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VII. CHEMISTRY, ETC.—The Educational Value of Chemistry. By Professor MAXWELL SIMPSON, M. D., F. R. S.

A Chance for Electric Competition.

The Brazilian Minister, having received from his government authority to invite proposals for the illumination of the city of Rio Janeiro, will receive bids from citizens of the United States up to December 2, and they will be opened at Rio Janeiro on January 1, 1879. The contract with the British Gas Company, which now illuminates that city, will expire on March next. That company would dispose of all its material, buildings, and machinery for \$2,651,756.

This would seem to offer an excellent opportunity for electric lighting companies to demonstrate their capacity on a grand scale. If they can do what they claim to be able to do, there should be no difficulty in their underbidding the gas men, with a wide margin for profit.

THE STEAM VALUE OF OIL FUELS.

Careful experiments made to ascertain the steam values of coal oils and petroleum have shown at times, when the combustion and all other conditions were perfect, results exceeding the theoretic efficiency of these fuels. In the experiments at Woolwich, a heavy oil, made from Boghead coal, that, theoretically, should convert into steam 17.5 lbs. of water per pound of oil, gave, as a maximum result, 17.8 lbs. of water converted into steam per pound of oil. Reasonably assuming that 12½ per cent of the actual heat generated was lost in radiation and in creating the draught in the chimney, we have the practical very far exceeding the theoretic efficiency.

With these fuels, which leave no residuum, complete combustion assures clean flues and boiler surface, the absence of any non-conducting deposit thereon to interfere with the best heat-transmitting conditions, and is an evidence also that the proportions of air and superheated steam are adjusted as correctly as practicable and thoroughly mixed with the oil vapors. Yet such conditions in themselves fail to account for an evaporation in excess of that due to the generally accepted value of the chemical combinations of the elements present.

By generally accepted value, we mean that estimated upon the known calorific power of carbon as contained in wood charcoal, which even now almost invariably forms the basis of calculations for determining the calorific power of carbon in any state.

But the often observed fact that the practical heating power of some coals and of the liquid hydrocarbons exceeds their estimated power, cannot be explained by the charcoal carbon rule, but only on the hypothesis that the different forms or conditions of carbon have each a value of their own, which can only be determined by actual experiment.

An eminent authority, Professor Henry Wurtz, who has studied, perhaps, more thoroughly than any one else, the phenomena of the combustion of liquid fuels, and whose conclusions have been indorsed by many other scientists, says, in explanation of these variations, that the heating effect of carbonaceous fuels "depends upon the density of the burning vapor and the concentration and intensity of the heat; that carbon, like everything else, has a latent heat of fusion or of liquidity, though the amount of this is as yet unknown, but it seems probable that it is large in amount. In case of oil fuel we are clearly dealing with liquid or fused carbon, which, according to this view, should yield us more effective heat for equal weights than solid carbon in coal. This has been overlooked in the accepted modes of estimating the calorific effectiveness of liquid fuels, and they must have been underestimated accordingly."

The rapidity of thermal action is due, in a great measure, it is well known, to the difference between the temperature of the radiant and that of the recipient, is greater at high than at low temperatures, and the effects are especially noticeable in boiler firing where there is a large difference between the two sides of the boiler plates. The transmission of heat not only increases with the difference between the temperatures, but is greater for each degree of difference.

In these facts we have an added explanation of the great advantages of intense and concentrated heat.

The values of these several points, for the correct determination of the heat efficiency of fuels, can be ascertained only by long and careful experiment; and to nothing of greater importance can the attention of metallurgists and engineers be turned.

Ignorance of these has, in many instances, led to the rejection or suppression of results of boiler experiments which indicated higher calorific power for the coal than theory permitted.

In one instance which we have in mind, a 48 hours' run was made with a boiler fired with pulverized Cumberland coal, and the average evaporation for the whole time was 15.164 lbs. of water from 212° Fah. per pound of coal. The fuel was reduced to an impalpable powder—almost equal to liquid carbon—and injected by a current of air into the heated fireplace; igniting instantly, it was perfectly consumed, giving a flame of great intensity and concentration; doing far better than the old law allowed, yet less, perhaps, than our progress in thermal science tells us should have been done.

The old formula must be revised to meet the issues presented by the new fuels and the improved methods of firing.

A NEW BANK NOTE PAPER WANTED.

