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## Iron and Its Value

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## Iron and its Value.

Iron is the most important metal in use, not only because of its superiority in strength and general adaptability, but also in consequence of the wide and abundant distribution of its ores. As cast iron it is made fusible either readily or with difficulty, hard or soft, brittle or malleable, and finally as strong and elastic as could be wished. As wrought iron, it may be obtained nearly as soft and ductile as copper or harder than any metal except steel, and its property of being welded renders it invaluable. And as steel, it has the greatest strength and elasticity of any metal in use.

Iron, like all other metals is found as ore, of which there are several kinds; such as, limonite, siderite, the red and brown hematites, and magnetite. The magnetite contains the largest per cent of metallic iron, the hematites rank next.

The working of the iron was practiced before history begins, and by several nations. Wedges of iron were found in the great pyramid of Egypt, therefore in all probability the art was known at or before 4400 B.C. At Delhi in India is an

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pillar supposed to have been erected as early as 900 B.C. This has been tested and been pronounced to be of soft wrought iron. At the time of the conquest of Britain by the Romans, the inhabitants had already learned how to reduce the iron ores in rude furnaces, and most of the furnaces of to-day are fashioned somewhat after that primitive style. These are called bloomeries, from the Saxon word bloma, meaning metal. The people of olden times did not mine the ore as it is done now, they had no way of keeping the mines free from water nor, of supplying them with fresh air, and the ore was taken from near the surface of the ground. This system is no longer pursued, and miners now ply their trade in the very depths of the earth.

The ore is first sorted in the mines and only those pieces which will pay are sent to the top of the shaft. There a second sorting takes place, the different sizes and grades being put into different heaps, some of which go to the crushers and the rest straight to the smelting furnaces. There are several impurities in the iron ore which are objectionable, the chief one being phosphorous. Others are sulphur, silica, lime, and aluminium. Some of these elements however if properly combined with the iron may be of an advantage to it.

The dressing of the ore should take place before it is sent to the smelting furnaces, during this process, all rocks, earth, and similar matter are separated from the ore. After the dressing process has been finished the ore is roasted, or calcinated. This is done in heaps in the open air or in kilns. The object is to get rid of all volatile matter such as, water & carbonic acid, and to open and soften the ore making it more easily reduced. Charcoal is generally used as the fuel for roasting as it is likely to contain fewer impurities than any other fuel. About one hundred and fifty <sup>parts</sup> of charcoal are needed to reduce one ton of ore. As soon as the ore has been roasted it is ready for the smelting furnaces. These are ordinarily about twelve feet across at the hoshes, and from twenty-five to thirty-five feet high, and they are furnished with forced drafts, or blasts, in order to secure a greater heat. The temperature of these blasts is an important factor in the economy and efficiency of the furnace.

The iron which is tapped from the furnaces is led by channels to the pig bed. This is made of moist sand and forms the moulds in which the pig iron is cast. By different means this pig iron is changed into cast iron, wrought iron and steel.

Cast iron is the direct product of the blast furnaces,

and contains from two to six per cent of carbon about five per cent silicon, and sulphur and manganese in smaller quantities. There are several grades of cast iron, which are classed as follows; gray, mottled, and white. Of these the gray iron contains more carbon than the others.

Wrought iron differs from cast iron in its comparative freedom from carbon, silicon, and other impurities, having only about twenty-five one hundredths of one per cent of carbon, and still less of the others. This iron is made by subjecting molten cast iron to an oxidizing flame until the carbon and other elements are burned out, and the metal is pure enough to become pasty and to form a spongy mass in the furnace.

Steel, the last form of iron to be mentioned here, is variously defined by different authorities and cannot be satisfactorily classed under any definition yet proposed. The term generally includes all impure iron which on account of other elements has the property of hardening by sudden cooling from a high temperature. This is called tempering. Steel contains from twenty-five hundredths to three and one half per cent of carbon. It is mostly used for making rails and tools.

At the time of the colonization of America the demand for iron was so greatly increased that the production from

European furnaces was insufficient on account of the destruction of the forests near where the ore was found, and this production was steadily decreasing all the time. The enormous extent of the American forests and supposed mineral wealth attracted many explorers who discovered rich deposits of iron as well as other metals.

The commencement of the manufacture of iron in America began in the 17 century. The first iron works were erected at Jamestown, Virginia soon after Raleigh settled there.

The ore found was tested and proved to be as good, if not better, than that of Europe. These iron works did not accomplish much, as the Indians murdered all the people and destroyed their buildings and apparatus. There were several forges built Rhode Island as early as 1765 in the towns bordering on Bristol County Mass., and one of the largest masses of magnetic oxide found in New England is in the town of Cumberland. There are several other places in this state where iron works were erected in its early history. Nearly all of the middle and southern states furnish iron ore, and through them America has become the largest iron producing country in the world.

One of the chief objects of this thesis was to collect and test samples of iron and steel which are used by agricult

urist and blacksmith and find the best and cheapest. These samples were collected in this state, and the results of the testing are given below.

No.	Tensil strength per sq. inch	Elongation in 10	Area in sq. inches.	Price per pound.
1	52,143	2.1	.196	\$ 0.024
2	49,964	2.75	.196	0.035
3	63,944	2.56	.196	0.03
4	136,394	.8	.196	0.0525
5	49,226	3.12	.25	0.035

No. 1 is wrought iron of the Anchor Grade.

No. 2 is the best refined iron.

No. 3 is Bessemer steel

No. 4 is the best crucible steel

No. 5 is Norway or Sweden iron

*Archie H. Linnell*