Since that period the cost has been rendered much lower, and those who have made good arrangements for mineral property, can manufacture iron at a cost of little more than L.2 per. ton.

At the request of the British Association. Dr. Thomson of Glasgow examined the chemical constitution of hot-blast iron, and he gives the following as the result of his in­quiry :

“ (1.) The specific gravity of hot-blast iron is greater than that of cold-blast.

“ The following are the specific gravities of eight specimens of cold blast iron :

1st. Muirkirk 6·410

2nd. Ditto. 6·435

3rd. Ditto 6·493

4tb. Ditto 6 579

5th. Ditto 6·775

6th. From pyrites 6∙9444

7th. From Carron 6∙9888

8th. Clyde Iron Works 7·0028

“ The specific gravity of the Muirkirk iron is considerably less

than of that smelted at Carron and the Clyde Iron Works ; the mean of the eight specimens is 6·7034.

“ It has been hitherto supposed that the difference between cast- iron and malleable iron consists in the presence of carbon in the former, and its absence from the latter ; in other words, that cast iron is a carburet of iron. But in all the specimens of cast iron which we analysed we constantly found several other ingredients besides iron and carbon. Manganese is pretty generally present in minute quantity, though in one specimen it amounted to no less a quantity than 7 per cent. ; its average amount is 2 per cent. *Sili- con* is never wanting, though its amount is exceedingly variable, the average quantity is about 11/5 per cent. ; some specimens contained 31 per cent. of it, while others contain less than a half per cent. Aluminum is very rarely altogether absent, though its amount is more variable than that of silicon. Its average amount is 2 per cent. ; sometimes it exceeds 41/2 per cent., and sometimes it is not quite 1/1000th part of the weight of the iron.

“ Calcium and magnesium are sometimes present, but very rarely, and the quantity does not much exceed 1/5th per cent. In a speci­men of cast iron which I got from Mr. Neilson, and which he had smelted from pyrites, there was a trace of copper, showing that the pyrites employed was not quite free from copper ; and in a specimen from the Clyde Iron-Works there was a trace of sulphur. The following table exhibits the composition of six different specimens of cast iron. No. I, analyzed in my laboratory, either by myself or by Mr. John Tennent.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Muirkirk.** | **Muirkirk.** | **Muirkirk.** | **Pyrites.** | **Carron.** | **Clyde.** | **Mean.** |
| Iron, | 90·98 | 90∙29 | 91·38 | 89∙442 | 94·010 | 90·824 | 91·154 |
| Copper, |  |  |  | 0∙288 |  |  |  |
| Manganese, | ... | 7.14 | 2·00 | ... | 0∙626 | 2·458 | 2 037 |
| Sulphur,.... | ... | ... | ... | ... | ... | 0·045 |  |
| Carbon, | 7∙40 | 1·706 | 4·88 | 3∙600 | 3 086 | 2·458 | 3·855 |
| Silica, | 0∙46 | 0·830 | 110 | 3·220 | 1∙006 | 0·450 | 1·177 |
| Aluminum, | 0·48 | 0·016 | ... | 3∙776 | 1∙032 | 4∙602 | l∙65l |
| Calcium,.... | ... | 0·018 | 0 20 |  | ... | ... |  |
| Magnesium, |  | ... |  |  | ... | 0·340 |  |

"The constant constituents of cold-blast cast-iron, No. 1, are iron, manganese, carbon, silicon, and aluminum. The occasional consti­tuents are copper, sulphur, calcium, and magnesium. These occur so rarely, and in such minute quantity, that we may overlook them altogether.

"The constant constituents occur in the following mean atomic proportions :

22 atoms iron = 77·00

1/2 atom manganese, = 1·*75*

4·36 atoms carbon, = 3·27

atom silicon, = 1·00

11/8 aluminum, = 1·40—84 42

“2. I examined only one specimen of cast iron, No. 2. It was an old specimen, said to have come from Sweden, but I have no evi­dence of the correctness of this statement. Its specific gravity was 7∙1633 higher than any specimens of cold-blast iron, No. 1. Its constituents were.

