# THE VARSITY

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### APRIL.

Welcome, O sweet caprice of smiles and tears
Spoilt darling, with the fickle, flashing eyes,
Trembling 'twixt joy and foolish happy fears,
Now laughing loud, now shivering through with sighs.
Pleasant art thou, young sister of the Spring,
Light dancing o'er the golden fronded moss;
To thy fresh notes the merry echoes ring
While larches shake their emerald tassels loose.
Soft Aphrodite waits with myrtle crown
To grace thee as the First Love of the world,
To soothe thy sigh, beguile thy fretted frown,
And kiss away thy anger, rain-empearled.
Shine out, then, tenderly, bewitching elf,
Earth hath no fairer child than thy fair self!

Berlin. J. KING

### THE UNIVERSITY AND THE PROFESSIONS.

#### VIII.—ENGINEERING.

What is an engineer? This is a question often asked and one not easy to answer in few words. Some who are known as engineers are engaged in locating railroads, designing bridges, boring tunnels, constructing canals, improving rivers, building docks and harbours, in short in the construction and improvement of routes for traffic by land and water. Others superintend the design and construction of sewerage and water-works, streets, pavements, and tramways, and the improvement generally of the sanitary conditions of towns and cities. Others make drainage, irrigation, and the reclaiming of waste lands their specialty. Others, again, have charge of sinking the shafts, laying out the levels and winzes, arranging the pumping and hoisting machinery, and providing for the ventilation of mines. The term Civil Engineer has, by general consent, been adopted to designate one engaged in any of the above occupations. Civil Engineers are thus sub-divided into railroad, bridge, harbour, hydraulic, sanitary and mining engineers, the names of the sub-classes being as numerous as the special occupations. Again, there are engineers who make the storage, conveyance and application of power their specialty. These are known as Mechanical Engineers, and comprise hydraulic, steam and electrical engineers. The design and construction of machinery is the prominent feature in mechanical engineering.

The term engineer is also applied to those who have charge of the operation of the mill wheels, engines, and boilers, whereby the powers of nature are turned into the channels which make them of practical utility. To this class belong stationary, marine and locomotive engineers. Other applications of the word are gas-engineeer, telegraph-engineer, manufacturing-engineer, etc. In addition to the engineers who have to do with the arts of peace, there are, it it is needless to mention, military and naval engineers.

The above enumeration, imperfect as it is, will give to the general reader some idea of the meaning of the term engineer at the present day.

For the purposes of this paper the classification of the profession into civil and mechanical engineering will be sufficient. As in all other professions, experience is one of the main factors in the success of an engineer. He must be pre-eminently a practical man, and able to make the best use of his own experience and that of others. In order to do this to the best advantage, the young engineer should have had a systematic education in an Engineering School, before engaging in the active work of the profession. The question naturally arises, what should be the nature of his school education? The general answer to this question is, that the school should train the engineer in those subjects which can be more efficiently taught in it than in the workshop and field, leaving to the latter the subjects which can be more efficiently taught by practical experience than in the lecture-room and laboratory. In other words, the school should not profess to take the place of practical experience. The school of practical experience is wide enough already, and open to the engineer through his whole life, and the attempt to put the young engineer through mere make-believe experience would be simply a waste of time and money. It is not to be understood that the teachings of practical experience should be ignored in the school,—far from it. The teachers should be practical engineers, men of wide experience, who can illustrate the principles they teach by practical examples. They should be able to impress upon the student's mind, such a vivid picture of the practical conditions affecting the problems discussed, as to make the sciences they teach what they profess to be, viz.: applied sciences. Illustrations drawn from the clouds are all well enough if mental gymnastics only is the object aimed at, but this should not be the case in an Engineering School. Quite as much mental training can be obtained from the effort involved in analysing any common engineering problem, in selecting the principal points and expressing them by mathematical formulas, as in solving an imaginary problem where the labour of preparing it for calculation has been left out, and all the data are preceded by "ifs." It is the judicious selection of the "ifs" which makes the difference between the educated engineer and the theoretical mathematician. The practical man without scientific training will make fewer blunders than the mathematician without practical experience. His bump of caution, at least, has been developed by hard knocks, and he has a pervading sense of the danger of making mistakes, which the latter has not. A school which turns out merely theoretical men is little better than none. An Engineering School should teach, among other things, the subjects which the young engineer cannot learn properly from his employers, when in the office, workshop or field. It should so train him that he may be able readily to read books, for it is to books that he must go when he cannot learn by *viva voce* question and answer. The subjects that should be taught in the School are, (a) Surveying and Drawing. These subjects can be taught to beginners both practically and theoretically, with more efficiency in a school than on actual work. The student can gain in two or three years a much wider grasp of the theory of the instruments and of descriptive geometry than he would probably gain in years of practical experience. (b) Practical Astronomy. (c) Spherical Trigonometry, Co-ordinate Geometry, Differential and Integral Calculus, and the Method of Least Squares. (d) Statics and Dynamics, Thermodynamics, Hydraulics, Theory of Machines. (e) Theory of the Strength of Materials. (f) Theory of Construction of Structures and Machines. (g) Chemistry. (h) Mineralogy. (i) Electricity and Magnetism. (j) Experimental Physics.

These subjects must necessarily be treated in entering upon them as pure sciences, but the application of them to engineering problems should be made as soon as possible. Of course, it is not necessary that civil and mechanical