and the theodolite reading of it be noted, the observed angles may be reduced to what they would be at the centre of the station. False stations have frequently to be made in practice; a simple rule to meet all cases is of great assistance to avoid the possibility of error in applying the correction with its proper sign. This may very easily be found as follows, without having to bestow a moment's thought beyond applying the rule, which is a matter of no small gain in, time when a large number of angles have to be corrected.

*Rule.—*Put down the theodolite reading which it is required to correct (increased if necessary by 360°), and from it subtract the theodolite reading of the centre of the station. Call this remainder *θ.* With *θ* as a “ course " and the number of feet from the theodolite to the station as a “ distance,” enter the traverse table and take out the greater increment if *θ* lies between 45° and 135°, or between 225° and 315°, and the lesser increment for other angles. The accompanying dia­gram (fig. 10) will assist the memory. Refer this increment to the “ table of subtended angles by various lengths at different distances " (using the distance of the object observed) and find the corresponding correction in arc, which mark + or — according as *θ* is under or over 180°. Apply this correction to the observed theodolite angle. A “ table of subtended angles ” is unnecessary if the formula

Angle in seconds = number of feet subtender×34/distance of object in sea-miles be used instead.

*Convergency of Meridians.—*The difference of the reciprocal true bearings between two stations is called the “ convergency.” The formula for calculating it is : Conv. in minutes = dist. in sea-miles X sin. Merc, bearing X tan. mid. lat. Whenever true bearings are used in triangulation, the effect of convergency must be con­sidered and applied. In north latitudes the southerly bearing is the greater of the two, and in south latitudes the northerly bearing. The Mercatorial bearing between two stations is the mean of their reciprocal true bearings.

After a preliminary run over the ground to note suitable positions for main and secondary stations on prominent head­lands, islands and summits not too far back from the coast, and, if no former survey exists, to make at the same time a rough plot of them by compass and patent log, a scheme must be formed for the main triangulation with the object of enclosing the whole survey in as few triangles as possible, regard being paid to the limit of vision of each station due to its height, to the existing meteoro­logical conditions, to the limitations imposed by higher land intervening, and to its accessibility. The triangles decided upon should be well-conditioned, taking care not.to introduce an angle of less than 30° to 35°, which is only permissible when the two longer sides of such a triangle are of nearly equal length, and when in the calculation that will follow one of these sides shall be derived from the other and not from the short side. In open country the selection of stations is comparatively an easy matter, but in country densely wooded the time occupied by a triangulation is mainly governed by the judicious selection of stations quickly reached, sufficiently elevated to command distant views, and situated on summits capable of being readily cleared of trees in the required direction, an all-round view being, of course, desirable but not always attainable. The positions of secondary stations will also generally be decided upon during the preliminary reconnaissance. The object of these stations is to break up the large primary triangles into triangles of smaller size, dividing up the distances between the primary stations into suitable lengths; they are selected with a view to greater accessibility than the latter, and should therefore usually be near the coast and at no great elevation. Upon shots from these will depend the position of the greater number of the coast-line marks, to be erected and fixed as the detailed survey of each section of the coast is taken in hand in regular order. The nature of the base to be used, and its position in order to fulfil the con­ditions specified under the head of *Bases* must be considered, the base when extended forming a side of one of the main triangles. It is immaterial at what part of the survey the base is situated, but if it is near one end, a satisfactory check on the accuracy of the triangulation is obtained by comparing the length of a side at the other extreme of the survey, derived by calculation through the whole system of triangles, with its length deduced from a check base measured in its vicinity. It is generally a saving of time to measure the base at some anchorage or harbour that requires a large scale plan. The triangulation involved in extending the base to connect it with the main triangulation scheme can thus be utilized for both purposes, and while the triangulation is being calculated and plotted the survey of the plan can be proceeded with. True bearings are observed at both ends of the survey and the results subsequently compared. Astronomical observations for latitude are obtained at observa­tion spots near the extremes of the survey and the meridian distance run between them, the observation spots being connected with the primary triangulation; they are usually disposed at intervals of from 100 to 150 m., and thus errors due to a tri­angulation carried out with theodolites of moderate diameter do not accumulate to any serious extent. If the survey is greatly extended, intermediate observation spots afford a satis­factory check, by comparing the positions as calculated in the triangulation with those obtained by direct observation.

*Calculating the Triangulation—*The triangles as observed being tabulated, the angles of each triangle are corrected to bring their sum to exactly 180°. We must expect to find errors in the triangles of as much as one minute, but under favourable conditions they may be much less. In distributing the errors we must consider the general skill of the observer, the size of his theodolite relatively to the others, and the conditions under which his angles were observed; failing any particular reason to assign a larger error to one angle than to another, the error must be divided equally, bearing in mind that an alteration in the small angle will make more difference in the resulting position than in either of the other two, and as it approaches 30° (the limit of a receiving angle) it is well to change it but very slightly in the absence of any strong reason to the contrary. The length of base being determined, the sides of all the triangles involved are calculated by the ordinary rules of trigonometry. Starting from the true bearing observed at one end of the survey, the bearing of the side of each triangle that forms the immediate line of junction from one to the other is found by applying the angles necessary for the purpose in the respective triangles, not forgetting to apply the convergency between each pair of stations when reversing the bearings. The bearing of the final side is then compared with the bearing obtained by direct observa­tion at that end of the survey. The difference is principally due to accumulated errors in the triangulation; half of the difference is then applied to the bearing of each side. Convert these true bearings into Mercatorial bearings by applying half the convergency between each pair of stations. With the lengths of the connecting sides found from the measured base and their Mercatorial bearing, the Mercatorial bearing of one observation spot from the other is found by middle latitude sailing. Taking the observed astronomical positions of the observation spots and first reducing their true difference longitude to departure, as measured on a spheroid from the formula Dep.=T. D. long, no. ft. in 1 m. of long./no. ft. in. 1 m. of lat., then with the d. lat. and dep. the Mercatorial true bearing and distance between the observation spots is calculated by middle latitude sailing, and compared with that by triangulation and measured base. To adjust any discrepancy, it is necessary to consider the probable error of the observations for latitude and meridian distance; within those limits the astronomical positions may safely be altered in order to harmonize the results; it is more important to bring the bearings into close agreement than the distance. From the amended astronomical positions the Mercatorial true bearings and distance between them are re-calculated. The difference between this Mercatorial bearing and that found from the triangulation and measured base must be applied to the bearing of each side to get the final corrected bearings, and to the logarithm of each side of the triangulation as originally calculated must be added or sub­tracted the difference between the logarithms of the distance of the amended positions of the observation spots and the same distance by triangulation.

*Calculating Intermediate Astronomical Positions.*—The latitude and longitude of any intermediate main station may now be calculated from the finally corrected Mercatorial true bearings and lengths of sides. The difference longitude so found is what it would be if measured on a true sphere, whereas we require it as measured on a spheroid, which is slightly less. The correction = d. long∙^-γ~-i^ must therefore be subtracted; or the true difference longitude may be found direct from the formula dep. no. ft. in 1 m. of long./no. ft. in. 1 m. of lat..

From the foregoing it is seen that in a triangulation for hydrographical purposes both the tearings