

among the masses of workers, and it is fully expected that the rising generation of artisans and mechanics will avail themselves of it in numbers. The leading men in the iron trade are fully alive to the importance of the question, and as the representatives of the various industries are prepared to second any feasible proposal, it is expected that some practical scheme will soon be adopted.

The council of the Institution of Naval Architects, in their recent report, lament that they have been unable to mature any scheme providing for the systematic education of private students of naval architecture, and are looking forward with no little anxiety to the establishment of Technical Universities.

If the representatives of the various industries of Great Britain and the great guilds of the city of London are so impressed with the necessity of affording more opportunity to the masses of the workers to obtain, in early life, a sound technical education, as a matter in which the prosperity of the country is concerned, ought not the Government and Manufacturers of the Dominion be equally anxious about affording some practical and systematic scheme for the technical education of children in our public schools, afterwards to be perfected in universities endowed specially for that purpose? It is a question of more importance to this country than has yet been attached to it by our statesmen, and which now requires their immediate attention, as we have to compete with a highly intelligent people on one side, and also with the talent and experience of older countries for a share in the prosperity that must ever fall to the lot of that country which carries excellence in arts, science, and manufactures to the greatest perfection; or else be content to see our industries driven out of the market by the superiority and cheapness of the manufactures of other countries, which then no protective tariff can keep out of the bounds of successful competition.

#### EGYPT MORTGAGED TO ENGLAND.

Egypt is undergoing a species of Anglification. The chief offices in the cabinet, beneath the rank of Minister, are in the hands of Englishmen, who are all liberally, I may say munificently, paid. The Postmaster General is an Englishman, with a salary of £2,000 a year; his nephew, who acts as deputy, gets £1,000 a year; and another Englishman £800. The director of the railway system is an Englishman, with the handsome salary of £3,000; the vice-director, a fellow-countryman, gets £2,000. It is estimated that the total salaries paid to English employes of the Khedive is about \$500,000, and the cry is still they come. Hardly a steamer arrives there that does not bring capable Englishmen sent for by the Khedive, or in quest of employment as engineers, architects, naval or military men, and organizers of some branch or other of the public service. The important affairs of the country, the Khedive finds, cannot safely be intrusted to the natives, lacking as they are in intelligence, honesty and industrial habits. Egypt is, as it were, mortgaged to British capitalists, and the Khedive seems disposed to allow them to manage an estate of which he is now little more than a trustee. In the general break-up that threatens to take place in the Turkish Empire, Egypt will naturally fall to England as her share of the spoils.

M. DERBAY states that silver ingots are often found with a fineness of .950 or .999, which work badly with those of .950, giving surfaces with gray spots which can hardly be removed by polishing and which always reappear under gilding. This property, according to the *Journal of the Franklin Institute*, is due to the presence of selenium in the sulphuric acid which is made from pyrites, and refiners should, therefore, be careful in the selection of their acid. As the selenium oxidises easily it may be separated by melting the silver precipitated by the copper, in an oxidising atmosphere, or in the presence of nitrate of potash or soda.

#### ECONOMICAL USE OF FUEL.

(See page 197).

Considering the enormous quantities of coal used yearly, in furnaces of all kinds, and for all purposes, it is to be wondered that the *thorough* understanding of the subject of "combustion"—of the theories involved, and the form of apparatus required to allow of its taking place under the most advantageous conditions—should have been confined, almost exclusively, to scientific circles, and never (or, excepting in rare instances) reduced to a practical basis. Placing at 75 (which is a high estimate) the percentage of heat resulting from the combustion of the various coals, which, in the best form of furnaces, we are able to utilize, we still have remaining 25 per cent. of absolute waste. This does not mean that we realize 75 per cent. of the actual *value of the fuel*, in units of heat; for, although different authorities have obtained different results as to the amount, it is safe to assume that *twenty-five* per cent. is a high estimate.

For instance—to follow out the above figures—in order to realize 25 per cent. of the *value* of the fuel, where there is wasted 25 per cent. of the amount of heat generated, the latter must be 33½ per cent. of the former—in other words, from that quantity of coal which has a power of 100 units of heat, the imperfect combustion develops but 33½ units, and of this amount, from faulty construction and other causes, we are enabled to *utilize* but 25 units or 75 per cent. of 33½.

This great waste is something enormous, and appears inexorable, as it is really unnecessary. It is not owing to any want of ability, that the subject has been so completely ignored.

In the laboratory of the chemist, we find apparatus for effecting an approximately perfect combustion, on an experimental scale, and the requirements of the process are well understood. Why not, therefore, profit by this knowledge, and by effecting the necessary modifications, adapt some such form of apparatus to a practical use? It is not impossible, nor even difficult, provided we start with a proper knowledge of the requirements of the case, without which the matter were better let alone. This is a subject which cannot be worked out by "rule of thumb," as a mere mechanical question may be. A knowledge of the *theory* of combustion is absolutely essential, and a solution will never be reached without it.

For instance—suppose we ask the average engineer how many equivalents of oxygen are necessary for the combustion of one equivalent of carbon; and what quantity of air is required to supply it. Nine out of ten—or ninety-nine out of a hundred—would be nearer the truth—would be unable to answer this question; and yet these men are engaged in the designing and construction of boiler and other furnaces, in which the acknowledged desideratum is economy of fuel.

As an illustration of the economy possible by the use of an efficient form of apparatus, for insuring the complete combustion of the vaporous and gaseous portions of the fuel generated from the grate or fire-bed of the furnace, we may mention as the best that has come under our notice, the "Jarvis Patent Furnace" which was originally designed for use under stationary boilers, although applicable to heating furnaces of all kinds using natural draught. In the case of the invention of this furnace, we have an illustration of the acquisition by the inventor, of the necessary *theoretical* knowledge of combustion, for the express purpose of enabling him to *start* with a correct appreciation of the requirements necessary to insure success; in short, to guide and direct, in a sure channel, his ingenuity and undoubted *practical* ability, instead of groping in the dark for that which he would otherwise have been unable to see was close to his hands. The motive in this case was the preventive of the smoke nuisance, but was still more urgent, as upon the result hung the stoppage, or continuance, of an extensive manufacturing business; an injunction having been granted by the local court, on account of the smoke and cinders from the boiler furnaces of the establishment. Certainly the inducement was a strong one and calculated to urge Mr. Jarvis to use his best efforts, and the result was so eminently satisfactory, that the invention was secured by letters patent: and the introduction of the furnaces commenced in September last. Since then, over one hundred and fifty have been put in operation in some of the largest manufacturing establishments in the country, several of which, after having had one of their boilers set, for the purpose of testing the merits of the apparatus, have given the second and third orders; in one establishment alone, there are *thirty-three* in successful operation, the average saving in *cost* of fuel being 25 per cent., and an increase of evaporating capacity of 30 per cent. Not only is the saving of fuel a matter of quantity, but also of quality, as it enables the use of inferior grades, such