

would to-day, on long voyages, imperil ship and life, did the mariner not know the pathways of the ocean, as marked out in the sky above by the eternal lights of the heavens, the only Pharos whose beams never fail, and which no tempest can shake from its foundation. A ship's place at sea can be determined, theoretically, within a mile, practically, however, perhaps not within three or four miles; evidently greater precision than this is highly desirable, in rounding certain dangerous headlands, which push their rock-bound and sometimes unlighted bastions, far into the sea. Mathematicians and mechanicians say, that we may count among the promises of astronomical science, this greater precision, and that for no distant day.

The discovery of Amercia and the proofs of the real shape of our planet, elevated geography to its present high rank. That branch of knowledge owes even more than its existence as a science to astronomy, it derives its rules and methods from the same source. Observations of the heavenly bodies furnish the means of performing the most important operations of practical geography; for example, the determination of distance and direction. Astronomy marks out lines of latitude and longitude which lie at the bottom of all descriptive geography. Some even of our most important political and administrative arrangements depend upon the co-operation of astronomy. Among these may be mentioned the land systems of Canada and the United States and the boundaries of the country. Limits of grants were formerly ascertained by sensible objects, as trees, streams, rocks, hills, and by reference to adjacent portions of land. This uncertainty of boundaries, met with in the older provinces and states, has been, and is, the cause of never-failing litigation. In the great West of both countries, the entire public domain is laid off into ranges, townships, sections and smaller divisions with unerring certainty, and under this system, scarce a case of contested location and boundaries has ever presented itself. The general land office contains maps and plans on which every quarter-section of the public land is laid down with mathematical precision. When we consider the tide of population annually flowing into the public domain, and the immense impor-

tance of its efficient and economical arrangement, the utility of this application of astronomy will be duly appreciated.

Canada will, no doubt, some day undertake a complete coast-survey, similar to that at this moment in progress in the United States. Such an operation is of the utmost consequence in reference to the geography, commerce, navigation and hydrography of the country. The entire work, it need scarce be said, is one of practical astronomy. Astronomical observations furnish by far the best means of defining the boundaries of states, where lines are of great length and run through unsettled countries. Natural indications, like rivers and mountains, however distinct in appearance, are, in practice, subject to unavoidable error. By the treaty of 1783 a boundary was established between Canada and the United States, depending partly on the courses of rivers and partly on the highlands dividing the waters which flow into the Atlantic ocean from those which flow into the St. Lawrence. It took twenty years to find out which river was the true St. Croix, that being the starting point. Forty years were passed in the unsuccessful attempt to determine the highlands mentioned, and just as the two countries were on the verge of war, the controversy was settled by compromise. Had the boundary been accurately described by lines of latitude and longitude, no dispute could have arisen. No dispute has ever arisen as to the boundary between Canada and the United States, where it runs for thousands of miles through untrodden prairies and over pathless mountains along the 49th parallel of north latitude.

To consider briefly the promises of astronomy. In a series of papers which appeared in the *Century* during the course of the years '84, '85, '86 and '87, and which have since appeared in book form, under the title of "The New Astronomy," the renowned director of the Allegheny observatory, Mr. S. P. Langley, treats of the prospects of astronomy's securing to man other and beyond all comparison, greater material advantages than any he has yet derived from it. These Professor Langley groups under three heads:

1. Motive power.
2. Forecasts of the weather.
3. Connection with electricity.