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ECONOMY OF FUEL.

In the production of heat for domestic or other purposes, we are under that universal and inexorable law of nature which provides that we cannot make anything from nothing. However much we can control, modify or convert the substances and forces which are in existence around us, and make them available for our convenience and comfort, we can create nothing; but must have a substantial original to work with. Every unit of heat produced requires the combustion of a proportional amount of fuel. A table of the heating power of various combustible substances is given from Dr. Ure, on page 272, Vol. V. of this Journal; and by proper combustion these amounts of heat can be obtained from them. No ingenuity can make them produce more than is due from them; but it is generally the case that through ignorance, carelessness or negligence, fuel is dissipated without obtaining from it nearly the amount of heat which it is capable of giving, and without utilizing a great part of what is obtained. There is no necessity that this should be so. Of course there are requirements of elegance and convenience which exclude from some apartments the apparatus needed for producing and utilising all that might be; but in most circumstances we may with proper appliances obtain and use nearly all the heat the fuel is capable of giving. When we hear of the vast amount of mechanical energy which is represented by the heat derived from a given amount of fuel, and find that the best Cornish steam engines are capable of realising but one tenth part of this energy, we may be led to infer that we may not be able to realise more than a proportional amount of heat; but this is not the case, for, by the great care and attention given to the construction and feeding of the furnaces of these engines, very near the amount of evaporative power due from the fuel is obtained: the deficiency in mechanical effect is owing to the peculiar nature of the medium by which the heat is brought into mechanical action, which we will explain before we conclude.

In order to obtain the full heating effect of fuel, it is necessary that it be wholly and properly burned; that the whole oxydisable part of it be united with its proper quantity of oxygen. Whatever combustible gas or solid matter passes away unburnt, is so much of the fuel actually lost. The smoke from coal is an example of this, and many have been the efforts to prevent this loss and to avoid the disagreeable presence of smoke in the atmosphere. Many in burning smoke have not succeeded in obtaining from its combustion any addition of heating effect, whilst others have sustained actual loss by it. The most common and easy method of burning smoke has been to allow large quantities of cold air to pass over the fire, and mix with the vapours as they pass from it; but in steam engine furnaces the cooling effect of this large body of air has overbalanced the heating effect of its combustion. A president of a Society of Engineers in Scotland is reported to have stated that "coals were burned most economically when producing the blackest smoke in an ordinary steam boiler." But it is absurd to suppose that the heat derived from the burning of a part of the fuel can be greater, or even equal to that from the whole of it if properly burned; we must therefore assume that the loss, if any, must be from improper combustion. There are many complicated chemical processes involved in the combustion of fuel, and it is difficult to ascertain the precise effect of each of them. It frequently happens, from our inattention to these processes, that the heat generated in one part of the fire is wasted in another part. For instance, when fresh coal is put upon a fire in certain circumstances, as much and sometimes more of the original heat of the fire is used to distil the volatile part of the new fuel, as the subsequent combustion of its vapours will produce; indeed, it has been supposed by some, that the heating value of coal may be expressed by that of the quantity of coke which can be made from it. This, however, is an error, for 1 lb. of coal will make ¾ lb. of coke, and by referring to the table, p. 272, Vol. V., we find that 1 lb. of coal will evaporate 10·90 lbs. of water, whilst ¾ lb. of coke will evaporate but 8·86 lbs. We shall probably be near the truth if we say that loss is caused by burning the volatile part of the fuel by halves, first expending so much heat in making the smoke, and afterwards using too much cold air to burn it; and that our effort should be, not so much to burn smoke, as to burn fuel without producing smoke. To do this we must not only have a properly arranged fireplace, but must give constant attention to the fire. Almost perfect combustion of fuel is effected in some large steam furnaces, where attention to the fire in each of them is the whole duty of one man; but domestic