Iron, 93·594

Manganese 0∙708

Carbon, .3·080

Silicon, 1·262

Aluminum, 0·732

Sulphur 0 038—99·414

“ The presence of sulphur in this specimen leads to the suspicion that it is not a Swedish specimen ; for as the Swedish ore is magne­tic iron, and the fuel charcoal, the presence of sulphur in the iron is very unlikely.@@1

“ In this specimen, the atoms of iron and manganese are to those of carbon, silicon, and aluminum, in the proportion of 41/2 to one, in­stead of 31/2 to one, as in cast-iron No. 1.

“ The atoms of carbon, silicon, and aluminum, approach the pro­portions of 7, 2, and 1, so that in cast-iron, No, 2. judging from one specimen, there is a greater proportion of carbon, compared with the silicon and aluminum, than in cast-iron, No. 1.

“ Mr. Tennent analyzed a specimen of hot blast-iron, No. 2, from Gartsherry. Its specific gravity was 6·9106, and iu constituents, Atoms.

Iron 90·542 25·86

Manganese, 2·764 0·78

Carbon, 3·094 4 05

Silicon 0·680 0·68

Aluminum, 2'894 2·31

Sulphur, 0·023 0·011

99·997

So that it resembles cast-iron, No. 1, in the proportion of its consti­tuents. The carbon is almost the same as in cold-blast iron, No, 2 but the proportion of aluminum is four times as great, while the sili­con is little more than half as much. The atomic ratios are, carbon, 4; silicon, 0·67 ; aluminum, 2·28.

“3. Five specimens of hot-blast cast iron, No. 1, were analysed. Two of these were fromCarron,and three from the Clyde Iron- Works, where the hot-blast originally began ; and where, of course, it has been longest in use. The specific gravity of these specimens was found to be as follows :

1st. From Clyde Works 7·0028

2d. From Carron, 7·0721

3d. From Carron 7·0721

4th∙ From Clyde Works,. 7·1022

Mean, 7·0623

“ It appears from this, that the hot-blast increases the specific gra­vity of cast-iron by about 1/22nd part. It approaches nearer the ape­cific gravity of east iron No. 2, smelted by cold air, than to that of No. 1.

“ The following table exhibits the constituents of these four spe­cimens.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Clyde.** | **Carron.** | **Carron.** | Clyde. | **Clyde.** |
| Iron, | 97·096 | 95·422 | 96·09 | 94·906 | 94·345 |
| Mangnnese,... | 0∙332 | 0∙336 | **0∙4l** | 0·160 | 31·20 |
| Carbon, | 2·460 | 2∙400 | 2∙48 | l∙560 | 1·416 |
| Silicon, | 0·280 | 1∙820 | 1∙49 | 1·322 | 0·520 |
| Aluminum,... | 0∙385 | 0·438 | 0∙26 | 1 374 | 0·599 |
| Magnesium,.. | ... | ... | ... | 0’792 | ... |
|  | 100·55 | 100∙466 | 100·73 | 100∙174 | 100· |

The mean of these analyses gives u«,

Atom.

Iron 95·584 or 27·31

Manganese, 0·87l or 0·249 } 6·5

Carbon 2·099 or 2·79

Silicon 1∙086 or 1∙086

Aluminum 0·422 or 0,337 }1·

101∙985

Or. in the proportion of 61/2 atoms of iron and manganese to I atom of carbon, silicon, and aluminum. In the cold-blast cast-iron we have, Iron. Carban. &c.

In No. 1, 31/2 atoms 1 atom·

In No. 2 41/2 1 —

In hot-blast 6 1/2 1 —

“ Thus it appears, that when iron is smelted by the bot-blaβt its specific gravity is increased, and it contains a greater proportion of iron, and a smaller proportion of carbon, silicon, and aluminum, than when smelted by the cold-blast.

@@@ I have been told by Mr. Mushet that the Swedes add sulphur to their iron No. 2.