

than any person would suppose, and I will state that we have a practical test of it by every train that passes over our road. There is a fertilizer factory established a few miles below the city on the road, which causes the air to be very offensive. The moment the train strikes this stench, the car appears to be entirely filled with it, but I don't think it requires half a minute after the car passes through this stench before it is entirely clear of it, to all appearance. We have nothing except the ordinary exhaust ventilators and perforated plates; and this is the case in winter, when the doors and windows are closed. I think that people generally are mistaken with regard to the time required to change the air.

Mr. J. M. Leech, Pittsburgh and Connellsville, said: "I think that what we require is something that will force the air from the floor up, and not something overhead. The ventilation that we have had heretofore has been either on the end of the car, forcing the draft into our faces, or else over our heads, forcing the air down. I think that what we require is something below. We don't propose to fasten down the windows. We propose to fetch the air in, and every person can regulate it to suit himself. We also propose in the winter season, by forcing the air over the fire box in the engine, to make it warm. In case the train is not in motion, there is a small stationary engine which will work a fan and supply air, either warm or cold, to fill the cars, giving all the air needed. I think something of that kind is what is required by the public."

PRACTICAL EDUCATION.

Professor John Sweet, of Cornell University, is a practical man, if there ever was one. It will be seen from the following address to the students that he considers the practice of the manipulations of the art which the student intends to follow to be of as much value in an educational sense as the study of text books, and thinks the time spent in the shop ought to count, hour for hour, equally with class room periods:

Mr. President and Gentlemen:—Every man's value, aside from his value to himself, that is, his value to his employer, if he be an employee, his value to his family, if he has one, and certainly his value to the world, depends upon what he can do rather than upon what he knows. Unless he can do, what he knows is nowhere. The more we know, the better we ought to be able to do. Education fills its mission only when it aids us in accomplishing our life work better or more readily.

However well a minister may be versed in theology, Scripture, morals, religion, rhetoric, and elocution, unless he has the power to hold an audience, to increase his congregation, to build up his church, to loosen the purse strings of his flock, he is not a success; he is of limited value. The first is to know, the last is to do. Many men possess the former without the latter, and doing is something accomplished without any very great stock of education. A physician, however thoroughly versed in his profession, if all his patients die, is a failure; while a quack who cures is so far a success; and in this matter of doctoring, which is especially one of the learned professions, so much depends upon practice, so much on good judgment, so much on the character of the patient and the influence of the physician in the sick room, that the knowledge which they acquire from books is on the short end of the lever; and the more successful the physician, the nearer the fulcrum gets to the book end. With the surgeon it is as with the physician. One might have the ability to make a manikin with his eyes shut; but if he lacks even the nerve, which is acquired only by practice, to cut off a finger, he would be, as a surgeon, a failure. A lawyer, were he an unabridged edition of Blackstone, bound in calf, if he had not the ability to convince the judge and jury, would be a failure.

Now, if this is true with professions professedly intellectual, is it not equally true of the profession of mechanical engineering? The question is not: Do you know how a carding machine works, but can you make a machine to trim teasel? Less likely are you to be familiar with threshing machines, cotton gins, locomotives, wood-working machinery, portable engines, clocks, gun-making machines, scythe making, gimlets, fish hook machinery, pin machinery, machines for setting carding machine teeth, rolling mills, hooks and eyes, blast furnace machinery, carpet tacks, machinist tools, nail machines, agricultural implements, and sugar machinery. The question is more likely to be: Have you done either, than have you seen it done, or do you know how it is done? More likely to be, can you do, than have you done? Are you to step from your graduating classes into positions of master mechanics, managing directors, superintendents, professors, or foremen? Is your sheepskin degree to be that which will enable you to get a high salary, a commanding position, a passport to every workshop you may walk up to? I hope none of you are so childish as to suppose it. Your education and the opportunities, if we can make them what I hope we can, will enable you to take leading positions; if you make the best use of your advantages and are judicious in selecting companions, you can lead. According to the natural order of things, not more than five out of every twenty will ever be mechanical engineers, and not more than two or three out of that five will ever acquire distinction. Five, ten, fifteen years, yes, even a lifetime, is to be devoted to work, work to which our two hours a day, in comparison, is but child's play, and not only work but study. Study with a new significance. Study to achieve, not to acquire; study to do, not to know. Study to accomplish, and none of this long day, late night, temporary "cramming" to pass. If you have entered on the study of mechanical engineering with a view of becoming mechanical engineers, which it is fair to presume the most of you have, and as the

success of a mechanical engineer most assuredly depends upon what he can do, the question of all others which most nearly concerns you is: How can you best fit yourselves for doing? One might spend his entire freshman's year in drawing 60° angles, free hand and by drafting instruments; he might spend the remaining three years of his college life in seeing a journeyman grind diamond-pointed lathe tools; and without practice, to which his four years drafting and observation would add nothing except to shorten the time required to learn, he could no more grind a tool for cutting screw threads than he could copy the statue of the Venus di Medici. No one knows how a piece of steel will "wiggle" on a grindstone until he tries it.

