On the Manufacture of Cast-Steel, by Dr. Karsten.

Any information connected with the manufacture of steel is of great importance to a large class of manufacturers and operatives in America.

Chemistry had already been established upon a scientific basis by the adoption of the doctrine of definite proportions at the time when attention was again directed to the compounds of iron with carbon. With regard to these substances, so impoortant in the arts, the law of definite combining proportions did not appear to hold good; but the per centage of carbon was greater in proportion as the carboniferous iron approximated more closely to steel, and from this to cast-iron. However, there still remained a possibility of reconciling this fact, with the law, by assuming the existence of a definite carburet of iron capable of combining with iron in definite or indefinite proportions, and determining its characters. Still the existence of such a carburet of iron has never yet been proved. In the course of a former investigation of this subject, I was of opinion that I had really obtained such a substance. But the evidence of subsequent experience is entirely the other way; and even if such a compound were discovered, the difficulty would not be removed, for it would still be necessary to admit that it combined in indefinite proportions with iron. It would appear as if the combination of iron with carbon in indefinite proportions does not exceed a certain limit, and that the maximum per centage of carbon is about 5·93.

The classification of the various kinds of carburetted iron, under the general name of cast-iron, steel, and bar iron, is entirely arbitrary, and based upon the physical characters. When entirely free from carbon, iron is so soft that it offers but little resistance to friction, and would be inapplicable to most of the purposes for which iron with more or less of carbon is employed. By combination with carbon within certain limits, it acquires greater hardness; the elasticity and ductility are increased. The increased hardness is especially remarkable when the strongly-heated metal is suddenly cooled. This character of some carburetted iron has been made the distinction between bar iron and steel, inasmuch as all bar iron which becomes harder when suddenly cooled, is by universal consent termed steel. The analyses of a great number of varieties of iron has led to the result that the per centage of carbon may rise to 0.2, or 0·25, before the metal becomes considerably harder when suddenly cooled. The purer the iron is, the greater its freedom from adventitious substances, especially sulphur, silicon, and phosphorus, the larger may be the per centage of carbon requisite to determine its hardening when cooled suddenly. The best kinds of Swedish bar iron and that made in Germany from spathic iron and brown iron ores, do not become very hard even when containing as much as 0·35 per cent. of carbon, although the hardness is such as to justify the appellation of steel-like iron. The transition from this kind of iron to true steel is so imperceptible, that it is necessary to adopt some arbitrary means of deciding whether the metal is bar iron or steel. It the carburetted iron acquires on sudden cooling such a degree of hardness as to give sparks when struck upon flint, it may be regarded as steel; and this degree of hardness requires a per centage of carbon amounting for the less pure kinds of iron to 0.5, and for the nearly pure iron to 0·65. However, steel containing such a small per centage of carbon is always but soft steel, which, to become capable of acquiring greater hardness, must be more highly carburetted. The hardness acquired upon sudden cooling increases as the per centage of carbon increases, but not in the same proportion. For iron almost perfectly free from adventitious substances, a per centage of 1·4 or 1·5 carbon corresponds with the highest capability of acquiring hardness and tenacity. With a still higher per centage of carbon the steel acquires greater hardness; but its tenacity is lessened and the malleability decreases so rapidly with the increase of carbon, that with a per centage of 1·75 it can scarcely be welded at all.—When the per centage of carbon amounts to 1·8, it is only with great difficulty that it can be forged, although with a very great degree of hardness it may still possess considerable tenacity. Steel which contain 1·9 per cent. and more of carbon can scarcely be forged at all, and with a per centage of 2·0 the limit between steel and pig iron appears to be reached; for such metal in the soft state, that is, before being hardened, cannot be beaten out while hot without splitting and breaking under the hammer.