The government has for some nine years been using for bank notes, etc., a paper made exclusively at the Glen Mills, near Philadelphia, the proprietors of which have derived a comfortable income from their exclusive contract. The Secretary of the Treasury came to the conclusion some time since that too much was being paid for the paper, and sent a committee to the mills to see if the paper could not be manufactured more cheaply and what the profit was to the company, but the committee were unable to make any suggestions on this head, as the company refused to divulge the cost of manufacture, etc. The prices now paid by the government are very high, from sixty to seventy cents a pound, according to the use to which it is put, the sixty cent paper being used for bank notes and the higher priced for bonds. In view of these facts the Secretary has determined to advertise for bids for supplying paper suitable for the purpose. The advertisement will call for a distinctive paper, and for a device or devices which can be placed upon the paper that

may be used, and which if adopted will become the exclusive property of the government. The paper must be made from pure linen stock, the distinctive feature to be produced by the introduction of silk or other colored fibers. The paper will have to be manufactured under the supervision of the government, and if deemed necessary, under the protection of a guard stationed at the mill to prevent counterfeiters stealing it. The bids will be opened on December 4.

The Secretary has from time to time received specimens of new kinds of paper for which were claimed all the merits of the fiber paper and more besides. He now proposes to make a change, if an equally good and more economical paper is offered, and it would seem as if this was a chance for some of our inventors to get up some new and better paper than any heretofore made, and thus get a profitable contract from the government.

TRADE MARK TREATY WITH BRAZIL.

The Rio de Janeiro correspondent of the *Evening Post* reports that a convention between the United States and Brazil, for the reciprocal protection of trade marks, was signed September 24, and now awaits the formal ratification of the two governments. It is described as a simple, straightforward instrument, giving to the citizens of either country all the rights and privileges of the other in the matter of registering patents, brands or trade marks as a proof of ownership or agency, and of seeking legal redress whenever such rights and privileges are infringed upon.

At the outset, Minister Hilliard was prepared carefully to specify in the document itself what steps should be taken by either party to secure the desired results; but an examination of the Brazilian laws relating to this subject showed them to be so full and so satisfactory that any concession beyond the right of appealing to them was wholly unnecessary. Under these laws a registered trade mark is entitled to the same protection, and the proceedings and penalties for infringement are much the same as with us.

In view of the increasing trade of Brazil with this country, and the already large demand there for American goods, imitations of which are largely foisted upon those markets, it is incumbent on every manufacturer who cares to maintain his rights to avail himself of the protection which this treaty will secure.

THE TREATMENT OF HYDROPHOBIA.

Mr. Stanford, a member of the English Parliament, has offered a prize of £100 for an essay on hydrophobia, its nature, prevention, and treatment, and the British Minister at Washington has brought the matter to the attention of the Department of State, that the necessary publicity may be given to the offer in the United States. The prize is to be awarded by the Royal College of Physicians of London. The questions which are thought by the college to require special investigation are: The origin and history of outbreaks of rabies, particularly in the British dominions; the best mode of prevention of rabies; the characteristics of rabies during life, and the anatomical and chemical changes which are associated with the disease in its successive stages, particularly in its commencement; the origin of hydrophobia in man, and the chemical and anatomical morbid changes observed in the subjects of the disease, with special reference to those having their seat in the organs of the nervous system and in the salivary glands; the symptoms of the disease, particularly in its earlier stages, and the diagnosis of the disease in doubtful cases, from conditions more or less resembling it, together with the alleged prolonged latency of the disease and the efficacy of the various alleged remedies and modes of preventing it; and what plan of treatment, whether prophylactic or curative, it would be most desirable to recommend for future trial.

The conditions under which the prize is to be competed for are that the essay must be in English or have an English translation accompanying it, and be delivered to the college on or before January 1, 1880. The essay must be accompanied by a sealed envelope containing the name and address of the author and bearing a motto on the outside, the same motto to be inscribed on the essay, which may be the joint production of two or more authors. If not published by the author within a year, it is to become the property of the college.

THE MECHANICAL AND OTHER PROPERTIES OF IRON AND MILD STEEL.

All who have to handle iron and steel, or who are interested in the question as to the adaptability of steel for taking the place of iron in mechanical and civil engineering operations, will find in the last issue of the SCIENTIFIC AMERICAN SUPPLEMENT (No. 150) one of the most valuable papers on the behavior of these metals under critical tests that has appeared in a long time. The paper was read by Mr. Daniel Adamson, of Manchester, Eng., before the European Iron and Steel Institute, at its session in Paris, September 16, and it is illustrated by some sixty figures, exhibiting the effects of various strains upon irons and steels of varying composition and structure. It is also accompanied by a full page table showing the chemical composition of the metals tested, the dimensions of the specimens, and the results obtained by the various tests.

