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(Illustrated articles are marked with an asterisk.)

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Scientific American Supplement

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THE LICENSING OF ENGINEERS.

Our attention has recently been called to a New York State law which seems to have been inspired less with a desire of serving the public and protecting its interests than for some less honest and less disinterested motive. We refer to a law enacted on May 22, 1897, establishing rules of qualifications for those having the care of boilers, steam generators or steam engines. Precaution should be taken to protect the public against accidents from negligence, ignorance or mismanagement; but the law in question can hardly commend itself to the unbiased mind, owing to the very narrow nature of certain of its features. The law is designed, not so much to enforce the employment of engineers for running elevators, boilers and engines in our large buildings, but it is designed to enforce the employment of a licensed engineer in small buildings, dwelling houses or apartment houses where steam heating apparatus is in use. To require a licensed engineer to take charge of apparatus of this kind is entirely unnecessary and oppressive. It is usual in such cases to have a fireman who is always in attendance and who is under the direct supervision of the janitor or the other manager of the building.

The particular features of this measure which show the animus which inspired the introduction of this bill are to be found in the qualifications governing the applicant for examination. In the first place, the applicant must be a citizen of the United States and over twenty-one years of age. The application must show that the applicant has been employed as a fireman, oiler or general assistant under a licensed engineer in some building in the city of New York for a period of not less than five years. It is evident from this provision that a thorough knowledge of steam engine practice is not what was sought after by the promoters of this bill. A thorough efficiency and a perfect familiarity with all the secrets and mysteries of steam engine practice are not sufficient to entitle the applicant to admission within the charmed circle, but he must "have been under the immediate supervision of a licensed engineer for a period of not less than five years," and, most wonderful of all, he must have been employed in the capacity of "fireman, oiler or general assistant in some *building located within the city of New York.*" We are unable to grasp why this extraordinary limitation should be considered as an essential equipment for an engineer, but it is evident that the society who introduced and fostered this interesting measure believed that this was surely a clever means for advancing their own interests. The engineer who, perhaps, has been driving a locomotive for thirty or forty years would not be allowed to take charge of any steam heating apparatus in any building in New York, without first taking up his residence there and undergoing an apprenticeship of several years.

This bill, like many others of its class, was passed by the Legislature without proper investigation into its merits or demerits. The bill was introduced to benefit a particular class; it manifestly had no other aim or object. The protection of the public against mischief is entirely of secondary importance. Like much legislation that we have to endure, this tends to make many suffer for the benefit of the few. The enforcement of this unjust and foolish law will throw out of employment many who have, for years, had charge of buildings and who were competent to manage the same as well as if they "had been an assistant under a licensed engineer for a period of five years in some building in New York."

It is to be hoped that this foolish law will be repealed. If it is not repealed, it is probable its validity will be tested, and it is more than possible that the act will be deemed unconstitutional.

The interested motives of the promoters of this bill may be noted from the fact that it was to take effect immediately, the intent evidently being to throw hundreds out of employment before they would be able to qualify themselves for passing the required examinations, or even filing their applications therefor.

PRISON ASSOCIATION OF NEW YORK EXHIBITION.

The recent exhibition of the Prison Association of New York was held with the idea of giving the public a more intelligent idea of the inner workings of our State prisons than it can glean from the daily press. The objects of the association are practical and humanitarian, and this was evident from the character of the exhibits, in which was very little of a merely sensational character. By far the greater part of it consisted of specimens of the handiwork of convicts in the prisons of New York State. A notable exhibit was that of a complete set of furniture for the warden's office, made by the prisoners at Sing Sing. It was made in oak, richly carved and polished, and the work would have done credit to any first-class factory. In the same room was an inlaid box made of nine thousand three hundred and fifty-six separate pieces of wood and a banjo made of six thousand and fifty-one pieces, both being the work of inmates of Auburn prison. The work done by students in one of the art classes was represented by some grille work which showed excellent taste and skill.

