(No Model.)

# P. MANHES.

## PROCESS OF TREATING COPPER MATTE.

No. 456,516. Patented July 21, 1891.

*Fig. 5.*

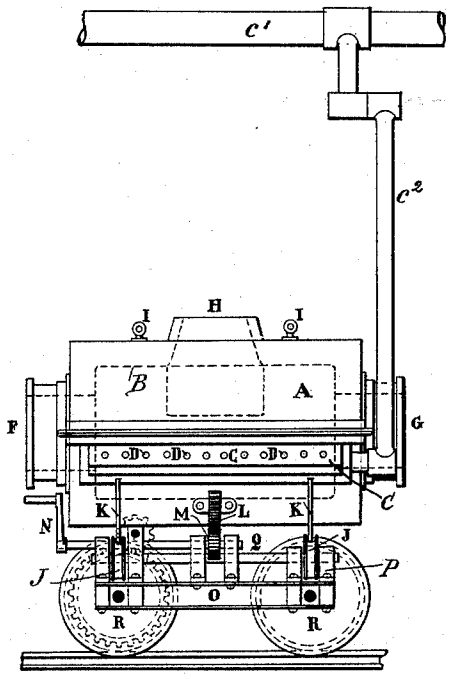



*Fig. 6.*

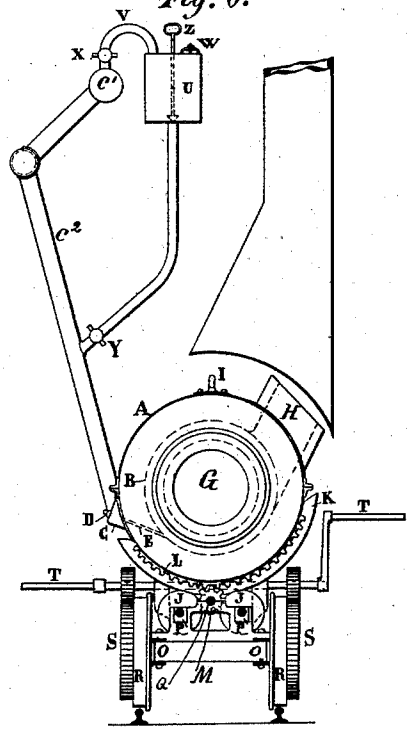



*Fig. 1.*

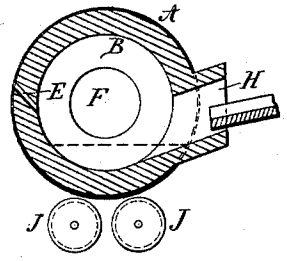



*Fig. 2.*

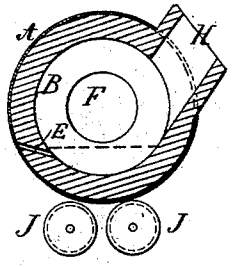



*Fig. 3.*

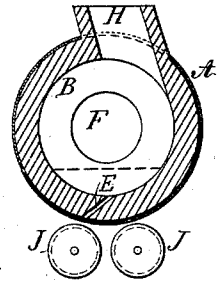
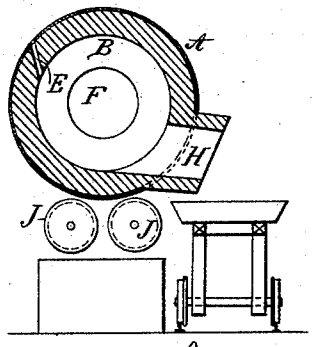



*Fig. 4.*




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# UNITED STATES PATENT OFFICE.

PIERRE MANHES, OF LYONS, FRANCE.

## PROCESS OF TREATING COPPER MATTE.

SPECIFICATION forming part of Letters Patent No. 456,516, dated July 21, 1891.

Application filed January 28, 1884. Serial No. 118,943. (No specimens.) Patented in France December 18, 1883, No. 159,249; in England January 3, 1884, No. 583; in Belgium January 7, 1884, No. 63,779; in Italy January 11, 1884, No. 279; in Germany January 13, 1884, No. 28,750; in Austria-Hungary January 14, 1884, No. 2,582; in Spain January 15, 1884, No. 3,901; in Portugal March 4, 1884, No. 894; in Sweden April 15, 1884; in Norway July 25, 1884, No. 31, and in Russia June 26, 1886, No. 5,369.

