FUTURE OF AMERICAN ENGINEERING.

The following are extracts from an interesting address delivered before the Engineers' Club of Philadelphia, by its President, Thomas C. Clarke, Esq. The author of the paper is a successful practical engineer, and therefore his predictions on future American engineering and his suggestions to young engineers carry with them more than ordinary weight:

The numbers of our profession are increased every year by hundreds of graduates from the technical and scientific schools, and by others who rise from the ranks of the great army of labor to become its leaders. All of them expect to make engineering, in some of its various branches, the profession and occupation of their lives; and all are interested to know whether there will be room and work for all.

One's first demand of his profession is that it shall give him an honest living.

His next strongest wish is to find an opportunity to execute some work that shall fully call out his abilities, and give him some measure of that fame which we all prize.

Finally, he ought to wish to "pay the debt which every man owes to his profession" by making some permanent addition to knowledge, either in engineering itself or in some of its kindred sciences.

If a man succeeds in but one of these three things he may be thankful; if in all, he may justly claim the title of an "eminent engineer."

The broadest and at the same time most concise definition of engineering is "scientific construction." If this be true, engineers have existed from the days when the early kings of Egypt reared the first pyramids a thousand years before Abraham was born, down to the generation which has seen the achievements of Stephenson, of Morse, and of Eads.

But while engineers have lived and labored for so long a time, it is only of late years that they have become a distinct guild and profession. The name was first applied to the makers of canals, aqueducts, dikes, jetties, and other hydraulic constructions. Then it was extended to the makers of railways, and now it takes a much wider range of operations. It will be attempted to show that on the breadth and inclusiveness of this classification depends the solution of the problem of the future success of our profession.

The first question is: What preparation and education will best make a man a scientific constructor?

A great deal of discussion has taken place during the last year or two on the education of engineers. It is not intended to enlarge upon this here. Suffice it to say that we are now all agreed that education is of two kinds—that derived from books, and that obtained from actual practice and from contact with men.

One tells us what to do, the other how to do it.

Both kinds are absolutely necessary.

The more of the first kind an engineer has, or in other words, the broader and deeper the foundations of his knowledge are laid, the more readily and intelligently will he acquire the second, and the more satisfactory will be the results of his practice.

But in order that his learning may be of practical use to him, he must also have experience.

The young engineer of the present day comes to his work with a much better preparation than those of the generation before him. He must not, however, make the mistake of supposing that the eminent engineers of a past generation, who never enjoyed the privileges of the schools, were deficient in scientific knowledge. They had it, but they got it from actual experiment, and went beyond the books of their day, and were in many cases the original discoverers and investigators, the fruits of whose labor every school-boy can now enjoy.

The weak point of the old system was, that while it produced many great men, yet the average did not stand as high as now; and the expenditure of much capital had to be intrusted to ignorant persons, whose blunders led to enormous waste, and whose names are now happily forgotten together with their mistakes.

The young engineer of the present day should also remember that now, as in the past, there is but one road to success. He who wishes to command must first learn to obey. He must show his superior officers that he is perfectly reliable and faithful. A man who has his mind occupied with the direction of large interests appreciates fully the wisdom of the saying, "Never do yourself what you can get any one else to do for you." But this cannot be carried out unless he feels perfectly sure that his assistants will not deceive him, that they will report things exactly as they are and will carry out his instructions to the letter.

After a young man has shown that he can always be depended upon, he will soon he promoted into a higher rank, where the orders are more general and where more is left to his discretion and judgment. If to faithfulness and energy he adds good judgment, and to good judgment tact, and the power of managing and controlling men, he may rest assured that before very long he will have gained the first requisite, material success. He will probably find that soon an opportunity will offer to carry out some work which will insure him a measure of reputation. Finally, his early scientific training having taught him to observe facts and draw deductions therefrom, he will probably, sooner or later, make some contribution to science. Even if not a writer, he will furnish some of the material of which books are made.

We have thus briefly traced the career of a successful engineer in the present condition of the profession, or rather in the immediate past. But it will be said: "The ranks are already too crowded. More and more men are coming in every day. Although we admit the truth of Webster's saying, 'There is always room at the top,' yet what shall we do who are men of only moderate abilities? We do not ask or expect the great prizes of the profession, but we cannot help thinking that in America engineers are less esteemed and less paid than in any other civilized country of the world. Shall we be better or worse off in the future? Are we going up grade or down?"

