

very often plotted at a distance of from 5 to 15 miles from the station. This would only be done when nearing the limits of the country controlled by the survey, and in these cases it becomes necessary to take into consideration the correction of curvature and refraction, which is 14.4 ft. for 5 miles, 57.4 for 10 miles and 129.1 for 15 miles. This is done by computing and plotting a curvature and refraction scale for the particular scale of the map, and so placing it on the machine that the forward edge of the elevation slide will cut it at the proper point each time that it is set. Then to get the true elevation of the control point, the curvature and refraction reading is mentally added to the thread reading.

To determine the focal length of a photograph with the machine, a photograph is selected that has two well-defined points in it, to which instrumental directions have been read from the camera station. These two directions are plotted on the plan. The centre mark of the forward edge (bottom in view) of the machine is then placed over the direction line of the photograph; and the distances of the points on each side of it are marked on the edge of the machine with a pencil. The larger the angle between the points the better the results.

The needle point of the focal-length clamp is screwed down at the station and the clamp left loose to slide longitudinally. The machine is then swung around and moved up and down about the clamped needle point until the two pencil points on the edge coincide with the two direction lines on the plan. The machine is then oriented in azimuth, and the reading on the vernier opposite the needle will give the focal length of the photograph to 0.01 in.

If a line is drawn along the edge, it will be the trace of the photograph. If a dot is made at the centre mark on the edge and a line drawn between it and the station mark, it will represent the direction line of the photograph.

The photographs were generally enlargements, double the size of the original, and measuring 12 by 8½ ins. They were all made the same size, so that their focal lengths were the same; but before being used for plotting, the focal length was checked by measuring the distance between the cone marks that control the location of the horizon and direction lines. All recent surveying cameras have marks placed at a distance apart equal to the focal length, which are photographed upon the negative so that the focal length of any photographic print or enlargement can be measured directly.

Photographic Surveying with an Ordinary Kodak.—

It so happened that a map being plotted under the direction of the writer was found to have what is officially termed "a hole in it"; that is to say, there was a small valley which could not be plotted for lack of photographs. It was known that the valley contained a small lake that had not been surveyed by plane table, so that it was necessary to get accurate information.

An officer of the survey could not be sent to the locality to get the required photographs, so it was decided to ask the superintendent of a fish and game club who lived near the valley to take the photographs for the survey. He understood how to use a kodak, but not a surveying camera, so a No. 4 Eastman kodak was sent to him with a map showing the hills surrounding the valley and the two places from which the photographs were to be taken, together with minute directions for exposure, etc.

In order to use these photographs it was necessary to locate from them the position on the map of the two

places from which they were taken and the position of their traces on the map. To do this, a photograph trace was drawn upon a piece of tracing cloth. This was taken to represent the trace of the photograph on the right side of the panorama from one station. The trace of the photograph next to it was then plotted in its proper position by making use of a common object in the overlap of the photographs, and the other three traces plotted in the same way. There were eight known points shown in the different photographs which had been plotted on the map from other sources. Direction lines were drawn through these points on the tracing cloth, which was then placed on the map and the position of the station located by the three-point problem, or in this case, an eight-point problem, that is, a position was found for the tracing cloth so that every direction line cut through its respective point on the map. When this position was found, the position of the station point was pricked through on the map and also positions of the photograph traces.

VANCOUVER HARBOR AND ITS IMPROVEMENTS*

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THE city of Vancouver possesses one of the finest natural harbors in the world, which with proper development can be made to handle an enormous traffic. This traffic will certainly come if proper organization, and facilities, are provided.

Mr. N. Thompson, chairman of the Vancouver Board of Trade, writing on "Vancouver as a Railway and Shipping Terminal," in *The Vancouver World* of October 25 last, quotes approvingly an eminent writer in the *London Statist* as stating that in the next ten years the value of Canada's productions of all kinds will show a three-fold increase, and believes that the war will delay this result for a very short time, and in the end may probably hasten instead of retarding the progress.

Reasons for Development.—There are many reasons for expecting a more rapid increase for Vancouver than for Canada as a whole. Within the last year have been completed two lines of railway tributary to this port, *viz.*, the Canadian Northern and the Kettle Valley. The first, with its extremely easy grade, should become a large factor in grain shipments from Alberta and Saskatchewan, and open a larger market for our timber, fish and other products. The second gives Vancouver a direct connection with the Boundary and Kootenay mining districts, and with the Okanagan fruit-growing district.

Within a few months the Pacific Great Eastern Railway will be in operation from Howe Sound to Fort George, making accessible the Cariboo district which is capable of great development both in agriculture and mining. Within a few years this railway will no doubt be continued northward into the Peace River country, "The Last Great West," where there are 60,000,000 acres of excellent wheat-growing land. These railways and also the Great Northern and Chicago, Milwaukee and St. Paul will require additional facilities to be provided for ocean-going commerce and local industries as well as that necessary for the growth of our old friend, the Canadian Pacific Railway. There is also the rapid develop-

*From the Vancouver World.