The clothing worn by the convicts is made on looms in the prison, and the various State institutions for the blind, the deaf and other unfortunates are also entirely supplied from this source. Here were shown specimens of the various suits, both for men and women, together with prison-made blankets, toweling, etc. The various prison schools and workshops at Sing Sing were represented by drawings, cabinet and joiner work, plaster cornice work, boots, shoes and a host of other articles of wear and household use.

The one truly sensational object in the exhibition was the chair used in electrocution at Sing Sing, in which thirteen people have already suffered death. Except for the heavy straps at the arms and legs, there was nothing to suggest its tragic purpose. The celebrated Bertillon system for the identification of criminals was shown and explained, and a typical case of photographs from the rogues' gallery formed part of the exhibit.

In a room devoted to the Elmira Reformatory a surprisingly large number of the arts was represented by specimens of steel engraving, zinc etching, bookbinding, printing, photography, etc., done by the boys in the various classes. Near by was a large board of drawings, mechanical and architectural, which had been made by prisoners who had received only six months' instruction.

In looking over the varied collection of articles, all the results of instruction in useful arts and sciences, one found it difficult to believe that it had come from within the inclosure of State prison walls. The exhibition testified to the great advance which has been made over the old methods in the treatment of convicts, and it is easy to see that, as far as the occupations of prison life are concerned, everything is done to improve the more debased and ignorant among the convicts and give them some reasonable hope of honest livelihood when their terms have expired.

The inmates of the State Penitentiary for the Eastern District of Pennsylvania were represented by a large model of that famous institution, made by themselves. This prison is conducted on the much discussed plan of solitary confinement adopted generations ago by that State. The prison is laid out so that the idea of solitary individual confinement shall be literally carried out. Formerly, from the time the convict entered the massive gate of the prison to the day on which he left it he never spoke to or looked upon the face of any man but his keeper. To secure this result the prison is built on a radial plan. The outer wall of the inclosure is 30 feet high and 640 feet square. In the center of the square is a tower 40 feet in diameter and two stories high, and from this radiate, like the spokes of a wheel, eleven long, low, one-storied structures. Each wing is built with two outer walls and a central dividing wall and covered with a low pitched roof, and it is divided by partition walls into a long double line of cells. Each cell opens out onto a little yard which is surrounded by high walls and is of about the same area as the cell. Light is obtained by a grated window in the roof. Formerly the convict ate, slept and worked in his cell and took exercise in his little yard, absolutely alone. The prisoner is received in the central tower, his pedigree is taken, and he is then taken to one of the cells, which he never leaves except for exercise. The idea of solitary confinement is not carried out so literally as it formerly was; but the convict does all his work in his cell and is never thrown in contact with the other convicts in workshops and classrooms.

Very different from this is the modern steel prison, with its modern provisions for light, heat and ventilation. The methods of this construction were shown by illustrations of the new wing of three hundred cells which is being built at one of the State penitentiaries.

A SEVENTY THOUSAND HORSE POWER CENTRAL STATION.

Work is progressing upon a building in New York City which will contain the largest aggregation of motive power ever gathered together in a single plant. Hitherto that distinction has belonged to the great ocean steamships, the largest power at present being in the engine rooms of the Campania and Lucania, of the Cunard line, each of which is credited with a maximum trial horse power of 33,000. In this connection it is interesting to note that the huge industrial establishments to be found in the textile and iron industries, with their miles of shafting, their vast power-driven machinery and their employes numbered by the thousand, do not call for one-half the motive power that is to be found snugly stowed away in the engine room of a St. Paul, a Lucania, or a Kaiser Wilhelm der Grosse.

The new power house is being built by the Metropolitan Street Railway Company of New York and it forms part of the scheme for introducing electric traction on the whole of the 218 miles of street railways owned or controlled by this company. At present there are three different systems at work: the cable, the underground trolley and the horse car. The mechanical power is supplied from four power houses: a cable power house on Houston Street and Broadway, another at Fiftieth Street, a third on East Twenty-sixth

Street, and an electrical power station at 146th Street. The first three of these furnish power for the Broadway and the Lexington Avenue cable roads, and the last furnishes current for the Lenox Avenue underground trolley.