These are very pertinent questions, and a true answer would be of the highest interest. I will endeavor to give you my views, always bearing in mind the modest epitaph of the old surveyor, "His hindsight was better than his foresight."

It has been previously stated that on the breadth and inclusiveness of the classification of engineers depends the solution of the problem of their future success.

If we bear in mind that while an engineer is, unfortunately, not always a scientific constructor, yet a scientific constructor must be an engineer, we shall see how numerous are the paths open to us to follow and how soon the crowd will be relieved. Let us see how the number of these paths has increased during the last half century. Before the year 1828 an engineer meant a man who knew how to make canals and waterworks. But when George Stephenson created the modern railway, an engineer soon came to mean a man who could build railroads. The construction of the 85,000 miles of railroads in the United States, costing over $4,500,000,000, has naturally given employment to the largest number of engineers in taking care of them and of operating them.

Within the last dozen years the substitution of iron for wood, first in railway bridges and viaducts, and afterward in structures of all kinds, has developed another class of special engineers, who, being of a pushing and energetic disposition, have perhaps monopolized rather more than their share of public attention. The development of our mineral wealth, in which it is estimated that over $400,000,000 have been invested during the last thirty years, may be seen reflected in the list of the Society of Mining Engineers, which numbers 734 members. Then we have the engineers of the waterworks, drainage, sewerage, and of the streets and structures of our large cities. The city of Boston is now expending some $5,000,000 in its improved sewerage, surpassing in some respects even the gigantic works of London itself. Mr. Chesbrough, city engineer of Chicago, was once introduced to one of the European engineering societies as that daring engineer who had raised a city of 300,000 people ten feet up in the air above its original position.

Allied to the preceding class we have the sanitary engineers, specialists whose duty it is to apply scientific principles to the construction of our dwellings, too long left in the hands of ignorant plumbers and builders. Then we have the honorable body of architects, who all ought to be engineers, that is, scientific constructors; for if they are not, so much the worse are their buildings. The great gas companies now almost always employ men of scientific attainments as their engineers, the result of whose labors may be seen rather in the increase of dividends than in the lower price of gas.

But another school of specialists is coming on whose labors will correct all this—the electric engineers—whose skill has already enabled us to light our workshops more brilliantly and at less cost than the gas engineers have been able to do it. The future of electric engineering includes not only the vast fields of electric lighting and of the telegraph, but all means of transmitting signals and perhaps of power.

Another class of specialists has an enormous future before it in this country, I mean agricultural engineers, who, as a separate body, have existed for some years in England. When one considers the great savings that are capable of being made by the application of correct scientific principles and practice to farming operations, which are now done so loosely and by rule of thumb, who will not say that here is not a great opening for engineers in the near future?

Then there is a class of engineers whose services are more and more in demand every year, I mean the engineers employed by large contractors. Some of the ablest men in England are contractors' engineers.

You will observe that for a man to succeed in any of these newer branches of our profession he must be much more than a mere surveyor or designer and measurer of masonry and earthworks. He must be, first and foremost, a mechanical engineer, as it is termed. He must understand dynamics as well as statics, and must be practically familiar with the construction of machinery and machine tools.

In Europe no man can attain eminence as a civil engineer who is not well versed in the mechanical part of his profession. Hence, we find them constantly called upon to design, construct, and report upon paper mills, cotton factories, sugar machinery, iron and steel works, and such things, which in this country are intrusted to manufacturers rather than to engineers. I do not mean to say that this country is behind others in mechanical engineering; the names of Fritz and Griffen, of Sellers and Holly, forbid that; but I do mean to say that if American engineers, as a class, were better versed in the mechanical part of their profession, they would not see themselves laid on the shelf by the capitalists who throw away their money on Keeley motors.

It was one of the traditions of the elder school of engineers that they should carefully abstain from taking part in matters of business. Architects and civil engineers were formerly either government officials or, as professional men, they held the same social position, which they feared would be lowered if they became business men, skilled in prices and sharp at a bargain. This was merely a survival of the old feeling of contempt which the governing classes—the men of the sword—felt for the men of affairs. The effects of this mischievous tradition has descended to our own day with unhappy results to the profession. I need scarcely tell you that an engineer is only half fitted for his work unless he is able to hire men and buy materials and execute his own designs, if occasion calls for it. It may seldom be necessary for him to do it, but the ability of so doing makes him a better judge of the value of a contractor's work, and a far safer estimator of the probable cost of public works.

