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## ARTICLE 4 Fuels and Fires Coal

The fuel that is most commonly used on blacksmith's forges is bituminous coal, usually called soft coal. It is broken into small pieces, and when free from sulphur and phosphorus and of good quality is excellent for this purpose. A fuel containing either sulphur or phosphorus should be avoided, as they will be absorbed by the iron. Sulphur makes the iron hot short, that is, it makes it brittle while hot; and phosphorus makes it cold short, that is brittle when cold.



Some grades of bituminous coal burn too rapidly, and some contain too much earthy matter to give a free burning, clean fire producing a proper heat.

Anthracite culm or hard coal siftings may be used at times, but this fuel is apt to contain a larger percentage of impurities than soft coal. In order to use it careful attention must be given to the blast, and in any case it will not make a hollow fire.

## Coke

Coke is a solid fuel made from bituminous coal by heating it in the fire or in ovens until it is volatile or gaseous constituents are Charcoal

Another solid fuel made by artificial means is charcoal. It is the best fuel because of the small amount of impurities that it contains. It is unrivaled for heating carbon steels, giving a clear, clean fire, free from sulphur and other objectionable matter. A charcoal fire is, however, not suitable for heating high-speed steels, as it is impossible to get the high temperature required. Charcoal made of maple or other hardwood is the best. Some manufacturers of twist drills, reamers, milling and other cutting tools, use charcoal exclusively. The objections to this fuel are that its cost is high and that it heats the work more slowly than coal.

Fire and Fire-Tools

The Fire—In the combustion of fuel (charcoal, coal or coke) the oxygen of the air combines chemically with the carbon of the fuel.

This chemical combination produces heat, the temperature attained depends on the rapidity with which the combination takes place, and the amount of heat depends on the amount of carbon and oxygen combined within a given period of time. Under ordinary conditions, the combustion would not go on rapidly enough to generate sufficient heat to raise iron or steel to the temperature necessary for working it under the hammer. Hence, the draft must be increased in order to supply more oxygen to the fuel, and thus increase the rate of combustion. It is possible, however, to supply too much air and blow out the fire



driven off, the solid portion not being consumed. If the coal contains sulphur and phosphorus, these impurities will always exist in the coke, although a portion of the sulphur may have been driven off by the heat in coking.

because too much cold air will chill the hot coals below the temperature at which the oxygen will combine with the carbon, or it may only lower the temperature by using the heat of the fire to warm the excess of air that passes through it. The greatest objection, however, to an excess of air is that too much oxygen will be supplied to the fire and some of it will combine with the hot iron, forming oxide of iron, which is the black scale that falls from heated iron while being forged. A fire supplied with an excess of air is called an oxidizing fire, but if all the oxygen is used in the combustion and there is an excess of carbon, the fire is called a reducing fire.

A good way to start the fire is to heap coal all around the tuyere

to a depth of two or three inches, leaving the tuyere uncovered. A handful of shavings or some oily waste is set on fire and put into the opening over the tuyere, and a small quantity of fuel is spread over it. The blast is turned on very lightly, and as the fire burns up, more fuel is added, and the blast is increased. A conical block of wood is sometimes used. The block is put over the tuyere with the small end down and the coal packed about it. The block is then taken out and shavings put into its place, and the fire started.