Mr. Adamson writes from the standpoint of the practical user of these metals, as well as an experimental investigator of their properties. His object has been not merely to go over the ground covered by previous investigations, to prove by experiment the tensile strength of iron and steel, but to supplement them by more comprehensive tests, in con-

nection with a more complete record of qualitative and quantitative conditions. For example, the exact chemical composition of the metals tested has been noted, to determine the effect of cinder, sulphur, phosphorus, silicon, carbon, and other chemical and mechanical admixtures, under varying conditions of temperature and stress.

A special object was to determine the behavior of various irons and steels when subjected to concussive force, such as may be produced by the explosion of gun cotton, gunpowder, and other explosive materials, with a view to determine among other points the effect which an exploding boiler would have on another boiler working under pressure at its side, or the effect of a collision of one ship with another; and whether wrought iron or steel possesses the greater power to resist such accidentally produced strains. He also made and records many experiments on various irons and steels to discover the influence of composition, temperature, and so on, in varying the power of the metals to resist tensile tests; and the same with regard to chemical tests, as by corrosion. Altogether the paper must prove not only a standard work on the character and properties of iron and mild steel, but also have a marked effect in shaping the practices of mechanical and civil engineers in the manipulation and use of these metals.

**THE PROPOSED ADDITION TO THE PATENT OFFICE.**

The Patent Office building, at Washington, was originally one of the finest specimens of the Doric order of architecture in the country. Somewhat more than a year ago a fire destroyed a part of the upper portions of the west and north wings of the building. In view of the circumstance that the office has for some years been seriously cramped for room, it is now proposed to secure the additional space needed by adding an attic story to the entire building, instead of simply restoring the burnt portion to its original state, and providing for the enlarged needs of the office in some other way. The proposed attic story, in the plan adopted,

other European nation, and are believed to be the inventors, or rather the originators, of the custom of using forks at the table. Forks, however, had long been used for raising meats out of pots or cooking vessels by the Greeks and Romans, and the use of forks for lifting the meat from the seething pots is recorded in the Bible. The Egyptian priests, also, in presenting offerings to the gods, used forks made of bronze, two of which, dug up at Sakkarah, are in the Abbott collection. None of these people, however, although familiar with the use of the fork in this manner, had any idea of using the fork at table. The mode of serving meat varies somewhat in different nations. In some countries the head of the house took the joint in one hand, and, with a knife held in the other, severed the meat into suitable pieces for each person. In other cases the joint was passed from hand to hand, each person cutting off sufficient for himself with his own knife, and then passing it to his neighbor, each cutting off such part as suited him. The portion thus cut off was afterward divided into smaller pieces suitable for eating, and conveyed to the mouth by the fingers of the hand unoccupied by the knife.

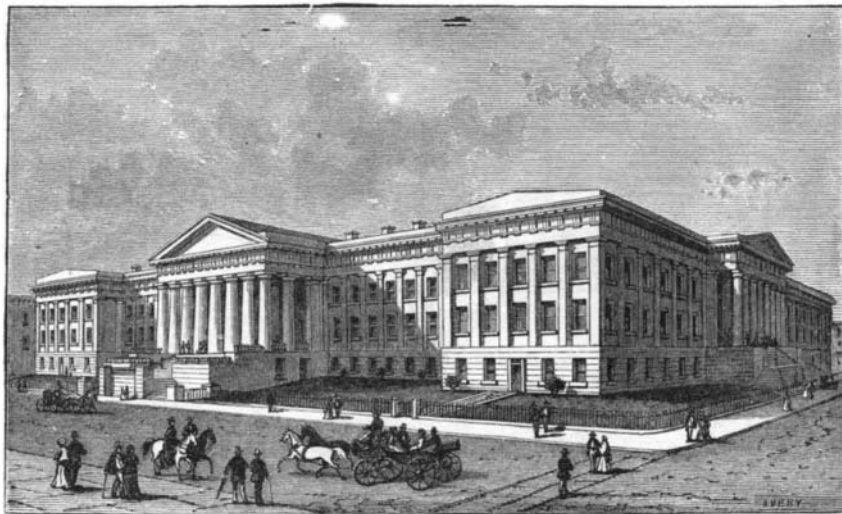
In many parts of Spain, to this day, table forks are unknown articles. In many taverns in other parts of Europe, knives are not placed on the table, because it is expected that each traveler is provided with his own, but as few persons will now eat without forks, landlords are obliged to furnish these, together with plates and spoons. It is curious that although the use of forks has not yet spread all over Europe, yet the savage Feejee Islanders have long had table forks in use. At a time when almost all of Northern Europe was destitute of the article, these people, the most cruel and most ingenious of all the natives of Polynesia, used forks in conveying to their mouths dainty morsels of *puakabalava* (long pig), as they called cooked man.

