The Canadian Engineer

VOL. V.—No. 7. TORONTO AND MONTREAL, NOVEMBER, 1897. {PRICE, 10 CENTS $1.00 PER YEAR.

The Canadian Engineer.

ISSUED MONTHLY IN THE INTERESTS OF THE

CIVIL, MECHANICAL, ELECTRICAL, LOCOMOTIVE, STATIONARY MARINE, MINING AND SANITARY ENGINEER; THE MANUFACTURER, THE CONTRACTOR AND THE MERCHANT IN THE METAL TRADES.

SUBSCRIPTION—Canada and the United States, $1.00 per year; Great Britain and foreign, 6s. Advertising rates on application.

OFFICES—62 Church Street, Toronto; and Fraser Building, Montreal.

BIGGAR, SAMUEL & CO., Publishers,

E. B. BIGGAR — Address—Fraser Building,

R. R. SAMUEL — MONTREAL, QUE.

Toronto Telephone, 1892. Montreal Telephone, 2589.

All business correspondence should be addressed to our Montreal office. Editorial matter, cuts, electros and drawings should be addressed to the Toronto Office, and should be sent whenever possible, by mail, not by express. The publishers do not undertake to pay duty on cuts from abroad. Changes of advertisements should be in our hands not later than the 1st of each month to ensure insertion.

CONTENTS OF THIS NUMBER:

For THE CANADIAN ENGINEER.

RAILWAY ENGINEERING.*

BY CECIL B. SMITH, MA. E., MEM. CAN. SOC. C.E., ASSISTANT PROF. OF CIVIL ENGINEERING IN M'GILL UNIVERSITY.

CHAPTER IV.

ARTICLE 11.—SURVEYS.

The final determination of the exact centre line of a railway roadbed and track is only reached after a process of sifting, which extends from the first thought of the necessity for such a railway until the track is laid. Roughly speaking, it is usual to divide the operations into three stages, which, however, often overlap each other, or are again divided into subsidiary steps. These customary general divisions are:

(1) Reconnaissance.
(2) Preliminary or Trial Line Surveys.
(3) Primary and Revising Location Surveys.

ARTICLE 12.—RECONNAISSANCE.

Reconnaissance may be said to begin after it has been decided that there is a necessity for a railway between two given terminals, or along a given route.

In the latter case, local considerations, or the shortness of the distance, or the existence of a definite water line route, may limit the scope of explorations, but looking to the larger problem, where an engineer has to determine what is the best route between two terminals several hundred miles apart, the study is interesting and one requiring a high order of talent. If the country to be traversed is unsettled, or thinly settled, the problem is simplified by lack of railway competition often, or even by considerations of traffic, but it then demands a close investigation of the natural resources of the country, which, though dormant, will be developed by the railway itself, and it might be considered best, all things considered, to build sometimes, at a sacrifice of distance, grades, or capital outlay, through a country of great natural resources, rather than through a barren one by a route physically superior. On the other hand, through a populous country, the question is much more complex, by reason of the existence of other railway routes already established; but, on the other hand, simplified by a more or less well defined trend of population, which indicates the probable future distribution of people in accordance with natural laws. For these and many other reasons, exploration should commence and be well under way, or even completed, before instrumental work commences; it should, at least, be completed for such a distance that some critical place has been reached through which the final location must pass.

In order to finally fix on the best route between two defined points, it is necessary to study a wide belt of country; even a great number of trial routes will not answer so well, because portions of various routes may be finally selected and joined together. In order to explore such a wide belt of country, use must be made of all existing maps. These when made from governmental surveys will be found of extreme service as a skeleton on which to build such additional information as may be necessary to complete the study in hand. All streams, summits, passes, etc., within the extreme margin of possible routes should be accurately fixed in plan and elevation. A knowledge of the classes of timber, stone, and excavations, and of difficult river crossings, etc., should be included, and from such data, together with closely estimated lengths of lines, ruling grades (obtained from barometer heights), probable traffic, cost of construction, difficulties of maintenance and dangers of future or present competition. A selection is made of the two or three most favorable routes, over which it is thought necessary to make instrumental surveys.

In carrying out reconnaissance, the instruments required will depend on the class of work to be done. These should always include an aneroid barometer, a Locke level, a pocket or prismatic compass and a field glass; distances may be determined from maps, if existing, by pacing, by the rate of travel of a horse, or if in open country, it will be better to take the time to determine them by stadia or some form of telemeter. The aneroid barometer is an instrument supposably compensated for temperature, and under static air pressures capable of always reading the same at the same altitude; but errors in graduation, in workmanship and adjustment, and the barometric changes going on in the atmosphere make it far from a precise instrument. In order to make it available, each instrument when purchased should be rated alongside a mercury barometer, and only those

* This series of papers will be issued in book form as soon as they have appeared in THE CANADIAN ENGINEER.