and deep, so that there may be room to erect safely upon them a structure which may require unexpected modification in the building. There is much short sighted criticism of engineering schools for amplifying their courses with studies of which the impatient "special student" does not see the value in relation to his chosen branch of work, simply because, as a rule, neither he nor the critics who join with him have had experience to teach them how inextricably the applied sciences are interwoven, and how many things ought to be somewhat familiar even to the close specialist. The engineer, above all, must realize the definition of a gentleman (Lord Chesterfield's was it not?) and know "something of everything, and everything about something."

POWDERED COAL AS FUEL.*

Weight is not the proper standard for the purchase of coal and the price paid for fuel should correspond to "the quantity of heat it contains." The quantity of heat developed in its combustion is a more exact statement. But, as this cannot be determined for coal or any other fuel, except by an experiment for each sample, supposed or proved to be a fair sample of the coal purchased, and as the amount of heat developed must depend upon more or less complete combustion, the suggestion seems to be impracticable in the coal trade. It is also suggested that a sliding scale should be adopted for the amount of dirt contained in coal, which varies in different samples from five to fifteen per cent. of the entire weight. This dirt produces useless and harmful clinkers, which costs time and labor to remove. But, when Mr. Donkin says "it is not tons of coal, but so much heat," that boiler-owners want when they buy coal, he puts an old truth into new and forcible expression.

Powdered coal, in combining with oxygen in the act of combustion, will generate more heat than can be obtained from it in any other way, except by first converting the coal into gas, and the pulverization of coal at the cost of one shilling per ton (alleged to be the average cost) is considerably less than that of making a ton of coal gas. The reason why more heat may be obtained from powdered than from lump coal is that, with suitable appliances, a more perfect and rapid combustion can be effected. Twenty years ago or more the extensive experiments of the American engineers, Whelpley and Storer, proved this to be the case. But these experimenters were ahead of the times, and they failed to make a practical commercial success of the system.

At the present time five systems of burning powdered coal are working in Germany. The forced blast is used with some, as it was used by Whelpley and Storer. Others employ a natural draft only, with means for continuously supplying the powdered coal to the furnace for maintaining continuous combustion. Of the latter class is the Wegener system, which sifts the powder into a current of air entering by natural draft, quite uniformly, the sieve through which the fuel passes being aided in its delivery by a tapper which beats against the sieve to which the coal is supplied. This tapper is operated by an air turbine working in the duct which supplies the air, the air current being set up by heated gases passing out through a chimney stack in the ordinary way. The arrangement could scarcely be more simple. The powdered coal falls into the ascending current of air, and, thus thoroughly mixed with the supporter of combustion, passes with it into the furnace, becoming almost instantly ignited and burning with intense heat.

The sieve employed is of wire gauze, sixty meshes to the inch—and the particles of coal are reduced, before use as fuel, to a fineness of $\frac{1}{100}$ to $\frac{1}{1000}$ inch.

The proper method of disposing of the ashes remaining after the combustion, is an important part of this subject. The dirt fuses into slag under the high temperature produced; but, in a current of air strong enough to carry along coal particles of $\frac{1}{100}$ inch fineness—the particles of the ashes resulting being much smaller and lighter—we should expect, without some special means of separating them from the spent gases, that they would all be carried up and out of the chimney, thus substituting a new nuisance for the old smoke nuisance, the abatement of which is sometimes claimed as a point much favoring the use of powdered coal as a fuel for steam generation.

* An abstract of a paper read before the Federated Institution of Mining Engineers, by Bryan Donkin.

THE POWER OF THE FUTURE.

BY THOS. FROOD.

Assuming that water-power, transformed into electric energy, wind-power, and steam or gas, will furnish all the energy required during this generation, our task becomes rather adaptive than inventive in trying to outline future progress in mechanics. Efficient means of storing and transporting energy are the pressing need of the hour. Imagine the effect on the mechanical world if *a barrel of power* (say 10 h p. for 50 hours) were as cheap and portable as a barrel of flour! In the form of battery charges, or improved storage cells, this is even now upon the horizon; and the genius who makes it commercially profitable to ship *portable power* for use on private motors (or other wheels), will have advanced humanity by two enormous paces. First, it will lessen the wear of physical energy, and thereby increase comfort and prolong life; and, secondly, it will tend to prevent overcrowding at manufacturing centres by enabling mechanics to do a great deal of work at home which can now be done only at the source of power. The manufacturing city would then be extended over a township, with a railway along each street, supplying material and collecting finished work; and the artisan would labor in his own cottage, with his family around him and his garden before the shop window, instead of in the fifth story of a dusty factory, with only a smoky sky and rusty roofs to meet the eye. The factory and the ironclad are two of the monstrosities of our civilization which "have got to go" ere our race reaches its zenith. That such a change would promote comfort, longevity, and national prosperity, as well as stimulate ambition, foster higher manhood, and lessen vice, need hardly be argued. That it will be encouraged by the large manufacturer and capitalist is very doubtful, but the guilds of the artisan of the middle ages developed a skill and manhood in the members which was the bulwark of freedom then, and would be a very welcome addition to our present social condition. Intelligent co-operation is always preferable to servile unthinking labor; and as a traveller on a cycle sees more of the landscape, exercises more skill, and controls his risks more than the railway passenger, so the man who runs and rules his own machinery will have more pride in the product than one who is almost automatic in a huge factory, and who