Work is now well advanced on the 55 miles of horse car lines which are being equipped with the underground trolley, and for the present the necessary electrical power will be furnished from the 146th Street and East Twenty-sixth Street stations, the generating capacity of the former station being increased and a new electrical equipment being added at the East Twenty-sixth Street station.

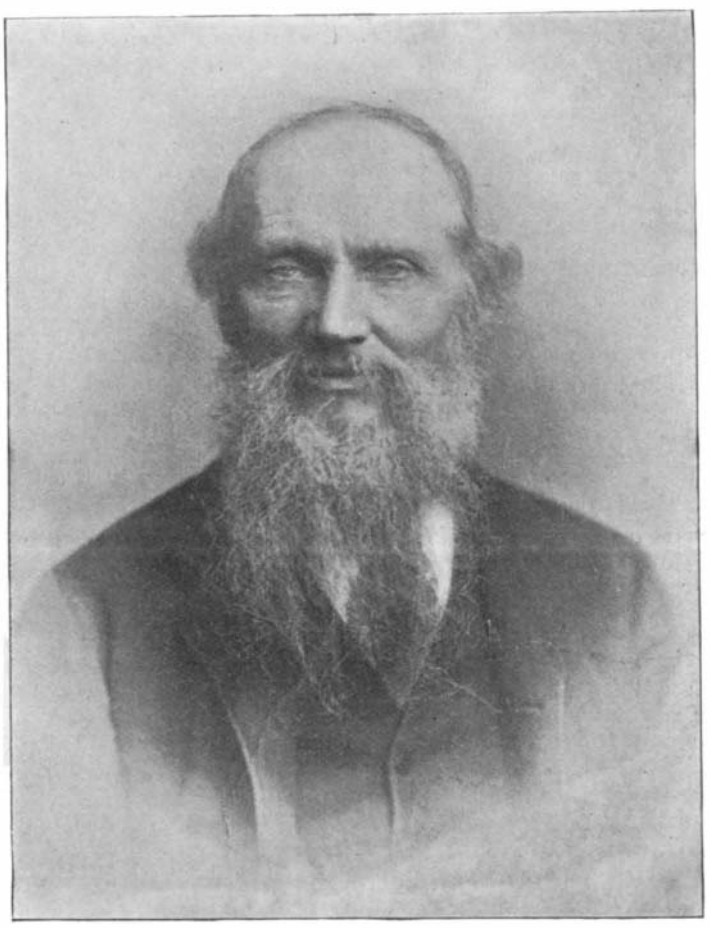
The many advantages to be gained by operating the whole of their vast system by one method of traction, and the uniformly good results which have been obtained on the experimental electric line on Lenox Avenue, have determined the company to make arrangements for equipping the whole 218 miles with the underground trolley. The advantages of economy to be gained by concentrating the power plant at one great central station are many and obvious, and it is this consideration that has led to the planning of the monumental power station which is now under construction near the East River between Ninety-fifth and Ninety-sixth Streets.

The economical distribution of current from one central station will be rendered possible by the use of a high potential in place of the 550 volt distribution which characterized the practice of a few years ago.

The building will cover a site measuring 201 feet by 270 feet. The foundation will consist of 8,000 piles, upon which will rest a five foot bed of concrete, which will extend over the whole area of the site. The building will be divided by a central wall into a boiler house and an engine room. The former will be four stories, and the latter two stories in height. The three lower stories of the boiler house will contain 87 water tube boilers, with a maximum capacity of 800 horse power each, and arrangements will be made for the use of forced draught. The upper third of the boiler house will be devoted to a set of huge storage bins, with a combined capacity of 9,000 tons of coal. The coal will be transferred from barges at the adjoining river dock to the bins by a system of elevators, and the ashes will be returned to the river scows by the same means.