Steel, in virtue of the remarkable capability which it possesses, after cooling slowly from a high temperature, of being worked like soft iron, and then acquiring a considerarable increase of hardness, without loss of tenacity on subsequent sudden cooling, has become a very valuable substance for various branches of industry. However, it has not yet been possible to refer the altered conditions of hardness presented by the slowly and suddenly cooled metal to any altered state of combination of the carbon and iron in steel.—Such wide differences of hardness and softness as those presented by steel, which has been submitted to these two modes of treatment, can only be regarded as resulting from a total alteration of its molecular structure. The conjecture that the state of combination of the iron and carbon in hardened and soft steel respectively must be very different, is rendered in a high degree probable from the circumstance that such a difference in the state of combination of the iron and carbon in the carburets with a large per centage of carbon—the different kinds of pig iron—may be proved to exist with perfect certainty. A distinction has always been made between white and gray pig iron. These substances differ so obviously in their characters—color, hardness, tenacity, and brittleness—that the fact could scarcely have been overlooked. In addition to this, the difference in their conditions of fusion must not he overlooked, the gray kind requiring a much higher temperature than the white iron, and passing almost suddenly from a solid to a liquid state, while the white iron not only fuses at a lower temperature, but before liquefaction, becomes soft and then pasty. Before a trustworthy method of separating carbon from iron had been discovered, it was supposed that this difference in the behavior of white and gray kinds of iron was attributable to the per centage of carbon, for on dissolving gray iron in acids a much larger quantity of carbon is left than when white iron is treated in the same manner. Now, however, it is known that this inference was erroneous, and that the characters of pig iron are dependent, not upon the greater or less per centage of carbon, but upon the state of combination of the carbon and iron. The gray iron, when suddenly cooled after having been melted, is converted into white iron; and white iron, when exposed to a high temperature, after melting, and gradually cooled, is converted into gray iron, without the per centage either of iron or carbon being in any degree altered. Every kind of gray iron corresponds to a white iron with precisely the same per centage of carbon; and the wholly different behavior and characters of these two kinds of iron are no longer regarded as owing to the greater or less per centage of carbon, since it is known that the gray soft iron, malleable at the ordinary temperature, is a mixture of steel or steel-like iron with carbon, while the white, hard, and brittle iron is a true chemical compound of iron with the entire quantity of carbon present.

The analogy between the gray and white pig iron on the one hand, and soft and hardened steel on the other, is unmistakable; but no trace of uncombined carbon has ever been found in slowly cooled soft steel. Even cast-steel, which contains from 1·9 to 2·0 per cent. of carbon, and which on account of this large per centage can no longer be forged, has never been found to contain uncombined carbon after the slowest possible cooling. It is only when the per centage of carbon amounts to 2 25 or 2 3, that carbon separates in the slowly cooled metal, and communicates to it the characters of pure pig iron. If, therefore, a distinction is to be drawn between steel and pig iron, founded upon a character determined by the combining proportions, it would correspond with a per centage of carbon amounting to 2·25 or 2·3, because a part of the carbon is then separated on gradually cooling the mass. The more the per centage of carbon increases from this minimum to the maximum of 5·93, the lighter is the color of the metal and the greater the hardness of the white variety. In the gray iron, on the contrary, the quantity of carbon which separates, and which determines the darker color and greater softness of the metal, as well as the greater or less per centage of carbon remaining in a state of chemical combination with the iron, is dependent upon the more or less gradual solidification of the melted mass. It is therefore not sufficient to know the per centage of carbon in pig iron, as ascertained by analysis, in order to form an opinion as to the behavior of the iron in question; but it is at the same time necessary to determine how much of that cabon is chemically combined with the iron, and how much is present only as a mere mechanical admixture. With regard to the metallurgical processes, the object of which is to separate the carbon from pig iron for the production of steel or bar iron, the state of combination in which the carbon exists, is of far greater importance than the total per centage of this element. White iron requires for this purpose methods and processes different from those applicable to gray iron; and cases may occur in which the smelter would be obliged to convert gray into white iron, even although this has to be effected by an addition of carbon, notwithstanding that its separation is the real object of his operations.

[Concluded next week.]

American Wine.

Mr. Cist, in a recent number of his Advertiser, gives the following interesting account of the present and prospective conditions of grape culture and wine making in Cincinnati and in the vicinity. He says:—

"I have recently visited the wine cellars of Messrs. Longworth and Zimmerman, on Sycamore street. Mr. Zimmerman, the active partner, with his two sons, has been engaged in Europe for years in the manufacture of wine, and considers the Catawba a finer basis for first rate wine, than any in Germany or France. The drawing off and properly ripening wine they consider of more importance to the development of a fine article, than the original manufacture.

The wine cellars of this establishment are 105 feet in length, an average of 35 in width, and 18 in height. Each seasons wine is kept by itself, in casks of 2,000, to 2,500 gallons capacity, and none of our native wine is bottled in this establishment until it has been four years in casks. Thus the wine bottled this season is the vintage of 1848, as that of next year will be the vintage of 1849. In this way the entire sediment, precipitated by successive fermentation, is retained within the cask.

