

## AZIMUTH.\*

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VERY naturally in deciding to read a paper before the association on any subject the first consideration is to find out what has been previously said on the subject. By the aid of the very excellent index of subjects prepared by our indefatigable secretary, and published in the Proceedings for 1912, it is very simple under the head of "Azimuth," to turn up all which has been said or written before this association on that subject.

The first paper on the subject was by Mr. John McAree in 1887 entitled "Solar Azimuths," but while Mr. McAree evidently preferred the method he described of obtaining the true azimuth, he still stated that he believed the method by observation on the Pole star to be the more accurate.

In the Proceedings for the next year, 1888, appears an article by Mr. E. Deville, the present surveyor-general for the Dominion, giving formulae for finding the time by observation in the vertical of Polaris.

The next year, 1889, a paper appeared entitled "An Ephemeris of Stars in the Vertical of Polaris," by Mr. F. L. Blake, which introduced a set of tables by that gentleman, for use in obtaining the azimuth of the Pole star, by observation of a time star in the same vertical.

There is now a gap of 10 years in the proceedings, during which period the subjects of azimuth and time are not dealt with, but in 1899 Professor L. B. Stewart presented a highly technical and very carefully prepared paper, again on the subject of "Time and Azimuth by Stars Observed in the Vertical of Polaris." This paper brought forth one in the following year, 1900, by Mr. Cyrus Carrol, entitled "Azimuth and Time by Observation on Polaris," in the discussion on which it was shown that the results obtained agreed very closely with those by the more intricate method described the previous year by Professor L. B. Stewart.

Mr. Otto Klotz, also in 1900, provided a paper on "Azimuth by Polaris," which dealt in simpler form with the formulae used the previous year by Professor L. B. Stewart, i.e., for observations on Polaris and a time star in the same vertical. The discussion on this paper was interesting in that it brought out the fact that the solar compass was no longer in general use by the surveyors of Ontario, and the prophecy from the president of that year, Mr. Geo. Ross, of Welland, that the time was coming when all registered plans and descriptions would have to show the true astronomic courses.

There was then another considerable interval, six years, in which the subject of azimuth was not touched in our proceedings, but in 1906 Mr. F. L. Blake again approached the subject in a clear and extremely practical paper embodying a set of tables for determining azimuth by observation on Polaris at any time. The table of corrections given in this paper for the changes of declination throughout the year was, of course, for the year of issue only, i.e., 1906. These tables, together with the accompanying instructions as to their use, were, I believe, issued by the department to surveyors engaged on municipal surveys in that year, and identified 1906 as the year in which our association attained its high-water mark, in the direction of supplying its members with an authoritative set of tables, for the ready determination of true azimuth.

The subject was, however, again dealt with in an article by Professor L. B. Stewart in 1909, in which he

discusses a set of tables for use in determining azimuth, which were in that year appearing in *The Canadian Engineer*.

The determination of azimuth has not since 1909 been discussed in our Proceedings, and the tables referred to as published in *The Canadian Engineer* in that year, have ceased. To-day we stand as an association in the position in which we have always stood, with the exceptions of the years 1906 and 1909 referred to, without the data for the easy and accurate determination of a meridian. The thanks of the association is undoubtedly due to those members who have so ably discussed this matter in the past, particularly to Mr. F. L. Blake, and Professor L. B. Stewart, for their continued efforts to provide us with the means of determining a meridian by other than the sitting-up-all-night elongation period. As an association, it would surely be unnecessary for us to rely on the courtesy of any individual, or the publication of any journal unconnected with the association for the supply of the data necessary to enable us to comply readily with the requirements of the Survey Act. The act, however, provides in Sections 27, 31 and 39 and the new Section 47 of last year, that astronomic courses shall be given to lines covered by those sections. There can be no doubt whatever, as has been shown in the discussions on the papers already referred to, that the infrequency of astronomic bearings on all record of the present time in Old Ontario, is due very largely to the want of a ready and comparatively inexpensive method of obtaining the same.

The surveyor called upon to make a survey in Old Ontario usually has to follow out an old plan on which are given bearings and distances. The bearings, as a rule, he knows are only an approximation, and therefore cannot be fully relied on. Thus, of the fundamental data required, a part is lacking. The reason for this he knows to have been the inconvenience and cost of taking an observation. At the present time we are to a great extent perpetuating this malpractice. If the profession of the Ontario Land Surveyor is to be kept up, or should I say brought up, to the status to which it belongs, the information supplied on plans must be as accurate as it is possible to make it.

In the past generation or two the country has been cleared and land has become far more valuable. It is easier now to make an accurate survey than it was thirty or forty years ago. The expense of an accurate survey is now justified, and I find that the people expect accurate work and are willing to pay for it. It would seem to follow that to make our work as accurate as is possible, astronomic bearings should be used in a very large proportion of our every-day work.

The sets of tables issued by the Surveyor-General's Office at Ottawa for the survey of Dominion Lands are designed to enable observations for azimuth and time to be made whenever Polaris is visible, with no more difficulty or fatigue than is encountered in recording any two sights in an ordinary survey, and by their use the reduction of the observation is made so simple that it will occupy only five or ten minutes and will give results always within a limit of error of one minute of arc.

For the use of these tables it is assumed that the surveyor is equipped with a sidereal watch and a transit having a quite ordinary telescope. The use of such a set of tables, compiled for Latitudes  $42^{\circ}$  to  $52^{\circ}$  would enable any of us to record true bearings on a very large proportion of our work, by the use of an ordinary watch and standard time.

It must be borne in mind that while a sidereal watch is an essential on Dominion lands or Northern Ontario

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