The object of the St. Francis River equalization is primarily to reduce the height of flood waters, thus minimizing the risk to bridges and other structures along the waterway, preventing overflow upon adjacent lands and minimizing present losses to lumbering operators caused by the breaking of booms, etc. It would increase the present low-water flow to approximately double the present figures, increasing the available continuous water power, and the capacity of manufacturing plants, as well as the advantages that would accrue to log driving by increasing the length of time each year for operations. Besides, the petitioners claim that the prevention of extreme low-water periods would greatly improve sanitary conditions and domestic water supplies in towns and villages along the river.

TO ESTABLISH A MERIDIAN AT ANY TIME, BY HOUR ANGLE.

By J. A. Macdonald, Ottawa, Ont.

BY the peculiar and ingenious arrangement, prepared originally by Mr. J. B. Shinn, of the U.S. General Land Office, Washington, and issued by the commissioner, a new set of tables designed to enable observations for azimuth to the nearest minute to be made at any hour by an observation of Polaris is now obtainable. By the use of this table, an observation for azimuth can be made at any time when Polaris is visible. All the data necessary to make the observation are presented on two pages. Every surveyor knows how inconvenient it is to await the time of elongation of Polaris, especially in the cold, winter weather, while at times both elongations occur in the daylight hours. By means of this simple table, the observation can be taken at pleasure, simply noting the time (local mean time); the azimuth of the star may be taken out later for that particular time. The annexed diagram shows in their proper relation the various aspects of Polaris in its daily apparent motion around the North Pole.

Hour Angle of Polaris.—In the figure the full vertical line represents a portion of the meridian passing through the zenith, Z (the point directly overhead), and intersecting the northern horizon at the north point N, from which, for surveying or draughting purposes, the azimuths of Polaris are reckoned east and west. The meridian is pointed by the plumb line when it is in the same plane with the eye of the observer and Polaris on the meridian, and a visual representation is also seen in the vertical wire of the transit, when it covers the star on the meridian.

When Polaris crosses the meridian it is said to culminate; above the pole, at S, the passage is called the Upper Culmination, in contradistinction to the Lower Culmination, at S'. The engineer will better understand the diagram by holding it up perpendicular to the line of sight when he looks toward the pole—Polaris is supposed to be on the meridian, where it will be about noon on April 10th of each year. The star appears to revolve around the pole in the direction of the arrows, once in every 23 hours 56.1 minutes, mean solar time. It consequently comes to and crosses the meridian, or culminates, nearly four minutes earlier each successive day. One-quarter of the circle will be described in 5 hours 59 minutes, one-half in 11 hours 58 minutes, and three-quarters in 17 hours 57 minutes.

The hour angles of Polaris expressed in mean solar time (common clock) are counted from the upper meridian, at S, to the west, around the circle from 0 hours 0 minutes to 23 hours 56.1 minutes, and may have any value between the limits named. The hour angles measured by the arcs are 1 hour 8 minutes; 5 hours 55 minutes; 9 hours 4 minutes; 14 hours 52 minutes; 18 hours 1 minute; and 22 hours 48 minutes respectively; their extent is indicated graphically.

All the surveyor has to do, then, is to subtract the time of upper culmination (as found in the tables) from the correct local mean time of observation. The remainder will be the hour angle of Polaris expressed in time.

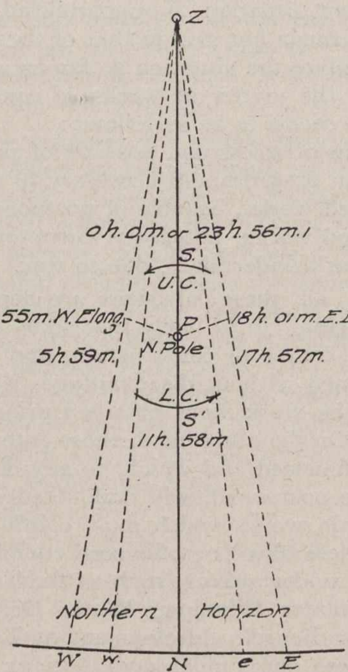

Fig. 1.

The table of culminations answers for all latitudes, and in general, for all longitudes, hence its simplicity. The table, Part II., answers for latitudes 30 deg. to 50 deg., and also distinctly for each year.

Example.—Required the hour angle and azimuth of Polaris for a point in latitude 41 deg. 12 minutes N, at 6 hours 16 minutes a.m., November 19th.

	h.	m.
Astronomical time of observation, Nov. 18th..	18	16.0
Astronomical time U.C. Polaris (Table, Part I.)	9	34.6
(Subtracting)	8	41.4

With this hour angle of Polaris, 8 h. 41.4 m., enter table Part II. Azimuth of Polaris at observation (Table, Part II.) 74 m. or 1 deg. 14 m. W.

These tables combine in two operations the essentials which, under ordinary methods, would require about twenty.

The watch time to be used when making observations should be as accurate as can be obtained, for to obtain the azimuth to the nearest whole minute of arc, the local mean time, upon which all depends, except for elongation, should be known within two minutes. When standard railway time is used, as probable in most cases, the observer will correct the same for difference of longitude at the rate of 4 minutes of time for each degree of difference in arc. This difference of longitude can be nearly always taken from a map. The correction will be subtracted from the standard railway time of observation when the surveyor's station is west, and added when east of the standard meridian, to obtain local time.