None of the sovereigns of England had forks till the reign of Henry VIII., all, high and low, using their fingers. Queen Elizabeth had several forks presented to her, and al-

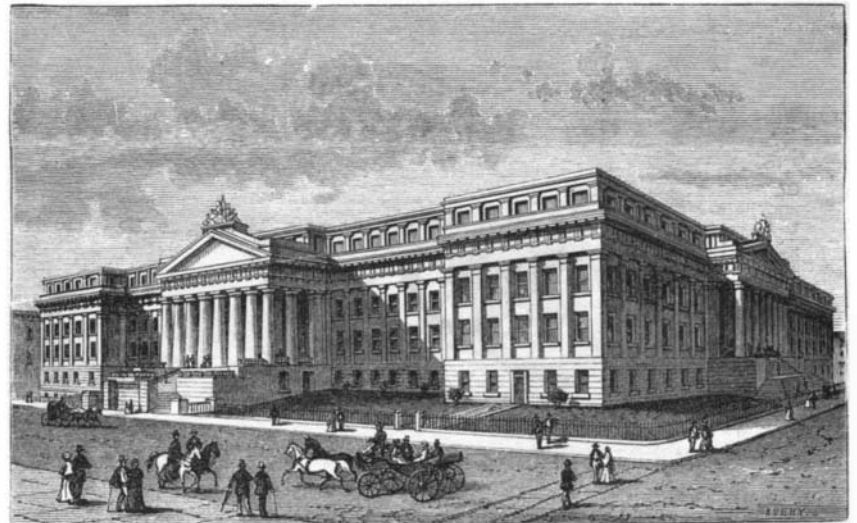
and forks hollow, so as to form a pepper box, the sprinkler being provided with a valve so as to shut off the supply when not needed. C. A. Durgin's patent of May 8, 1866, shows a fork having the two inner tines dropped below the outer ones, so as to make a kind of spoon, for taking up peas or other small articles. J. S. Jennings' patent of September 11, 1866, shows a fork having pivoted to it a swinging knife, the two being so connected as to be readily used by a one-handed person, as the swinging knife may be readily operated by a single finger of the hand holding the fork. A combined knife, spoon, and fork, in one instrument, is shown in the patent of N. Ames, September 17, 1871, a spoon being formed on the end of the back of the knife, and the point of the spoon terminating in short tines. The patent of S. W. Francis, February 3, 1874, and C. Reese, April 23, 1878, both show spoons, having cutting edges at the sides of the bowl and tines at the point, thus combining a spoon, knife, and fork in one implement. A very elegant fork was patented by J. C. Draper, February 18, 1873, which was designed to be used in eating fruit, and is provided with a small bowl at the junction of the tines to catch the juice of the fruit. Another peculiar fork is shown in F. M. Dixon's patent of February 13, 1877, designed to be used for holding green corn in the ear, and has a long central tine to pierce the cob, and a short one on each side intended to enter the cob just sufficient to prevent its turning.

**A YEAR'S WORK IN THE PATENT OFFICE.**

The report of the operations of the Patent Office during the fiscal year ending June, 1878, shows no abatement of the inventive spirit of the American people. The number of original applications for patents was 19,657, and 14,100 new patents were granted. There were also 627 reissues and 722 patents granted for designs. Twenty-seven hundred and thirty-seven caveats were filed during the year. The receipts of the office amounted to \$734,888, and the total expenditures were \$665,906. Of the amount expended, however,



THE PATENT OFFICE AS IT IS.



THE PATENT OFFICE AS IT IS TO BE.

is raised on top of the old block course, and is about thirteen feet in height, without any variation all around the building.

The effect of the added story will be seen on comparing the two engravings herewith. However skillfully treated the addition must destroy the purity of the architectural type, and materially injure the general architectural effect of the building. This great sacrifice of art to utility would be justifiable on one condition only—that of absolute necessity. If there were no other way to provide the Patent Office with the room it needs, as many stories might be added as the original walls would support, the problem then being to make the alteration as little offensive to good taste as might be possible. But, as we believe, that exigency has not yet arisen, and is not likely soon to arise—provided the Patent Office is given its due in its own house. This handsome edifice was built for the Patent Office, its almost prophetic projectors having in view the vast requirements which the Office would ultimately have need of. Temporarily other governmental offices were sheltered under the same roof, the Patent Office having room to spare. By its natural growth, however, the Patent Office now needs the space thus surrendered, and ought to have it, the temporary tenants finding accommodation elsewhere.