European engineers profess to be able to do this, and this is one reason why they command their five per cent commission on the cost of their works, and attain wealth and position, while in this country engineers are too often paid the salaries of second rate clerks.

It has sometimes happened that, in looking for the engineer of some railroad, I have been disgusted to discover him at last hidden away in a dusty office on the upper story of a building, ignored by almost everybody; while the ticket agents, and the fast freight agents, and the palace car agents, and all their tribe, sit downstairs in splendid apartments, drawing large salaries and commissions, and evidently people of the highest consideration. This is because they are first class business men, while the poor engineer is not.

Let the engineers of the future, if they wish to prosper, learn to be men of business and control the check book and the ledger. We shall then hear less of public works frightfully overrunning the original estimate of cost, and the whole profession will stand higher in public estimation. Pardon me if I say that I feel sure that whatever reputation I myself have is due to the fact that the public feel confident that I can and will execute my own designs within my estimates both of cost and time.

From what has been said you will see that my views of the future prospects of engineering in America are not gloomy. The truth is, that it is by engineers, whether called by that name or not, that America has been made what she is to-day. The Fultons, the Morses, the Ericssons, the Howes, the McCormacks, and the Edisons are engineers, although their names may never have been enrolled on the lists of learned societies; while among those whose names are to be found on such lists, who is there in any country who ranks above Jervis, Latrobe, and Eads?

Follow, therefore, in their footsteps. The field is vast, for it covers the whole area of scientific construction, while the laborers are even yet but few. From the brilliancy of the past we may predict the greater glories of the future. Some of us who are passing off the stage may not live to see them, but there are young men in this room who may one day behold greater triumphs of engineering than the world has yet seen.

A Natural Soap Mine.

On Smith's Creek, Elko county, Nevada, there is a most remarkable stratum of steatite resting horizontally in a steep bluff of volcanic matter which flanks the eastern side of Smith's Creek valley. The stratum of steatite is from three to ten feet in diameter. It is easily worked and is a veritable soap mine. In fact the farmers, cattle men, and sheep herders in that region all use the natural article for washing purposes. Chemically considered this peculiar clay is a hydrated silicate of alumina, magnesia, potash, and lime. When the steatite is first dug from the stratum it looks precisely like immense masses of mottled Castile soap, the mottling element being a small percentage of iron oxide. The Virginia (Nev.) *Chronicle* says that a firm in Elko have undertaken to introduce this natural soap into the market. It is similar in appearance to the Castile soap sold in large bars. Nothing is added to the mineral but a trifle more alkali and some scenting extracts. Its detersive qualities are as powerful as those of any manufactured soap.

The Great Tornadoes.

Sergeant Finney, of the Signal Service Corps, who left Washington about the 1st of June to investigate the terribly destructive tornadoes which occurred in Kansas, Nebraska, and Missouri, on the 29th and 30th of May last, visited over thirty cities and towns in the States named. He surveyed the entire ground over which the storm passed, and states that there was a general storm area in Northern Kansas, Southeastern Nebraska, and Northwestern Missouri, and that he discovered traces of eleven distinct tornadoes, two of which prevailed on the 29th and nine on the 30th of May—all originating in that one storm area.

An Alleged Cure for Rattlesnake Bite.

Myron G. Collins, of Tennessee, claims to have discovered a cure for rattlesnake bites. Drs. Eve and Shacklett, of Nashville, according to the *American*, made a test of the medicine. Collins let a rattlesnake bite him on the wrist, and at once applied to the wound and took inwardly a decoction of mosses from oak and hickory trees. He suffered from nausea, and his pulse and temperature were excited, but within an hour he had completely recovered. The bite of the same reptile speedily killed a dog.

THE first death from genuine yellow fever was reported at Memphis, July 9. Great efforts have been made to put the towns and cities of the Mississippi valley in wholesome condition; and it is to be hoped that, in spite of the early outbreak of the disease, no general epidemic may prevail.