

Mr. Low. among the ravines. The consequence was that the alignment was a succession of maximum curves, with light grades rising higher and higher above the valley, and when the main valley was reached the line was several hundred feet above it, and had to be deflected at right angles, entering convenient side valleys and gradually coming down to the level of the main valley. The length of the line was nearly double that of the steeper alignment, with no compensating advantages. It is needless to say that the steeper line was built.

In referring to the instances mentioned, the writer intends to convey the idea that, in the location of a railroad line, common sense, coupled with judgment, is also a requisite.

Mr. Oakley. F. T. OAKLEY, M. AM. Soc. C. E. (by letter).—The writer was very much pleased to read this paper, for, while he believes that most of the items treated in it are elementary and to many locating engineers are as a-b-c's, they are worthy of record, on account of the author's reason, that there is little of public record of these matters, and on account of the fact that the details of methods of location are of such great importance in obtaining the results sought.

A description of methods which have now the sanction of many years of trial should be appreciated, not only by students of location, but by those whose practice has been largely in the line of maintenance, and those who are charged with the responsibility of employing locating engineers, and it is hoped that all will have a better appreciation of the value of those details of the work which are not a part of theory.

The importance of the commissary department of a locating party can hardly be over-estimated. The writer wishes to suggest the use of a lunch-can, of galvanized iron, in the form of a cylinder, with a tight-fitting lid. Such a can should have trays, about 5 in. deep, which will fit snugly in the can, the trays having handles which will fold inside of the tray. One or two of these trays may be subdivided to provide compartments for small articles. Such cans will be found to be much more sanitary than boxes.

The writer is also of the opinion that a small medicine chest, containing a few simple remedies, would be a valuable addition to such an outfit, and especially useful in a sparsely settled country.

With reference to the drafting table, he would suggest that a board, strengthened by cleats, be used for the top, this board to be supported by a "saw-buck," so constructed that one set of legs will fold between the other set, the outer set being connected by two cross-pieces, one at the top and the other at the bottom on the opposite side of the legs. The inner pair of legs should have cross and X-braces, the two sets of legs being held together by bolts at the point of crossing. When this "saw-buck" is open, chains may be placed across the top at each end, secured at one end of the chain

by a screw-eye, and at the other by a screw-hook. The table may be raised and lowered by the adjustment of these chains.

In the writer's experience, the work of running preliminary lines may be very much expedited, and at the same time greater accuracy be secured, by the following procedure with the transit party:

When a "hub" has been set and the transitman has been called up, the engineer in immediate charge of the party can direct the chainmen where to go, and keep them in very good line until a few stakes have been set, when experienced chainmen can then maintain their own line for some distance across open country, and trimming and cutting can proceed, together with the chaining through timbered country. In this manner, by the time the transitman arrives at the "hub" and has his instrument set up, the chain party will be well out on the new tangent. The transitman, having his vernier set at zero, should then line up on the stakes already set, and, continuing, keep the chainmen in line. The chainmen should proceed to the point where the locator indicates that another "hub" is required and a change of direction is to be made. At this point the chainmen, having secured line as for a stake, will put in a "hub," drive a tack or nail in it, and place the line pole upon the tack just set. The transitman will then turn his instrument to this point, only a slight adjustment of the instrument being necessary therefor. When he signals the chainman "all right" the chainman answers the signal "all right, come ahead." The transitman at this time should turn to the back-sight and read the angle.

The object of this procedure will be apparent to most persons: First, it keeps the chain gang moving, and thereby expedites the movements of the entire party, no time being lost in waiting for the transitman or for the back flagman. Second, it gives an accurate measurement of the angle, without the necessity of repeating the measurement, the course observation, in most cases, being a sufficient check upon the angle reading. Of course, the angle reading may be repeated if desirable. The angle will be measured by this operation immediately after the sights have been taken, thus eliminating any error due to the instrument standing for some time after being set up. Those who have run a transit over unstable ground, or when frost is coming out, will appreciate this method. The elimination of such errors will be found to make it possible to check more closely the angles of various lines, and be very valuable in platting more than one line over the same territory. Consequently, it will expedite the work of the draftsman upon the map. The exact position of the stakes on preliminary lines is not of material importance.

The writer has been accustomed to keeping level notes in a