Messrs. Zimmerman will put up this season 30,000 bottles; in 1853, 50,000; and in 1855, 100,000. What will be done beyond that period must depend on the yield of the grape crop in 1853; and later seasons. All this is Catawba wine, termed Still, in distinction from Sparkling Catawba.

Mr. Longworth is engaged in the manufacture of Sparkling Catawba, at his wine cellars on Butler street, of Broadway. He made in 1850, 50,000 bottles; in 1851, 75,000, and this year he will put up 105,000 bottles.—Sparkling Catawba requires fifteen to twenty months for ripening before being ready for market. Mr. L. has also dry and sweet wines, the first of the Catawba, and the other from the Isabella grape.

Messrs. R. Buchanan, Corneau and Sons, G. P. Bergen, Rehfuss, Yeatman, Miller, and others, are also extensively engaged in the manufacture of Catawba wine. All these persons label their wines. The aggregate annual manufacture of first wine may be put down at 150,000 bottles Still, and 180,000 Sparkling Catawba.

Probably 30,000 bottles Still Catawba wine is made, sold, and drank in this vicinity by Germans, mostly the product of small vineyards. This is unbranded, and of various qualities—the greater part of inferior quality. But whatever may be the quality of our native wines, they are all pure; that is from anything else than the juice of the grape.—One or two manufacturers make sweet wines to a small extent, acknowledged to be fictitious.

The supply of native wines, greatly as it is on the increase, hardly keeps up with the increasing demand. All the wine older than five years, of Catawba, is out of market, and the Sparkling, although not requiring such a large lapse of time to fit it for use, is taken off as fast as it can be made for market.

There are about 1,200 acres of grapes in cultivation in the vicinity of this city. Every year adds to the quantity of bearing vines, and to the number of persons engaging in the business."

American Sewing Machines in Scotland.

The following compliment to American sewing machines, (nearly all of which have been illustrated in our columns) is taken from the 'Glasgow Chronicle':—

"A machine of American invention has been intruduced into this country by Mr. Darling, of Glasgow, (at whose manufactory numerous examples of it are now in operation) which carries the mechanical principle into a fresh department of human labor—namely, that of common hand sewing. The patent sewing machine promises to produce a revolution in the business of the seamstress as great as the powerloom effected in that of the weaver. This is, in truth, a moderate statement, for the capabilities of the machine have not yet been fully tested, and it is impossible to say how far its influence on the labor market may yet extend. By the hand the machine may be driven at the rate of 500 stitches per minute, by the foot at nearly twice that rate. Nor must it be supposed that the work executed at this extraordinary rapid rate is loose, irregular slop sort of work. On the contrary, it is strong, close, sewing, beautifully regular, such as it would require a very firm and well-practised hand to equal. Now, after all that has been said about American reaping machines, what will be said about this new American sewing machine, which seems likely to do still more towards facilitating indoor labor than the larger invention towards abridging the work of the field? We do not wish to exaggerate the probabilities of the case, but it must be remembered that the invention has so far passed the period of probation that it is in very extensive operation in America, that such trial as it has had in this country has been extremely successful, and that already its inventors are improving on it and adapting it still more carefully and completely to its end. Looking at it when at work, it is impossible to resist the couclusion that it is destined completely to supersede all ordinary plain hand-sewing, and that sewing, as an occupation for either men or women, tailors or seamstresses, is gone for ever.

Another Silk Factory.

The "Hartford (Ct.) Times" say:—"It may be remarked in publishing the above, as another evidence of the progress in silk manufacture which is now being accomplished by American skill and ingenuity, that the establishments of Cheney Brothers, located in South Manchester, about nine miles East of this city, are producing a most beautiful article of Sewing Silk, which is unsurpassed in strength, fineness of texture, and lustre, by any Italian product. The machinery in their mills is of the most ingenious character, and by its complete adaptation to the purpose, an evenness and fineness is obtained in their sewing silk which is, if we are not mistaken, altogether unequalled by any other silk made in this country, and not surpassed by any made in Europe. This machinery has been invented by the Messrs. Cheney themselves, and the ingenious and beautiful operation of its different parts is well worth witnessing.

Patapsco River.

The measures for the improvement of the channel of this stream are now in progress, as we learn by the 'Baltimore American.'—The dredging machine has been, since the 11th ult., excavating the bottom of the river at Sparrow Point knoll, the intention being to reduce the knolls nearest the main channel and bring them to a common level with the bed of the river, say eighteen feet, after which the commissioners will determine on the requisite additional machinery for opening a channel, twenty-two feet deep, throughout the entire length of the river.