steadily on, having been extended along the sea coast and also along the Great Lakes, and many of the states and territories have been covered by its operations, including some in the far west, *viz.*, Nevada, Colorado, Utah, New Mexico, Montana, Idaho and part of Arizona.

"Several of the States have conducted independent trigonometrical surveys of their own territory, including Massachusetts, California, New Jersey and New Hampshire, and in other States they are in progress.

"All the foregoing surveys are based on triangulation.

"It may be asked what are the practical benefits to be derived from a trigonometrical survey, and what is there to justify the expenditure of the large sum of money which a survey of this kind would ultimately cost. To make the point of practical benefit clear, the following will be readily understood by all:—

"It is stated by an eminent American engineer that 'If the State of Massachusetts had had a good topographical map in 1838, some $20,000,000 would probably have been saved in its public railway expenditure.'

"Mr. Sandford Fleming, C.M.G., in his report to the minister of public works, dated April 5th, 1879, says: 'If the railways of Ontario has to be established *de novo*, a careful study of the requirements of that province would enable any intelligent engineer of ordinary experience to project a new system which at one-half the cost would far better serve the public, and would meet every demand of traffic, would more fully satisfy every expectation, and which would not result in disappointment and loss to those who have been induced to invest their means in that which has proved to many an unprofitable undertaking.'

"If to-day a railroad is projected in England, or any other country possessed of a good topographical map, preliminary surveys, such as we are obliged to make, are unnecessary, for from these plans the lengths and grades of any proposed line can be determined with sufficient accuracy to enable a final location to be made.

"In carrying on a survey of the character contemplated it is necessary to run lines of exact levels from station to station, and thus we would have the elevations of points all through the settled portions of the country, and in future operations, in which levelling is a feature, all levels could be referred to a common datum line (sea level, for instance), and when railway lines are pushed back into the wooded interior, the physical character of which is but little known, we would then have some definite idea of main watersheds and valleys, to guide future operations, instead of relying, as is at present done, on guesswork and hearsay evidence.

"Among other benefits to be derived from a survey of this kind are the following: Our extensive coast line, both in the Gulf of St. Lawrence, on the Atlantic and Pacific seaboards, and also in our inland waters, has been very roughly determined in many places, and in consequence many disasters happen to shipping, and many valuable lives are lost annually, which would in a great measure be avoided were we in possession of reliable charts of our waters; and one of the first requisites in making the hydrographic surveys necessary to provide the data for compilation of these charts is that certain points on the shore should be accurately fixed. It may be mentioned in connection with the Hydrographic Survey of Georgian Bay, at present (1888) being carried on under the direction of Staff Commander Boulton, R.N., that Commander Boulton stated before the D.L.S. Association, at its last annual meeting, that in making his survey he had not been able to connect his work with any point accurately determined by Canadian authority, but had to use points established by the United States Coast and Geodetic Survey.

"On our inland lakes and waters large sums are annually spent in harbor and other improvements, and yet the geographical positions of these harbors and waters are not accurately shown on any map or chart.

"A large sum has been spent in building the Murray Canal between Lake Ontario and the Bay of Quinte, but there is no correct chart of the Bay, and a stranger attempting to navigate a deeply laden vessel in its waters would probably meet with disaster. This has happened time and again, and will continue until we have an accurate chart of the Bay, and, as has already been said, the work of making these charts would be greatly expedited by having points along the shores established by a trigonometrical survey from which to begin the hydrographic survey.

"Numerous isolated surveys have been made under various departments of the government, at points on the Atlantic coast, the Gulf of St. Lawrence and in the Great Lakes; it is also proposed by the Militia Department to make a series of reconnaissance surveys at different points; all these surveys, made, or to be made, give valuable results, but they cannot be considered complete until they are connected. To this end a carefully executed triangulation is necessary.

"Again, with the increase in the value of real property, any work having in view the permanent marking of these points which would definitely fix the positions of boundaries of real estate, is for the public good. In many of the provinces the boundaries of valuable properties are in most cases dependent on the durability of wooden posts, a few marks on trees, or the testimony of the oldest inhabitants, and as a consequence expensive litigation often arises; in fact, it may safely be said that the amount annually expended in litigation regarding boundaries would go a long way towards paying for the cost of a trigonometrical survey.

"Were the boundaries, especially those of large areas, such as counties, townships and concessions, accurately defined by a trigonometrical survey, similar to that made by the countries herein referred to, all doubt as to their position would be forever set at rest.

"At the present time, throughout the Dominion, every city and many of the towns and villages are looking about for means of obtaining a good water supply or of improving the supply they have.

"Gravity being the best method of utilizing a water supply, is generally first sought after, but the information necessary to determine the availability of a supply by this means can now only be had by expenditure of large sums of money, as has been lately seen in Toronto.

"Had there been a good topographical map in existence, that expenditure would have been unnecessary.

"In drainage work the information derivable from a survey of this kind would be invaluable, and as our agricultural population is waking up to the benefits arising from proper drainage, no time should be lost in giving them this aid. The maps would enable any engineer to determine by a simple calculation the area of any basin to be drained and to know accurately the size of drain necessary and its proper location, and the survey would do away with all litigation arising from parties claiming that their lands do not lie in the basin to be drained, as a reference to the map would show at a glance the natural drainage outlet for any piece of land.