Technical Education.

ADDRESS DELIVERED BY PROFESSOR GALBRAITH, AT THE OPENING OF THE ENGINEERING LABORATORY OF THE SCHOOL OF PRACTICAL SCIENCE, TORONTO.

(CONCLUDED.)

The practical work of a technical school in so far as it is of the same kind as that of after life must be selected and pursued rather as illustrating the principles of the special science under consideration than for the sake of the work itself.

In practical life, on the other hand, the result is the thing aimed at, and it matters nothing to those who pay for this result how it was arrived at, whether by rule of thumb or by the application of scientific principles. The work of the school is more analytic than synthetic, more destructive than constructive. The student pulls, as it were, machines to pieces in order that in after life he may learn to put them together. His proper work is investigation and experiment. After he graduates, his work on the contrary is construction and design. It would not be advisable to give equal prominence to both kinds of work in the school. The time is too short and the feeling of responsibility which should govern construction and design is absent and cannot be artificially excited. Make-believe work is essentially false and unscientific.

The arrangement of the courses of study in the school of practical science is in accordance with these principles. The departments of instruction are civil, mining, sanitary, mechanical and electrical engineering — architecture, analytical and applied chemistry, and mineralogy and geology.

In addition to the instruction given in the school the students take such work in the University of Toronto as is necessary. The university work is mathematics, physics and chemistry. Up to the present session mineralogy and geology have also been taken in the university. The greater part of this work will henceforth be taken in the school.

Through the exertions of the Hon. the Minister of Education and the liberality of the Provincial Legislature an engineering laboratory has been established and is now approaching completion. The Dominion Government have also contributed their quota by releiving the school from the payment of customs duties on such apparatus and machinery as it was found necessary to import from abroad.

It may be of interest to you to have a short description of the main features of this laboratory.

It consists of three departments: First, the department for testing the materials of construction. Second, the department for investigating the principles governing the application of power. This department is sub-divided into the steam laboratory, the hydraulic laboratory and the electrical laboratory.

The third department may be termed a geodetic and astronomical laboratory, as the work to be done in it, which relates principally to standards of length and time, is of special importance in these sciences.

In order to prepare specimens for the testing machines a shop has been fitted up with a number of high-class machine tools specially suited for reducing the specimens to the requisite shapes and dimensions with a minimum of hand labor. It is also fitted with the necessary appliances for making ordinary repairs.

The machines in the department for testing materials are the following:

An Emery 50-ton machine built by Wm. Sellers & Co., of Philadelphia, for making tests in tension and compression.

A Riehle 100-ton machine for making tests in tension, compression, shearing and cross-breaking. It will take in posts twelve feet long and beams up to eighteen feet in length.

An Olsen torsion machine for testing the strength and elasticity of shafting. This machine will twist shafts up to sixteen feet in length and two inches in diameter.

The last machine in this department is a Riehle 2,000 lbs. cement testing machine. The cement testing laboratory if fitted with the usual accessories.

These machines are all of the latest and most improved designs, and with the exception of the cement machine there are at present no duplicates of them in existence.

In the power department there are under the division steam, two boilers, a Babcock & Wilcox 52 horse-power and a Harrison-Wharton 12 horse-power boiler. The engine is a 50 horse-power Brown automatic cut-off engine built by the Polson Iron Works Co., Toronto, specially for experimental purposes. It is steam jacketted and has three alternative exhausts, to the open air, to a jet condenser and to a Wheeler surface condenser kindly presented to the school by Mr. F. M. Wheeler, of New York, the inventor. There are also a Blake circulating pump, a Knowles air pump and a Blake feed pump, the latter of which was a gift from the manufacturers. The engine is arranged so that it may be compounded when there are funds for the purpose. To have built the engine compound in the first place was deemed inadvisable as the money was urgently needed for other work.

A machine now being constructed by the Riehle Bros,, of Philadelphia, for measuring journal friction and testing lubricants, will shortly be placed in position. It is fitted with an ordinary railway car journal and box. The maximum loads occurring in practice can be applied. The maximum speed will be 50 miles an hour. This machine is expected to be an improvement upon any yet built for a similar purpose. I received a letter a few days ago from a railway in the Western States which intends to order one if we give a satisfactory report.

The hydraulic division of the laboratory is furnished with a three throw pump with double acting cylinders, built specially for the school by Nor they & Co., of Toronto. It has adjustable strokes and has a maximum capacity of half a million gallons per day. It has been designed to produce an extremely steady pressure, this being requisite for hydraulic experiments. The maximum head under which it works is 230 feet. There will be practically no addition to the running expenses of the laboratory due to the working of this pump as the same water will be used over and over again, and the power will be furnished by the experimental engine. In order to make engine experiments the coal has to be burned in any case and the necessary resistance supplied either by a brake or otherwise. Driving the pump is one method of doing this. A three feet turbine wheel of the jet type built by the Fensom Elevator Co., of Toronto, forms a part of the same equipment. The pump furnishes the power for this wheel. There are two large tanks built by the Doty Engine Co., of Toronto, for experiments on the discharge of water through orifices and over weirs.

The above apparatus is arranged with a view to testing water meters, measuring the discharge of fire streams and various other hydraulic investigations within the capacity of the plant.

The electrical division of the laboratory is equipped with the following dynamos:

Edison, Bell, Thomson-Houston, two Gulcher machines and a Westinghouse alternator with transformers, a Crocker-Wheeler, and a Kay motor, also two small fan motors.

