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ENGINEERING IN CANADA

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Canadian universities in general are not very widely discussed in the United States. In fact, many Americans would be somewhat surprised to learn that Canada, in comparison to her population, is probably just as well equipped educationally as this country. Corresponding to our State Universities, there is a Provincial University in practically every province of the Dominion. Starting with the western provinces, there is The University of British Columbia in Vancouver, The University of Edmonton in Edmonton, Alta., one in Regina, Sask., The University of Manitoba in Winnipeg, the University of Toronto in Toronto, Ontario, and so on for the rest of the provinces.

Three of the largest Canadian universities are situated quite close together, and serve the provinces of Ontario and Quebec. They are the University of Toronto, Queen's University at Kingston, Ontario, and McGill University at Montreal, Quebec. These three keep up a regular schedule of intercollegiate sports. Each has a well equipped Engineering College. The writer is most familiar with The University of Toronto, so will not go into details concerning the others.

The University of Toronto has approximately 5000 students about 500 of whom are studying engineering. The faculty of the Engineering College has about 80 members. These figures are significant inasmuch as they indicate that there are less students for each member of the teaching staff than there are in most state universities in the United States. The student registration is comparatively small, which is due, in part at least, to the high entrance requirements in Toronto. To get a clear conception of this part of the educational system of Ontario, let us consider the preparation necessary for an engineering course there.

HIGH SCHOOLS IN CANADA

The public schools are well organized and the instruction is very similar to that in the State of Ohio, with which most of my readers will be familiar. The four-year high school course in Ontario is also very much like the high school course in Ohio. The details of arrangement differ slightly but the subjects taught and the amount of work covered seem to be practically the same. The requirements, however, are considerably more rigid in Ontario. One little item in this connection is the fact that from the time the student enters high school all written work, problems, examination papers and everything which is to be read by a teacher must be in ink. It soon becomes a habit, and students there work just as conveniently with a fountain pen as with a pencil, and, on the average, more neatly.

During the four year high school course the student must take two departmental examinations, the Lower School at the end of the second year and the Middle School or Junior Matriculation at the end of the fourth year. These exam-

inations are set by the Board of Education of Ontario, and are thus uniform throughout the province, and given at the same time in all high schools. They cover all the subjects taught. In many of the schools the courses are now so arranged that the students can write off some of the subjects of these examinations each year, and thus avoid the hardship of taking some twelve of them within two weeks or less. The examination papers are graded on a uniform basis for the whole province, by a group of teachers appointed by the Board of Education. They even take the trouble to identify the papers by number so that the student's name does not appear on the paper. This makes it very unlikely that an examiner will know whose paper he is marking.

When a student has been successful at these two examinations he is graduated from the high school and goes through the ceremonies connected with that great event. He has the credits required for entrance to most of the smaller universities. If the University of Toronto is his choice, he finds himself limited to two courses, namely Agriculture, and the Pass Arts course in the College of Arts. In order to enter any other course, he must take a year in this Pass Arts course, or attend high school for at least a year of advanced work. If he takes the work in high school he writes another departmental examination called the Upper School or Honour Matriculation. He is then prepared to enter Medicine, Dentistry, Engineering or any other course he wishes as a freshman.

NO MID-TERMS AND ATTENDANCE RECORDS

The rigid entrance requirements just described have several noticeable effects on the progress of the courses. On the average the student carries a heavier schedule than in most American universities. Most of the instruction is given by the lecture system, supplemented by laboratory work where necessary. In the Engineering College the students take three or four lectures each day, between the hours of nine and one. He is busy from two until five each afternoon and from nine until twelve on Saturday with laboratory work of some kind. The course in Engineering involves four years of this, each school year starting about October 1 and ending the third week in April. Each year is made up of two terms or semesters of about 15 weeks each. The most of the courses are carried throughout the year with one or two lectures per week, depending upon the importance of the course. Most of the classes are large, especially during the first two years. Ordinarily no tests or mid-terms are given during the year. No record of attendance is kept in the majority of classes. In this way, the grade for a course is based almost entirely upon the results of the final examination. The student is required to get at least 40 per cent on every subject with an average of not less than 60 per cent



Plane-Table Surveying on Shore of Gulf Lake U. of T. Summer Camp.

for the whole year's work. A student who fails in one or two subjects is allowed to repeat the examination for these, and if successful, is given credit for the course without further class room work. If, however, a student fails in more than two subjects or fails to obtain the 60 per cent average, he is required to repeat the entire year's work in all subjects taken.

Courses of instruction are given in civil, mechanical,

electrical, chemical, mining and metallurgical engineering as well as in architecture. A student in any one of these courses is automatically a member of the student club connected with his particular branch of engineering.

