

The lower town of Quebec, which has extensive harbour accommodation, is built on reclaimed land around the base of the cape, one of its sides being washed by the river St Charles, which here flows into the St Lawrence. At the mouth of the St Charles the Princess Louise embankment, 4000 feet long by 300 wide, encloses a tidal area of 20 acres, having 24 feet of depth at low water. Connected with it is a wet dock, which is to have a permanent depth of 27 feet with an area of 40 acres. On the opposite side, at Pointe Levis, the Lorne graving-dock is nearly completed. Its dimensions are 500 feet in length, 100 in width, and 25½ feet depth of water on its sill. During the year ending June 1884 the departures for sea of vessels from Quebec were 698, with an aggregate burthen of 686,790 tons.

The Canadian Government have sanctioned the proposal to construct a railway bridge across the St Lawrence within a few miles of Quebec, at a point where the river narrows to a width of 2400 feet at high water. The area of the waterway at high water is 200,000 square feet and at low water 160,000. For a width of about 1400 feet in the centre of the channel the water shelves rapidly from either shore into deep water, until it attains a maximum depth of nearly 200 feet. The proposed bridge, as designed by Messrs Brunlees, Light, & Claxton Fidler, will consist of three principal spans, entirely of steel, resting on masonry piers founded on the rock. The central span will have a clear width of 1442 feet, the underside of the superstructure being 150 feet above high water.

Seven miles below Quebec the St Lawrence is 4 miles wide and divides into two channels at the head of the Island of Orleans, nearly opposite which, on the north shore, are the celebrated falls of Montmorency, with a perpendicular descent of 240 feet and a width of 50 feet. At the foot of the island, which is 22 miles long, the river expands to a width of 11 miles. This width increases to 16 miles 90 miles farther on, at the mouth of the river Saguenay, which drains an area of 23,716 square miles.