*To all whom it may concern:*

Be it known that I, PIERRE MANHES, of Lyons, France, have invented an Improved Process of Treating Copper Matte, of which the following is a specification, the same having been patented as follows: in France, deposited December 18, 1883, granted March 1, 1884, No. 159,249; in Great Britain, dated January 3, 1884, No. 583; in Belgium, deposited January 7, 1884, granted January 31, 1884, No. 63,779; in Italy, deposited January 11, 1884, granted January 21, 1884, No. 279; in Germany, deposited January 12, 1884, granted October 2, 1884, No. 28,750; in Austria-Hungary, deposited January 14, 1884, granted June 11, 1884, No. 2,582; in Spain, deposited January 15, 1884, granted April 23, 1884, No. 3,901; in Russia, deposited February 6, 1884; in Norway, deposited February 15, 1884, granted July 25, 1884, No. 31; in Sweden, deposited February 17, 1884, granted April 15, 1884, and in Portugal, deposited February 18, 1884, granted March 4, 1884, No. 894.

The present invention relates to a new process of obtaining copper at a single operation from copper matte of any standard and composition. This process consists, essentially, of varying during the continuance of the operation the height of the tuyeres which bring the air charged or not with foreign matters into the bath of melted matte in order to perform with precision the chemical reactions necessary in such parts of the bath where they are useful. During the transformation of the mattes into copper the composition of the bath is far from being homogeneous, the diverse matters which compose it being superposed in order of density and their volume varies in proportion as the operation advances. It is therefore of very great importance to vary at the same time the height at which the air enters the mass, so as to make it act only where it is useful, and to prevent it acting upon those parts of the bath where its presence would be injurious or at least useless. To put this process in practice I employ a furnace similar to the converter employed in the treatment of iron.

In the drawings, Figure 1 is an elevation, and Fig. 2 an end view, of a converter that may be employed with my process. Figs. 3, 4, 5, and 6 are sectional views showing the position of the tuyeres during different stages of the process.

This furnace is composed of a horizontal cylinder of sheet-iron A, lined on its interior with refractory material, and it is turned on its axis by means of the crank-handle N, the shaft of which carries a pinion M, that acts upon a circular rack L, secured to the cylinder. This cylinder has two circular rails K, which rest upon the rollers J J upon a carriage supported on wheels, which allow the apparatus to be moved from place to place. This carriage is operated by the cranks T. The cranks T are secured to a shaft that has pinions meshing into gear-wheels upon the axles of the wheels that support the carriage. The furnace is open at its two extremities F and G to receive, if necessary, the heat from any furnace. The charging and discharging take place at the mouth or flue H. On the opposite side to this flue are placed the tuyeres E, passing in a range through the lining at the desired inclination and opening at the interior on the same horizontal line. These tuyeres in any desired number are supplied from an air-box C, receiving the air by a flexible or jointed tube P. Pulverized material placed in the box V can be injected with the air by opening the cocks X Y, which allow a portion of the air-blast to pass through the box V.

The apparatus above described will serve to explain my method by the following example: Suppose the copper matte contains, as usual, sulphur, iron, and copper, and in a much less proportion lead, zinc, tin, arsenic, antimony, &c. The converter, after having been heated to a red heat by an independent furnace, is brought to the furnace containing the matte, and the converter is inclined so that the orifice H occupies the position shown in Fig. 1, and the melted matte is run into the converter by the trough I. When the charge is considered sufficient, the tap-hole of the furnace is closed and the converter is slightly raised, but without allowing the melted metal

