metal, the Uchatius steel is made. The production is not inconsiderable, and the article finds a market at Gefle, principally in the form of a bar steel of small dimensions, at a price of 30s. to 35s. per cwt. Uchatius' process would have become a practical success in England, had it not been swept away by Mr. Bessemer's invention before it had time to establish itself in practice. The steel manufacturers of this country and the public at large have all reason to be satisfied with the historical coincidence of the two inventions, since there would otherwise, and had Bessemer followed behind Uchatius, have been two revolutions to be passed through instead of the one which has taken place. We should have had to change from the old mode of steel conversion to the Uchatius process, and ultimately again from that to the Bessemer process.—*Engineering.*

Mushet's Process of Cast Steel Manufacture.

In the manufacture of cast-steel by the ordinary process of melting either blister steel or scrap steel, or mixtures of materials which when melted produce cast-steel, it is customary to add to the steel or mixture of steel-producing materials constituting the charge of each melting pot or crucible a few ounces of peroxyd of manganese as a flux. The peroxyd acts as a flux, and likewise improves the tenacity and ductility of the cast-steel produced when heated and forged, and materially increases the capability of the said cast-steel to bear a high degree of heat without cracking when being forged or rolled.

Mr. Robert Mushet's improved process consists in employing as a flux, in place of peroxyd of manganese, chromate of iron, oxyd of chrome, or an artificial mixture of chrome-oxyd and oxyd of iron. But as natural chromate of iron answers perfectly for this process, and is far cheaper than chrome-oxyd or artificial mixtures of chrome-oxyd and oxyd of iron, the inventor prefers to use the natural chromate of iron. Chromate of iron is a mineral found abundantly in nature, and consisting essentially of the oxyds of chrome and iron. The chromate of iron employed is that which is most free from gangue, veinstone, and likewise free from sulphur and phosphorus, which latter are sometimes found associated with chromate of iron. The chromate of iron is prepared for this process by pulverizing or by breaking into small pieces. Or it is used in the granulated state, in which it is frequently found in nature.

To the charge of steel or of steel-producing materials which it is intended to melt into cast steel, and which charge usually amounts to from forty to fifty pounds avoirdupois for each melting pot, more or less, Mr. Mushet adds from three to six ounces of chromate of iron, but he does not confine himself to the specific quantities of chromate of iron. The chromate of iron is introduced into the melting pot along with a charge of steel or of steel-producing materials which it is intended to melt into cast-steel, and for the sake of convenience the chromate is wrapped in a piece of paper and dropped into the melting-pot along with the steel or mixture of steel-producing materials. The chromate of iron may nevertheless be introduced into the melting-pot subsequently to the introduction and melting or partially melting of the steel or steel-producing materials, but it is found to be convenient to introduce the chromate along with the steel. When the steel and chromate of iron are melted into cast-steel the melting-pots are withdrawn from the furnace, and the cast-steel is poured into ingot-molds in the usual manner.

Example No. 1: Take cast scrap-steel ingot tops or steel bar ends 40 pounds, and chromate of iron pulverized 6 ounces. Introduce these materials into a melting-pot, and when the steel is melted withdraw the melting-pot and pour the melted steel into an ingot-mold. *Example No.* 2: Take spring steel-scrap 38 pounds, spiegeleisen 2 pounds or 3 pounds, chromate of iron pulverized 6 ounces, and proceed as in example No. 1. *Example No.* 3: Take hard converted bars 40 pounds, chromate of iron 6 ounces, and proceed as in example No. 1. It is not necessary to employ oxyd of manganese or any other flux in this process, except chromate of iron, these other fluxes not being essential to the success of the process. They may, however, be occasionally used without any injurious effect. This process not only increases the ductility and tenacity of the cast-steel produced by it when the said cast-steel is heated and forged, but it also prevents or materially diminishes the shrinkage, or what is termed the "piping," of the cast-steel ingots, thus saving much waste. The bars of steel also which are forged from ingots of cast-steel produced by this process are (when the cast-steel has been thoroughly melted in a workmanlike manner) free or nearly free from those serious imperfections technically called "rokes" or seams; and, lastly, cast-steel thus prepared is wholly or nearly free from the defect of what is termed "water cracking" when hardened. — *Mechanics' Magazine.*

Malleable Cast Iron.

Malleable cast iron, as has been proved by the careful experiments of M. Tresca, has a coefficient of elasticity and an elastic limit equal to that of good wrought iron. For a repetition of complicated articles difficult and expensive to forge, we cannot imagine a better material; and there can be no doubt that malleable cast iron has not yet had justice done to it by the engineer. Though its manufacture is getting rather widely spread on the continent and in England, it is yet in the hands of comparatively few people, and is in fact, almost a secret. The most noted English malleable cast iron founder is Mr. John Crowley, of the Kelham Works, Sheffield, and of Manchester. A bar of his manufacture, five-sixteenths of an inch in diameter and about a foot long, with a fracture like steel, is now before us. Few would guess that large quantities of such rods are cast to make the common fish-tail gas burners by cutting them up and turning and boring them in the lathe.

The discovery of the process of making cast iron malleable is ascribed to Samuel Lucas, whose specification describes the chief features of the mode still adopted in the manufacture. Dr. Percy has pointed out that Reaumur, as long ago as 1722, published this process. The difference between the positions of Reaumur and the Lucases—Samuel and Thomas—in the matter is, that Reaumur never carried out the discovery on a commercial scale,