MINUTES OF PROCEEDINGS,

10TH DECEMBER, 1885.

Walter Shellshear, President, in the chair.

The following candidates were balloted for and duly elected as

MEMBERS:

HENRY E. DICKENSON.
FRANCIS BERGIN.
JOHN McDOUGALL.

Mr. CLEMENT VAN DE VELDE then read the following papers :—

THE TREATMENT OF COPPER ORES BY THE "MANHES PROCESS."

By CLEMENT VAN DE VELDE.

In late years very rich copper fields have been discovered in various parts of the world, and at many of the mines worked, principally in the United States of America, an enormous production is the result, and to-day, copper, like many other staples, is produced more than the demand requires. The latest statistics show that the stock of copper has never been so large as at present.

The price of copper has dropped so low, that only mines putting out exceptionally rich ores can pay small dividends, and the great majority of them find it difficult to make both ends meet. They use the method known as the "Gallic Process."

In the Australian colonies no such ores as just mentioned are worked at the present moment, and it is needless to state that the copper industry in Australia is far from being in a flourishing condition. Several mines have stopped work. Others have reduced their output, and unless the price of copper rises or they find a cheaper way of producing, all the copper mining companies of Australia will have to close their works.

This cheaper way of producing copper from the ore was discovered three years ago by a French metallurgist, Mons. Pierre Manhès, of Lyons, and after repeated trials, he succeeded in perfecting his system, and the Manhès process is now used by the leading copper smelters throughout the world.

Owing to the price of fuel and labour, the French copper fields remained unproductive for a long time. As in all similar cases, necessity was the mother of invention. For long years Mr. Manhès studied to discover an economic method which would allow to work the French mines, and French ores are now converted into copper at Eguilles, three miles from Limoges, where at the present moment fifteen tons of copper are produced daily, and the plant to double this production is now in course of erection.

Before describing the new process, and in order to thoroughly appreciate the advantages of it, we will briefly summarize the several operations of the gallic method still used in Australia. We will thus be able to compare and judge. The gallic method comprises at least six operations, and sometimes more.

It is only when native copper or very rich carbonates are to be treated that the number of these operations can be reduced.

Reverberatory furnaces of two kinds are exclusively used to-day :—Roasting and smelting furnaces. The fuel used is coal or wood. The process varies somewhat at different mines, but the main features are the same.

As we are all acquainted with these furnaces, a description of them would be superfluous. We shall consequently limit ourselves to enumerate the six operations of the gallic process :—

1.—The first operation lasts from 12 to 24 hours; it is the calcination or roasting of the ore. (After this operation the colour of the ore is brownish black.)

2.—After the roasting the ore is smelted with the slag obtained in the operation No. 4 in a furnace called ore furnace, and the product is called *coarse metal*, and contains about fifty-five per cent. of copper. It takes about five hours to smelt the charge of the furnace, which is then stirred and skimmed and the metal drawn off.

3.—The coarse metal of No. 2 is then roasted in an open-air roasting furnace; the matte is frequently stirred, the operation is generally finished in 24 hours, and towards the last the temperature is raised.

4.—The coarse metal or granulated bronze matte of No. 3 is smelted, with the addition of fluxes rich in oxydes of copper, such as the roasting and refining slag resulting from both operations No. 5. and No. 6, and carbonate of copper or ore containing oxyde of copper. This produces the rough metal, containing 75 per cent. of copper and the metal slag smelted in No. 2 operation. The matte must be white metal.

5.—This operation is called roasting. The white metal ingots of No. 4 are introduced into a smelting furnace like No. 2, with a slight difference for the introduction of the air. The product is composed of roasted slag with blister copper, which contains about 95 per cent. of copper. The temperature is regulated so that the ingots are smelted drop by drop, within 6 to 8 hours. This blister copper is again cast into moulds.

6.—The last operation is the refining, which produces the marketable copper, and takes about 15 hours.

By this short enumeration it is easy to see how tedious and expensive this gallic method is; and it is this method, slightly modified, which is still applied in all the Australian mines.

Let us now examine the Manhès process. The object of this invention is to obtain in one operation in the Bessemer Converter, or in any other revolving or stationary converting furnace, copper at 98 to 99 per cent., by means of forcing air, under sufficient pressure, through the molten ore.

The raw copper thus obtained in one operation needs only to be refined by the ordinary means.

The ore, without any previous calcination, is smelted in any kind of furnace. This smelting is for the purpose of slagging away the earthy matter by concentrating the metallic parts into a matte or regulus, more or less rich in copper, but always containing iron and sulphur. The liquid matte is tapped from the ore-smelting furnace direct into a converter, which has been previously heated to a sufficient temperature. Under the action of the blast the sulphur is eliminated in the state of sulphurous acid, as also the other volatile substances, such as arsenic, antimony, etc., and at the same time the iron is rapidly oxydised and transformed into silica by contact with the earthy matters which form the lining of the converter, and if necessary by the addition of silicious flux ; the slag is removed by the ordinary process, and the copper remains alone in the apparatus.