In the adjoining engine room will be eleven cross compound condensing engines. They will be of the vertical type, and each will have a maximum capacity of 6,600 horse power. They will stand in two rows parallel with the dividing wall of the power house and each will be direct connected to a 3-phase alternating current generator. The current at 6,000 volts will be led to substations where static and rotary transformers will convert it to the 550 volt current used in the conduits.

We are informed by President Vreeland that the estimated time of construction is twelve months. The whole equipment will not, of course, be put in at once, but it will be set up contemporaneously with the demand created by the ultimate extension of the underground trolley to the Broadway and Lexington Avenue cable roads and to the various horse car lines owned or controlled by the company.



LORD KELVIN.

LORD KELVIN.

Among the distinguished scientists who attended the recent meeting of the British Association at Toronto, Canada, were Sir John Evans, Lord Lister and Lord Kelvin, each great in a different line of work. Lord Kelvin is particularly notable, owing to the fact that he has been a professor for over fifty years, and during this time he has witnessed the wonderful progress in physics and chemistry to which his personal contribution is so important.

Lord Kelvin, though of Scotch descent, was born in Belfast, in 1824, and was so precocious that he, then plain William Thomson, entered the College of the University of Glasgow at the age of twelve. From Glasgow William Thomson went to St. Peter's College, Cambridge, and in 1845 he graduated with highest honors and was elected a fellow of his college. Even before his Glasgow student days came to an end, William Thomson's original work in science was commenced, and his first mathematical papers, written before he entered Cambridge as an undergraduate, are all worthy of attention. From 1842 to 1845 he published important papers on heat, electricity and mathematics. In 1846 Thomson was elected professor of natural philosophy in the University of Glasgow, and thus at the early age of twenty-two he was appointed to the chair which he still holds. Many offers have been made him by the great English universities, but he has preferred to remain in his northern professorship, and his constancy is appreciated by the university which he adorns. The dynamical theory of heat early engaged the attention of Thomson, and he published important papers upon the subject in 1849, and in 1852 more than one joint paper was undertaken by the life-long friends Joule and Thomson. In 1855, Thompson published a paper on "Electrodynamic Qualities of Metal," and it was while engaged in experimental work connected with this research that he began to make use of the assistance of his students; and this was the commencement of the physical laboratory of the University of Glasgow, which was, in fact, the first of physical laboratories. In 1855 and 1856 a new field opened itself to the genius of Thompson.

The problem of ocean telegraphy had presented itself to the world, and very soon he was practically called upon to solve it. When the cable was completed it was found that it required one minute to transmit one word over the cable. Thomson, experimenting with the reflection of the image of a candle thrown from his concave eyeglass on a sheet of white paper in a fairly lighted room, judged that the flame of a paraffine lamp reflected from a silvered mirror of one-tenth of that area would give an image bright enough for conveniently reading telegraphic signals. The mirror galvanometer was supplied for the 1858 cable. The directors of the Atlantic Company insisted that Thomson should go to sea with the expedition and also that he should take a patent for his instruments. To take out a patent was somewhat against his wishes, as he desired to give to the public the fruit of his labors, as he did with his sounding machine and his mariner's compass, but he found in each case that the only way to secure attention to inventions of importance was to patent them and work the patents. In 1867 the siphon recorder was invented and patented. On the successful completion of the Atlantic cable, in 1866, he received the honor of knighthood.

Sir Willam Thomson's other inventions can be only briefly referred to. They include electrical test instruments and the improved mariner's compass, to say nothing of the large number of minor inventions. Sir William Thomson succeeded Sir George Gabriel Stokes, Bart., as president of the Royal Society, in 1890, and was created first Lord Kelvin in 1892. The degree of LL.D. was conferred on him successively by the Universities of Dublin, Cambridge and Edinburgh, and that of D.C.L. by Oxford. He was a fellow of both the London and Edinburgh Royal Societies, and has been president of the British and other associations. He has also received various decorations from abroad. He is Grand Officer of the Legion of Honor, commander of the Order of Leopold, and has received the German Ordre pour le Merite. He is a member of a large number of foreign societies and has a multitude of medals conferred upon him for his eminent inventions and discoveries.