to pass into the tuyeres. Then the apparatus is rolled to that part of the works where the air-blast is applied and where is located the tube P for said air-blast and also the chimney Q for conveying away the fumes. The converter is partially revolved as soon as the air-blast has been connected until the air penetrates the liquid matte to the desired depth below its surface. The air passes at a downward inclination, and the depth to which the air penetrates depends upon the pressure of the air made use of. The reaction commences immediately. The oxygen of the air combines with the sulphur and forms sulphurous acid, and with all the other bodies it forms oxides, which are carried away by the gaseous current. The greater part of the iron which passes to the state of oxide remains in the bath and would soon injure the lining of the converter and quickly render it useless if recourse were not had to the injection of silica to combine with such iron and form a slag. For this reason, from the commencement of the blowing, the reservoir of silica V is put in communication with the air-blast, and this latter carries the silica into the bath, where it is brought into contact with the oxide of iron and forms silicate of iron, which melts and floats in the bath of melted matte. The volume of matte becomes less by the liberation of the sulphur and other bodies. Consequently the converter is turned progressively and slowly, in order that the air-blast may still penetrate the matte to the desired extent. The matte is thus concentrated and approximates metallic copper by the loss of the other elements—iron and sulphur—as well as the combustion and volatilization of the metalloids and metals more easily oxidized than copper. After a time there remains in the converter only subsulphide of copper, and this is shown clearly by the color of the flames. From this time the oscillatory movement of the converter should be reversed—that is to say, in place of plunging the tuyeres deeper and deeper in the bath of melted metal they should be raised in a continuous manner. In fact, from this time, the sulphur continuing to be burned, the copper is liberated from the slag and it descends by virtue of its greater density below the remaining subsulphide. Therefore a slowly-progressive ascending movement is given to the tuyeres, (in the reverse direction to that given during the first part of the operation,) so as to blow the air only into the subsulphide of copper by raising the level where the air acts on the mass in proportion to the height of the reduced copper, and this is to be continued until all the subsulphide is decomposed. There remains in the converter crude copper. It is run out by tipping the converter to the position shown in Fig. 4, or the copper can be refined in the converter itself by any ordinary process. At the middle of the operation, when it is recognized by the color of the flames that all the iron has been burned, the converter is tipped to the position Fig. 1, and the slag which floats, if sufficiently fluid, is run out, the air which strikes the surface at the rear of the bath being usually sufficient to force it out. If the slag is not fluid, it is raked out by the usual means. The apparatus is afterward turned back to reduce, as aforesaid, the subsulphide of copper by still further blowing. It is to be understood that at this point of the operation the injection of silica is stopped, since there is no longer any iron to scorify, and consequently there is no further fear of injury to the lining of the converter. It will be seen that by this process poor and impure mattes can be treated at will for obtaining either a white matte absolutely free from iron and other bodies more easily oxidized than copper, or crude copper, or even refined copper in condition for rolling, and this is done in less than an hour after having taken the matte from the blast-furnace and without consumption of fuel. Independent of these important results this process obtains a marked economy in the pressure of the air, the tuyeres being plunged beneath the surface of the matte only the amount really necessary. This improvement also permits of treating in the same apparatus variable quantities of material with the same conditions of blast.

I do not herein lay claim to the process of treating copper matte set forth in my United States application, Serial No. 93,228, filed April 27, 1883, in which an ordinary converter is made use of, and the air is admitted all around the base of the same, and the depth at which the air is caused to enter the matte cannot be varied by tipping the converter, because the converter has to be swung up rapidly to a vertical position and there remains; otherwise the melted matte would run into the lowest of the ranges of tuyere-holes.

I do not claim a converter of a cylindrical shape in itself.

By my improvements I am able to treat the copper matte differently from the treatment of other melted materials, because the depth at which the air is introduced becomes an important element in burning off the impurities and reducing the matte to copper without unnecessarily chilling the melted copper.

I claim as my invention—

The method herein specified of treating copper matte and reducing the same to copper, consisting in running the melted matte into a cylindrical converter having a single horizontal row of tuyeres partially revolving the cylindrical converter and blowing through the tuyeres, so that the air commences to act uniformly at the surface of the matte, continuing the movement until the air reaches the surface of the melted copper that has subsided into the bottom of the converter, and then reversing the movement to raise the tuyeres and cause the air to act gradually from the surface of the melted copper up to

the surface of the matte and slag for completing the reduction of the slag to copper, and then removing the slag or floating foreign substances and pouring out the copper, substantially as set forth.

The foregoing specification of my improvement in portable converter-furnaces for metallurgic operations signed by me this 10th day of January, 1884.

PIERRE MANHES.

Witnesses:
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