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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-