The students in the Engineering College are automatically members of the Engineering Society. Although a student organization, this society is the oldest engineering society in the country, being established sometime before any of the professional organizations in Canada. Its activities are many and varied. Perhaps its most important function is to provide a link between students and faculty, and a definite means of transferring student opinion to the faculty. Then, it operates a supply department which provides students with stationery and drafting supplies of all kinds as well as refreshments between classes, all at cost. The Supply Store is situated on the main floor of the Engineering Building. The Society also holds regular meetings every two weeks and invites special speakers to talk on some subject of general interest to engineering students.

Fraternities are not nearly so strong at the University of Toronto as at most American universities. Fraternity members there probably do not make up more than 25 per cent of the total enrollment.

During the first few years of its existence, the "School of Practical Science," as it was then called, was entirely housed in the smaller wing of the present Engineering Building. In 1906, the "School" became a part of the University of Toronto and has since been known as "The Faculty of Applied Science and Engineering." It has grown until an engineering building more than twice as large as the original, together with the Mining Building and the Electrical Building, both of which are larger than the Engineering Building itself are inadequate.

In the matter of room available for student use, it may be interesting to note that each student

from the time of his entrance, has an assignment of a desk in a drawing room with locker space in the form of drawers for his personal use. These drawing rooms are always open during school hours and a student uses his desk for many other purposes besides the drawing course that he happens to be taking.

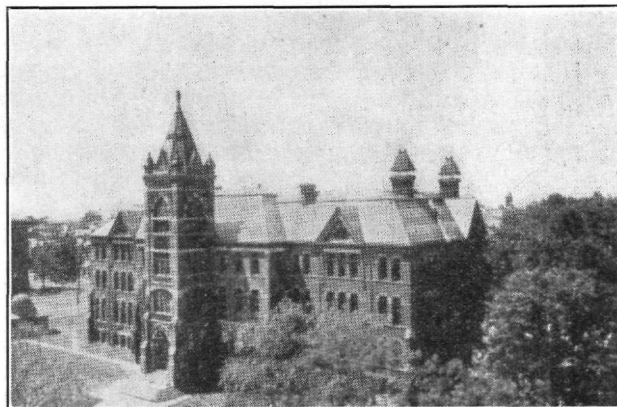
THE PIANO AS A SURVEYING INSTRUMENT

The extra year of high school work required for entrance allows the student to get started on his professional courses in the freshman year. The courses of the first year are quite similar for all branches of engineering. They include Calculus, Descriptive Geometry, Statics, Dynamics, Technical English, and Land Surveying. The Civils also take a course in Geometrical Optics which is not included in the other engineering courses.

In the second year the object seems to be to clear up all of what may be called preparatory or non-professional work. A total of seventeen lecture courses are taken by the Civils, besides laboratory work in connection with seven of them. Six of the lecture courses are finished during the first term. These are spherical trigonometry, engineering chemistry, inorganic chemistry, photography, heat and mineralogy. The remaining courses are longer and run throughout the year. They include descriptive astronomy, calculus, another course in surveying, mechanics of materials, organic chemistry, metallurgy, geology and economics. This is doubtless the most difficult year of the four from the student viewpoint. Out of such a long list of varied subjects there is bound to be some in which the student is not particularly interested. This makes it unusually difficult for him to keep his average grade up to a good standard. He also has more than the ordinary number of chances to fail in more than two subjects when he is carrying so many.

The third year work in civil engineering begins about the middle of August at the permanent survey camp on Gull Lake, one hundred and fifty miles northeast of Toronto. Six weeks are spent in field work in rough country. The course includes problems in triangular and shore line location on the lake, hydrographic surveying, highway location, and railroad surveying. The students divide themselves into parties of four as a permanent arrangement throughout the camp period. Each party is assigned a full set of equipment which no one else uses. Also each party rents two canoes to use in going back and forth to work

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BUILDING AT THE UNIVERSITY OF TORONTO

ENGINEERING IN CANADA

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across the lake. Transportation by water is much more convenient than by land.

The camp is situated at the north end of Gull Lake which is about five miles long and three-fourths of a mile wide. The water is clear and deep, as is to be expected in rock country. The camp location is five miles from the nearest village and seventeen miles from the nearest railroad station. The University has erected permanent frame buildings on the grounds, a dormitory for students, a dining hall, an office building for storage of equipment and drafting room, and a building for faculty living quarters. Most of the instructors have cottages along the lake and bring their families to camp. The largest building, the student dormitory, is a one-story frame structure about one hundred feet long by forty feet in width. It is equipped with beds and mattresses for all students, tables, benches, chairs and last but not least a piano. Situated midway along one side of the building is a huge stone fireplace, large enough to take several four-foot logs at a time. This and the piano add a great deal to the students' enjoyment of camp life. They usually hold two or three dances in this building during the camp term. Living with a group of thirty boys in camp for six weeks is in itself a worth while experience.