This, then, is the true solution of the whole problem; give the Patent Office its own, or so much of it as it may require, only restored to its original state, and find lodgment for the dispossessed offices in a building of their own. The United States might better spend in this way a hundred times the money voted for the spoiling of the Patent Office edifice, rather than ruin the effect of such a fine piece of architecture by what, after all, must prove but a temporary makeshift.

**TABLE FORKS.**

We are often disposed to sneer at the Chinese mode of eating their food with chopsticks, and fancy they must make very dirty work at their meals, yet they are cleanly compared with the habits of our ancestors of two or three centuries since. At that time, even in the best society, forks were unknown, except among the Italians, who appear to have had them in general use considerably earlier than any

though she was seen to use them on state occasions it is doubted if she used them ordinarily.

Voltaire states that table forks were first used by the Lombards in the fourteenth century, and Martins says that they were in common use in Italy in the fifteenth century. Coryat, in his "Crudities," published in 1611, states that he observed a custom in all Italian cities through which he passed that he had seen nowhere else in all his travels. "The Italians, and also most strangers that are cormorant in Italy, doe alwaies at their meales vse a little fork when they cut their meat." Heylin, in his "Cosmograph" (1662), says: "The use of silver forks, which is by some of our spruce gallants taken up of late, came from China into Italy, and thence into England." Another writer states that at the period of the revolution (1688) few English noblemen had more than a dozen forks of silver, along with a few of iron or steel. But after this steel forks became an article of manufacture at Sheffield, and they came into general use, having, however, only two prongs, and it was only in later times that the three pronged kind were used. These were originally forged and filed to shape slowly by hand, but in the present mode of manufacture, after the tang, shoulder, and shank are formed, a portion is flattened for the prongs, which is then struck up into form by a swage drop, leaving only a thin film between the tines, which is cleared away by the file. These processes are followed by hardening, tempering, grinding, and polishing, and securing the handles.

Although silver forks have long been in use to some extent, it was not until of late years that their use became in anywise common, as very few, even among the wealthy, used them until about fifty or sixty years ago, and the steel ones are still very largely used among the poor.

Many patents have been granted of late years on forks of various kinds, over a dozen being for means of combining the "finger guard" on carving forks with a "rest," so that the raising of the former will lower the latter. In addition to these we find many patents granted for various improvements relating to ordinary dinner forks. One granted to F. C. Beach, December 5, 1865, shows a fork provided with a simple device for sharpening a knife; and the same gentleman, in connection with A. C. Klincke, obtained another patent September 4, 1866, for making the handles of knives

\$50,000 was for the restoration of 18,563 models injured by the fire of last year, and, omitting this item, the excess of receipts over expenses appears to have been \$118,982.

The number of trade marks registered was 1,505, as against only 938 for the preceding year, and the receipts from this source and from the registration of 492 labels, amounted to \$42,762, a sum eight times greater than the total expenses of conducting the division.

**NEW RULE IN TRADE MARK CASES.**

Commissioner Paine of the Patent Office has lately adopted a new and very excellent rule in trade mark cases, which consists in dividing the payment of the government fees, so as to lessen the expense of applying for registrations.

The government charges for every trade mark registration are twenty-five dollars, and heretofore the rules of the Patent Office have required the payment of the whole amount in advance, before the examination of the case. If on the examination it was found that the proposed trade mark was old, or if for any other reason the case was rejected, then the applicant was obliged to lose the whole of the fee paid.

By the new rule now promulgated by Commissioner Paine, the applicant pays only ten dollars in advance. If the case is rejected he has no more to pay; but if registration is allowed he then pays the balance, fifteen dollars.

The new rule will promote public convenience and have the effect to increase the number of applications for registration. Full particulars how to apply for trade mark registration, expenses, etc., will be found in the "Scientific American Hand Book," which may be had at this office by all who choose to send for it, free of charge.

**Electric Light in Chancery.**

Recently an interim injunction was obtained against Messrs. Wells, of Shoreditch, restraining them from continuing the use of the system of electric lighting, the apparatus of which is shown in one of our engravings this week. The applicant, Mr. Wild, claims that the Jablochhoff system, which is the property of a French company, is virtually the same as that invented by himself, and for which he took out a patent in 1863.