There are in connection with it a Roberts storage battery, a gravity primary battery and a fair equipment of lamps, arc and incandescent, of different types.

The power department is equipped with the usual measuring instruments, indicators, gauges, gauge testing apparatus, scales, brakes, dynamometers, ammeters, voltmeters, resistances, galvanometers, etc.

In the geodetic and astronomical department are 100 feet and 66 feet standard of length—a 10 feet Rogers comparator with graduating attachment—a Howard astronomical clock and electro-chronograph—a Troughton & Simms 10 inch theodolite and all the ordinary surveying instruments.

That you may not leave this building to-night under the mistaken impression that our equipment is complete, and that we can spend no more money, I propose to conclude this paper by touching upon some of our most pressing wants.

The department of architecture has recently been established and is provided with a good collection of photographs and drawings. A large number of casts; models and plates will be required, however, to complete the equipment.

The oldest laboratory in the school is that in the department of analytical and applied chemistry. It is well equipped for general work in qualitative and quantitative analysis; also for the quantitative analysis of food, air, water, fuels and illuminating gas. Special apparatus is now urgently needed for the analysis of iron, steel, and other materials of construction to supplement the testing work of the engineering laboratory.

The important department of mineralogy, assaying and mining has at present a very meagre laboratory equipment. In view of the interest which is now being taken in Canadian mining, it is to be hoped that this state of affairs will be immediately improved, and that the school of practical science may be enabled during the next session to offer to those who may desire it, a complete course of instruction in mining engineering and metallurgy.

In sanitary engineering we have at present no special laboratory. Our hydraulic plant can be utilized largely in connection with this department, but in addition a collection of models is very necessary for purposes of illustration.

As cities increase and population grows denser, sanitary problems become more complicated and have to be dealt with by communities and governments instead of depending on individual action. As a consequence, sanitary engineering is becoming a most important branch of the profession, and a prominent position should be assigned to it in the curriculum of a technical school.

The rapid development of electrical lighting is bringing into prominence the question of the measurement of the illuminating power of electric lights. Special difficulties surround this problem, and it is desirable that our electrical laboratory should be furnished with the means for making such investigations.

It would greatly facilitate the work of the school in all departments to have means for making photographic lantern slides. Ordinary charts and maps soon grow out of date and take up a large amount of room. A photographic outfit would give the means of making lantern slides of all the latest illustrations of machinery and construction that are published in engineering, manufacturing and architectural journals and of exhibiting them to large classes.

Another pressing want is a good technical library. If it were not for our periodicals, we should have no library at all; and while the Toronto Public Library has a good collection of works on technica subjects, yet they are for all practical purposes beyond the reach of our students.

Collections of rocks, minerals and products illustrating various stages of manufacturing are very much needed in the departments of mining and applied chemistry.

In view of these pressing demands the question will naturally arise, What is to be the outcome of this technical education—where are the young men to find employment? If the country cannot support them, what justification can there be for the expenditure? It seems to me that this is a question in political economy and might properly be referred to the distinguished head of that department in the University of Toronto or to our friends, the Trades and Labor Council.

My answer can be only vague and general. I would reply by asking why we have gone into debt for the purpose of building canals and railways, docks and harbors—why have we built expensive houses of parliament, churches and jails, sewers and water works, colleges and poor houses? Is it not because we feel that we are as good as our brothers across the sea or as our cousins south of the lakes—are we not a civilized people, and have not a right to these luxuries whether we can pay for them or not? Is it not as useful to the country to turn out men educated as engineers, architects, mechanics, miners and farmers as to turn out lawyers, doctors, ministers and bankers? Will not the graduates of our technical schools have that very education which our mechanics, artisans and tradesmen of all classes most desire, and of the necessity for which they are reminded every hour? If you had seen with me the crowd of eager men, young and old, who assembled the other evening at the opening of the Toronto Technical School, you would no longer have any doubt as to the desirability and necessity of technical education. If the country cannot support such men, so much the worse for the country, and so much the better for that country in which they find employment.

If we are ever to pay off our foreign debt and trade on equal terms with other nations, we must develope our material resources with economy and skill, and among the means making towards this end not the least promising is technical education.

ELECTION OF OFFICERS.

The following were elected officers by Montreal Typographical Union, No. 176, at its regular meeting:

T. J. Lundrigan, President.

John Taylor, Vice-President.

H. Rush, Corresponding and Recording Secretary.

David Smith, Treasurer.

Executive Committee—Jas. Wilson (chairman), James Gallagher, D. McLean, L. Z. Boudreau and Dav. Taylor.

Board of Directors — Robt. Wilson, John O'Connell and J. P. Malone.

Sergeant-at-Arms—John McCrudden.

The Bricklayers' Union at its last meeting elected the following officers for the ensuing year:

President—Joseph Bleau.

First Vice-President—Calixte Valin.

Second Vice-President — Ovila Chamberland.

Recording Secretary—Jean Goyette, re-elected.

Treasurer—Joseph Corbeil, re-elected.

Collecting Treasurer—Pierre Deguise, re-elected.

Assistant Collecting Treasurer—Geo. Obe.

Marshal—Benjamin Bleau, re-elected.

Auditors—Philias Nadeau, Joseph Carpentier, Clovis Morin.

Fifty years ago the Massachusetts abolition party was organized.