Professor EGGERT states as his opinion that the procedure of LEHMANN is more accurate than that of BOHNENBERGER, but that the latter is more rapid. Consequently he recommends that the approximate position of the station be determined by the two-triangle method and the accurate position by the approximation procedure.

The experiences of the present writer do not point quite in the same direction. Using the Survey of India method proper, *i. e.*, the approximate point procedure with a first orientation by compass, a surveyor, in most cases, will find the quality of this first orientation so good and the consequent triangle of error so small that with but small experience he will be able to approximate the point so well that its position, checked by the second orientation and resection, will be practically exact.

The two-triangle method demands always a lengthy geometrical construction, but may be of advantage when a compass cannot be used or for surveyors who find it difficult to acquire the habit of judging the position of the point with regard to the triangle of error, or who may not find successive approximations quite to their taste.

It should be repeated that the problem dealt with above is the same as the general station-pointer or Pothenot problem on a plane or in space and, accordingly, that it is subject to the same limitations. Thus, if the circle through the three known points passes through the station or near it, then the solution will be indeterminate or weak. In such a case another set of known points or another method must be chosen.

The procedure described above seems to have been used for many years by the Survey of India. The writer has not been able to ascertain whether the methods have been used in practice in Germany. In Norway it seems to have been among the standard methods for some ten years. In Sweden the writer has used it several seasons and now he would not think of making a survey without it, as its use sometimes allows twice the number of points to be fixed per day as compared with older methods. It was accepted with some diffidence by other surveyors, as originally by the writer, but it is now introduced as a standard method in the new Swedish Manual for Hydrographic Surveyors issued this year. The purpose of this article is merely to direct attention to the procedure, as it does not seem to have been mentioned before in this Review. When the writer had the honour, some fifteen years ago, to attend the courses of the General Hydrographic Service in Paris, where a great many methods were brought under review, this one was not then among them. In general it seems that this procedure is all too little known, although anyone who has used it will undoubtedly subscribe to the testimony of Mr. HINKS, viz., that it is the method that has brought perfection to plane-tabling. Thus it may perhaps be deemed pardonable to have taken so many of these pages to describe a method which has not yet come into such universal use as it undoubtedly deserves.

THREE POINT FIX: GRAPHICAL.

by

PAUL A. SMITH, JR. H. & G. ENGINEER, U. S. COAST AND GEODETIC SURVEY.

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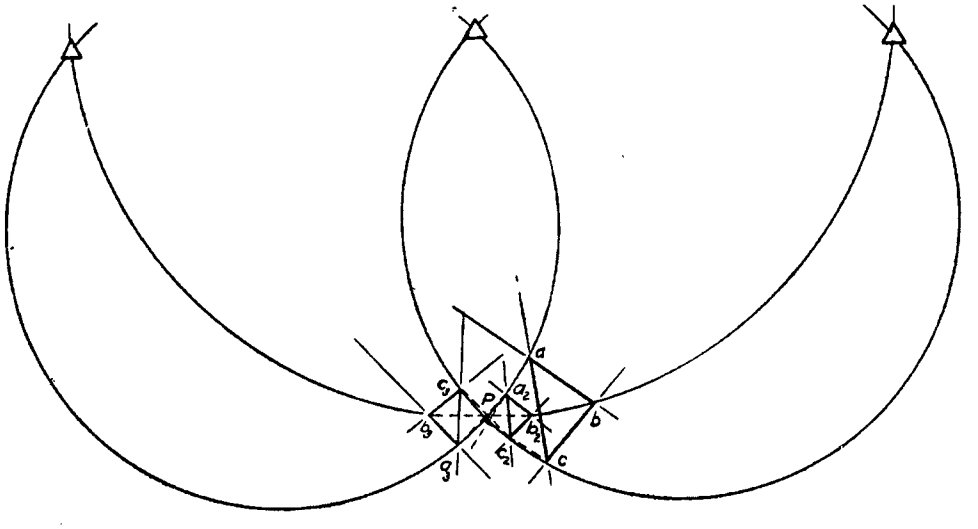
Topographers have various methods of approximating the true position from the first attempt when a plane-table is set up for a three point position at an unknown point. A note in the Engineering News Record of January 10, 1935, by Professor J. MAUGHS BROWN of the University of South Dakota mentions a method which has been in use by some field engineers of the Coast and Geodetic Survey for many years.

Briefly, the method is the determination of the true point by finding the intersection of the circles through the control stations and point sought. The table is oriented by magnetic needle, or by estimation, and the cuts are drawn from the control stations forming the usual "triangle of error", a, b, c. The table is then changed in orientation slightly and additional cuts are drawn from the control stations forming another triangle, a_2, b_2, c_2. If both triangles are on the same side of the point sought, "P", they will be similar, and if the second triangle is nearer to the point P, it will be smaller as indi-

cated in the figure. If the similar vertices are connected as indicated by the dashed lines, the intersection of the lines will be a very close approximation to the point *P*. In case the change in orientation of the table is such that the triangle falls on the other side of the point, *P* as a_3, b_3, c_3, the triangle of error will be a reflection of the first, but as before, the similar vertices when connected will locate the position of the true point *P*. In the former case the determination by the intersection of the lines connecting the vertices will give a point outside the circles, while in the latter it will give a point inside, due to the position of the chords with relation to the arcs of the true loci. In actual practice the point determined by this method is usually so close to the true point *P*, that little or no difference can be detected, especially if the first orientation is close to the true, as is usually the case when a declinatoire is used to obtain approximate orientation. Many topographers use the method outlined in the *Topographic Manual*, p. 58, which is that the point sought is on the same side of all resection lines as the observer faces the station, and the distance of the point sought from the resection line is proportional to the distance of the point occupied from the control station through which the resection line was drawn.



Other topographers sketch short arcs of the three circles through the respective vertices of the triangle of error and thus arrive in a similar manner at the point sought. These three circles are shown in the figure below, and with a little practice it is easy to picture the approximate direction of the arcs from the first triangle of error accurately enough so that the second attempt usually gives correct orientation and position. Aluminium mounted sheets have eliminated the most serious trouble in taking three point fixes — distortion of the old linen mounted sheets.

A UNIQUE BROKEN BASE METHOD.

by

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In carrying forward a scheme of triangulation it is often desirable to introduce a base where, due to topographic characteristics of the country, no suitable site can be found. In such cases recourse may be had to a broken base measured in detached sections as shown in the accompanying figure.