Handling a file even excellently well is an art acquired by years of practice only, and those of you who take to the glory of making a dead true surface with shadows of reluctance find even in that there is something gained by practice; or rather that, simple as it appears in itself, it is an art no more to be learned without practice than the art of writing. And further, when the time comes when you can say: "I can do it no better than I could yesterday; I can do it as well as any man;" then, if you will count up the time it has taken you to scrape a flat surface, you will find that it falls not much short of the time which it took you to learn to write. I expect you to ask why are we to learn to grind and file and scrape at all? Cannot we be mechanical engineers without going through the drudgery of a common workman? Let us see. Did you learn to read and write and cipher before you came to the university? Yes. And what headway would you have made had you not? Do you expect to run a lathe and keep a cheap hand to grind the tools for you? Do you expect to be a judge of a workman and his work without having been a workman yourself?

One cannot take a leading position unless in his own shop, without becoming an employee. Employers do not place their affairs in the hands of men without some evidence of competency, and inexperience in the minor affairs shows itself when one is least conscious of it.

You came to the university to get a higher class of instruction than you could at the common schools. I had hoped and still hope to make the Sibley College machine shop a place where you can get a kind of experience which you cannot get at the ordinary establishments, but you must learn to chip and file and grind before you are fitted for it. Some of you may reasonably inquire, then, why are not those who have learned the trade before coming here compelled to take shop practice and do by their work as they do by their studies? That is exactly what I had hoped to do, not by rules and proclamations, but by force of example. Those who are doing so, I believe, will have less reason to regret it at the end of their college life than those who are not.

The glory of winning the Woodford prize is only equal to the glory won by another the year before, and may be eclipsed by him who comes after; while the glory of making the first measuring machine of America is the glory of a longer time; a glory not to be divided. There may be a good many Woodford prize winners; there can be but one first measuring machine. I regret that, in carrying out my plan to let each and every one do what he wanted to do, so far as possible, there should be even so few who, it would seem, have wanted to take the advantage of it. I regret that I have failed in getting more interest taken in the care of the tools; but I regret, far more than all, that I have failed in getting a greater interest taken in our work, by the larger part of you who are most to benefit by it. While I would not question the value of theoretical knowledge, as you may some time in your life find a use for every item of knowledge you can possibly acquire, that certainly will be of the most use to you which you can use the most frequently, and you most assuredly have got to gain a prominent position before your theoretical knowledge will be of special value. Suppose you were to leave here without any practical experience whatever, your only chance then for a situation would be side by side with the boy of no education. It is now a work of hands, not heads; and the boy, while you have been storing the mind for four years, has been skilling his hand for two; and although you may be two years his senior, he will at this handicraft outstrip you two to one. You will be paid for what you do, and not what you know; and if on Saturday night you go home with your little four dollars and a half in your pocket and not conclude that your college life has been half thrown away, I for one will be mistaken.

It is claimed that we give theoretical and practical instruction in the mechanic arts. The words are equal—how about the fact? It requires no greater knowledge of mathematics than to be able to count your finger ends, to find the ten hours a week spent in the shop is not half your working time; besides, the ten hours is not taken from your working time at all, but just so much out of your hours of recreation. To assume shop practice is recreation, is boy's play indeed. To put the practice on an equal footing with the study: While some of you choose to come here for an education, with the privilege of getting a smattering of the trade, others, if they so choose, should be allowed to come here and learn the trade, with the opportunity of gaining so much of theory as they have time and capacity for.

I, myself, should have liked to have had the shop practice put upon its true basis, that is that what you learn in the shop is and by right ought to be considered just as much education as that which you learn in the lecture room. But we have become so accustomed to dividing the theoretical from the practical—so used to call the one education and the other work—that as yet, it is past our power to change it. But whether we call it work or study, trade or education, I wish to convince you of its importance. I wish to show up the insignificant position it holds compared to what it deserves.