The operation takes very little time, and when finished the raw copper is cast either into ingots, or preferably poured into a refining reverberatory furnace direct. This furnace is previously heated, which avoids the necessity of re-smelting the metal to refine it.

The slag from the converter contains still some copper, in the shape of oxydes and granulations. These are assorted, and those which are considered too rich to be rejected are passed into the next operation. But the best way is to smelt them in a cupola furnace, with suitable flux, in order to obtain black copper or matte, and slag which is sufficiently poor to be rejected. However, as this slag is always very rich in oxyde of iron, it can be used with advantage as flux in smelting ores or other quartzy matters.

When the matte contains much iron, which attacks the ordinary earthy lining of the converter, it is necessary to make this lining of a basic material, such as lime, magnesia, etc., and to add a silicious flux, which will slag the oxydes produced.

In all the applications just described Mr. Manhès has mentioned in preference the use of the Bessemer converter, which is best adapted to effects of intermoleculary combustion, which is the basis of his process. However, for the complete success of the operation it is necessary to dispose the converter in a special manner, which we will now describe.

While the copper is being produced, this metal, owing to its density, falls to the bottom of the apparatus ; now, if, like in the converter used in the iron metallurgy, the blast enters the bottom of the apparatus by vertical blast-holes, it is compelled towards the finish of the operation to traverse metallic copper, which, containing no more combustible elements is solidified by the contact of the cold blast which soon brings on the obstruction of the blast holes. This could be avoided by forcing air, previously heated, but this is not practical and very expensive, while a very simple arrangement of the converter gives the same result.

This arrangement, which, however, may vary in the details, merely consists in leaving, below the level of the blast-holes, a sufficient space for the metallic copper to gather as soon as produced, and where it is then sheltered from the contact of the blast; the capacity of this space must always equal, if not be superior, to the one that must be occupied by the metal produced during the operation.

Generally to obtain this result, Mr. Manhès replaces the vertical blast-holes, which open at the bottom in the common Bessemer apparatus, by horizontal blast-holes placed all around the converter and opening into it at the desired level above the bottom of the apparatus.

But Mr. Manhès obtains better results by the use of his last invented converter, of which you see a model before you. This converter has blast-holes on one side only, and is then more or less inclined, so as to blast at any desired level into the molten mass. (Plate I.)

In this manner, till the end of the operation, the blast passes through matte still containing combustible elements; the metal is not chilled and the blast-holes do not get choked.

In conclusion, with the gallic method from eight to fifteen tons of coal or an equivalent quantity of wood is necessary to obtain one ton of copper, by the Manhès process only one and a-half tons of coke or an equivalent quantity of wood is required per ton of copper, including the motive power for the blasting machinery.

With the new process the labour is reduced by half. Consequently by the methods used until now the cost per ton of copper is from £12 to £16, while by the Manhès process it is reduced to from £4 to £6, according to the quality of the ore, the price of fuel, and the price of labour.

By the old method a considerable number of reverberatory furnaces are required and from 10 to 15 days are necessary to transform the ore into copper, whilst by the Manhès process the same transformation is made in four hours.

You see that the process is simplicity itself, and it is a wonder that it was not discovered before. It recalls an anecdote on Christopher Columbus: When told that anybody could have discovered America, he simply asked the gentlemen present to make an egg stand on its end; they all failed. He, taking the egg, slightly cracked it on the table and there it stood. It was surely simple enough.

All attempts at blasting copper ore failed until Mr. Manhès conceived the idea to constantly blast through the matte above the level of the copper produced. It must be added, however, that after the principle was discovered, it still took Mr. Manhès about two years before he succeeded perfectly in one operation. It is therefore not to be wondered that if it took a man of his science and his practical knowledge all that time, his pale imitators in Australia did not meet with any kind of success with their plans.

In presence of the immense advantages of the Manhès process, the question arises why the Australian copper mine proprietors have not yet adopted the process. The author begs leave to briefly state his opinion in this matter :—The process is so simple that attempts have been made, and are being made, at counterfeiting.

There is no doubt that Mr. Vivian, of Swansea, the Parrot Silver and Copper Company, and Mr. Cousins de Lata, in Chili, have bought the patent rights for their respective countries; but it can be easily understood that these people have not the slightest interest in posting others as to the advantages of the process.

We think that the proper way for the Australian copper mine proprietors to convince themselves of the perfect working of the process would be to communicate with the inventor himself, and send a competent man to the Eguille works, where every facility will be afforded him to examine the working in all its practical details.

The adoption of the Manhès process in these colonies is only a question of time, and probably not a long time. It is to be hoped that the copper mine proprietors will be forcibly reminded of the national motto, "Advance Australia," and will adopt this great invention to save their properties.

The paper was accompanied by several diagrams and models from which Plate I. has been prepared.