In 1876 Sir William Thomson was a judge at the Centennial Exhibition at Philadelphia, and in 1884 he visited America to attend the Montreal meeting of the British Association. On this occasion he delivered a course of lectures on "Molecular Dynamics," at Baltimore, to a class composed mainly of professors from different parts of the world, gathered together at the Johns Hopkins University.

During Lord Kelvin's present visit to the United States he traveled quite extensively and made a number of addresses. On September 23, accompanied by Lady Kelvin, Count di Brazza Savorgnan, Prof. Elihu Thomson and others, he visited the Schenectady works of the General Electric Company. The electric railway work most arrested his attention. He was particularly interested in the new "surface contact" electric road, of the type now being constructed for Monte Carlo. Another feature of railroad work shown was the handling of one of the cars equipped for the South Side Elevated, of Chicago, weighing 25 tons and carrying four 50 horse power motors underneath.

With these cars the rate of acceleration obtained is as much as 40 miles an hour in 15 seconds, giving a tremendous increase in quickness of service on elevated or suburban lines.

Lord Kelvin was much interested in the experiments which were shown him in high voltage currents. He carried a little green note book with him in which he jotted down formulæ, figures and autographs. It was easy to see in so much advance he was glad to recognize here, in America, the rapid fruition of ideas and suggestions which the slow pace of European advance would not have allowed him to test on this large and satisfying scale.

Coming away from the works, his indefatigability as an investigator was shown by his leaving a comfortable carriage to ride in a dusty trolley car equipped with magnetic brakes. Emergency stops were made along the road quite frequently, and Lord Kelvin hung over the open trap door of the car floor with an interest that might easily have resulted in his disappearance down it, but for the restraining hands of those who wished him to go back to Glasgow University safe and sound.

The recent awards to this country of important electric railway contracts for England and the Continent have awakened great interest among English electrical engineers, who see in these contracts a source of danger to the British electrical industry.

Lord Kelvin was asked by The Evening Post representative as to his views on this matter. He said: "I do not consider it out of the way or surprising that these orders should be placed here. England has not yet developed her electric railway work to as large an extent as you have, and hence is buying, as she always does, in the best market to save money. She has the engineering and manufacturing talent, but lacks the opportunity. Here you have towns of 10,000 population springing up in a year, and they naturally want the latest and best, making a good demand which renders easy production on a large scale and also stimulates the older communities near them. We have no such developments in England, and the areas of our towns are smaller, so that the necessity of city transportation is not so keenly felt as with you."

Asked as to the near outlook in England, Lord Kelvin said: "The predictions as to the resort in this country to electricity on steam roads in some parts of the country seem to me well founded. From my observation I do not expect, however, any change at present by our big railroad systems in England. They move slowly and with judgment, and things must be proved. I do believe that all our English tramways and all our city travel must soon become electrical. I do not see any alternative from that."

Archæological News.

F. Petrie, Honorary Secretary of the Victoria Institute, England, writes to the Rev. Alfred Putnam, D.D., President of the Danvers Historical Society, a letter in which he says: "It will interest you to hear that one of the Institute members writes home from upper Egypt to announce his discovery of a palace of Pharaoh of the sixth dynasty, with numerous valuable inscriptions. The wine jars of Pharaoh were found intact in a long cellar. All were hermetically sealed, but, on breaking the seals of one, the wine seemed petrified.

With the present year, the Archæological Institute of America will begin the uniform and regular publication of its papers, reports and other documents in a new periodical which will be styled the American Journal of Archæology, second series. The journal of the Archæological Institute of America will be conducted by an editorial board, the members of which will represent the several interests of the institute and the institutions in its care. The new journal will succeed the American Journal of Archæology, and the new periodical will be issued six times a year. It will include the archæological papers of the institute, the papers of the American School of Classical Studies at Athens; papers of the American School of Classical Studies in Rome; proceedings of the institute and other archæological societies; reports of the institute; summaries of archæological news, correspondence, notes and notices. The journal will be published in England and America by the Macmillan Company.