Let us see. The spirit of the law, giving Government and State aid to the university, if it means anything, means to encourage practical education. Mr. Cornell with his endowment, if he "would found an institution where any man can receive instruction in any study," did not intend to exclude practice; and knowing the interest he takes in our progress, it is well enough known that he meant to include it, while Mr. Sibley's gift was unquestionably intended to establish the work shop. Now these gifts and endowments, and land grants, were given for what? To pay the superintendent of the machine shop and business managers? No, not at all. They were given wholly and solely for your instruction and the instruction of others like you. The executive committee are but guardians; the faculty, from president to instructor, are but instruments or agents for its execution.

It is but right that the students of one class should stand upon an equality with the students of any other. At present the candidates for the degree of B.M.E. are not so situated. I would have the work and study equally divided, or optional, and credited hour and hour alike. I know this will necessitate the abandonment of some of your studies. What one of you has not at least one study that you would like to abandon? Besides you cannot learn all there is to be learned, nor all that is both advantageous and desirable in four years, and what is to hinder your learning after leaving the university, as well from books as from your practice? You will find many things to learn which are of the greatest value, in fact things indispensable in a leading position, which you are getting neither in your studies nor the shop. You must learn to lead, command, or direct men. That sometimes takes years of experience; to get that experience is easy if you begin right. The key note is this: "Always let your ability be superior to your position," for while you are superior to your associates you can lead them. Attempting a position you are not capable to fill is fatal. You are all supposed to be competent to write a good business letter; if you are not, let me tell you you will want that qualification one hundred times for every time you find use for your French and German. You are also supposed to understand bookkeeping; if you do not, you will find it is something you will want three hundred and sixty-four times to every time you find use for your calculus.

In conclusion, allow me to say that this is the opinion of but one man, in opposition to the opinion of twenty. It is based on firm conviction, after as due deliberation as I have been able to devote to the matter; and while no principles relating to business will hold good in all cases, I trust you will not find more exceptions to the rule than enough to prove it true.

Dangers of Nitro-Glycerin.

Nitro-glycerin is a thick colorless oil, and appears to be as harmless, to look at, as lard oil or petroleum. People are so accustomed to the handling of oils of all kinds that it is almost impossible to make them realize the danger that lurks even in the smallest quantity of nitro-glycerin. It explodes when gently struck, and is ten times more powerful as an explosive, weight for weight, than gunpowder. The other evening, in Jersey City, a gentleman and lady were taking a moonlight stroll on the heights, in the vicinity of one of the shafts of the new Delaware and Lackawanna railway tunnel. The man saw on the ground the glimmer of a small tin tube, picked it up, and slapped it from one hand to the other, when a terrific explosion ensued. His eyes were destroyed, his flesh lacerated, his limbs broken, while his lady companion was dreadfully injured. It was a discarded nitro-glycerin tube, such as are used in blasting, and is supposed to have been thrown away by workmen at the tunnel shaft.

In Parker City, Pa., recently, a young man was carting six cans of nitro-glycerin over a rough road in a wagon, when, from some cause which will never be explained, it exploded. The man, horse, and cart were literally blown to pieces. The man's head and part of his breast were found three hundred feet distant, having been blown over the tops of the highest trees. Fragments of his limbs were scattered in different directions, and his right hand was found half a mile from the spot. Even the horse's shoes were torn from his feet.

Copyrights.

The new law in respect to copyrights, by which the official fees for copyrights on labels are increased, goes into effect in August. Until that date, however, copyrights can be had at the old rates, and all who desire to avail themselves thereof should have their applications filed at once. Further information can be obtained at this office.

G. L. M. says: To make a nest egg, take an ordinary hen's egg, break a small hole in the small end, about $\frac{3}{8}$ of an inch in diameter, extract the contents, and, after it is thoroughly clear inside, fill it with powdered slacked lime, tamping it in order to make it contain as much as possible. After it is full, seal it up with plaster of Paris, and you have a nest egg which cannot be distinguished by the hen from the other eggs, and one which will not crack (like other eggs) by being frozen.

An automatic feed arrangement, for supplying boiler and other furnaces with fuel in a pulverized or granulated state, is the invention of Mr. J. Martin Stanley, of Sheffield, Eng. The powdered or granulated fuel, suitably prepared, is injected into the fire space by means of a jet of steam, the quantities being regulated by suitable valves, and the supply of steam and fuel being automatic.

PROFESSOR C. A. YOUNG, of Dartmouth College, is on his way to China to observe the transit of Venus.