The camp closes just a few days before the regular term opens in Toronto. The third year work there includes a heavy schedule of laboratory work in hydraulics, thermodynamics, mechanics of materials, electricity and structural drafting. In addition to lectures in these same subjects, the lecture courses for the third year include theory of structures, least squares, practical astronomy and geodesy, cements and concrete, commercial law and public speaking. It will be noticed that the courses in the third year have a more direct bearing on civil engineering as distinguished from the other branches than those in the first two years.

The fourth year is still more specialized. No options or elective courses are offered in the first three years, but the fourth year work is made almost entirely optional. In civil engineering five different options are offered, namely astronomy, municipal engineering, structural engineering, hydraulic engineering, and railway engineering. A student may choose any one option, but must carry all the courses scheduled in that option. Certain lecture courses of a general nature are included in all options. These are engineering economics, engineering law, contracts and specifications, and management. The usual method of obtaining a Master's Degree is to spend a fifth year taking some other fourth year option.

ENGINEERING ORGANIZATIONS IN CANADA

Upon graduating the engineer in Canada is eligible for membership in some form in a branch of the American Society in his particular branch

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of engineering. The Engineering Institute of Canada is the organization which corresponds to the American Society of Civil Engineers.

Then there is the Association of Professional Engineers of Ontario, organized for the promotion of the profession as such. They have made several efforts at legislation in the Provincial Parliament which would close the profession and prevent, to some extent at least, the practicing of engineers who are not graduates of some university of recognized standing. They claim that the public should be protected from the danger of employing men who are not properly qualified as they are in the profession of medicine and law for example. However, they are forced to face the fact that many of the successful engineers are not college graduates and their attempts at legislation have been only partially successful so far. The surveying profession is already very well protected throughout the Dominion and we shall discuss that at greater length later.

As a mark of distinction for professional engineers, the Association has for several years been issuing an official ring, a plain hand-made circle hammered out of wrought iron to be worn on the little finger of the right hand (or the left if the man is left-handed.) Those entitled to wear the ring include all graduates of engineering colleges in Ontario, as well as all professional engineers who are practising in the province. The presentation of the ring comes after a ritual of considerable length, which was written by Rudyard Kipling. The ritual involves a solemn oath to the engineering profession and the promise to return the ring if at any time the wearer ceases to practice engineering. The ring is not particularly attractive in appearance, but means a good deal to the wearer, especially to the younger graduates of Ontario's engineering schools. If you are interested in engineers, and happen to shake hands with a man who wears a ring on his little finger or notice it otherwise, it may be worth your while to note whether it is shaped like an old fashioned wedding ring—broad and flat, and whether it has the characteristic dull metallic color of wrought iron. Such a ring shows the wearer to be recognized as a professional engineer in Ontario.

SURVEYOR'S LICENSES AND DEGREES

The ordinary land surveying such as subdivision work, property surveys, etc., is done by licensed surveyors. This license is not merely a slip of paper, but is a regular degree given only after a rigid examination in surveying. The examinations are different and separate for the various provinces, since in each case they require a knowledge of the surveying law in the particular province in question.

In Ontario the examination is in three parts, the first being the preliminary examination, given after a year of apprenticeship to a licensed surveyor. A graduate of an engineering college is exempt from this examination, since it covers only the basic mathematics and the elementary field practice of surveying. Next there is the intermediate examination which also requires a year of apprenticeship as a prerequisite. This paper covers elementary law and theory of surveying, usually about ten subjects with a two hour exam-

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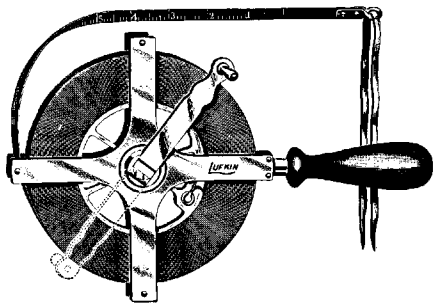
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ination in each. Then the final examination is on the more advanced work, involves still more subjects, and is hard enough that only about one third of the candidates are successful. Those that pass are granted a degree in Surveying, Ontario Land Surveyor, (O.L.S.) Most of them already have a college degree, but in any case, this degree is as highly esteemed as Bachelor's Degree from a university.

If surveys in Canada are of sufficient importance to make such a rigid test as this advisable it would seem that something should be done in many of the States of the Union to prevent the election of utterly unqualified men to surveying positions. A man who can run a transit, or thinks he can, is not necessarily qualified to make a legal survey, much less to oversee the important surveying operations of a whole county, for example.
