(No Model.) 2 Sheets—Sheet 1.

P. MANHES.

PROCESS OF TREATING NICKEL MATTE.

No. 479,290. Patented July 19, 1892.

FIG. 3

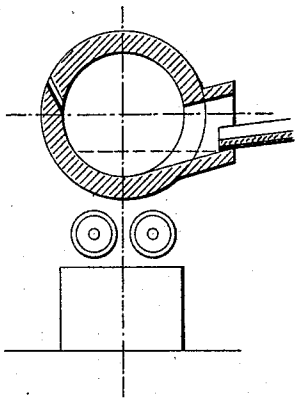

FIG. 1

Witnesses

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(No Model.) 2 Sheets—Sheet 2.

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FIG. 2

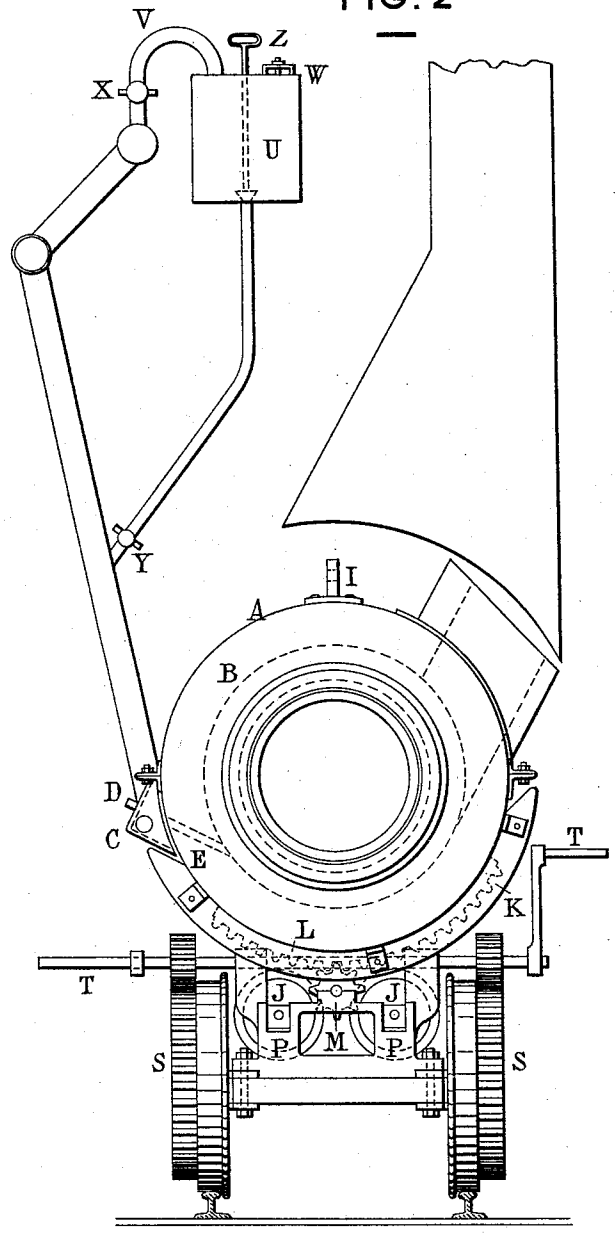


FIG. 4

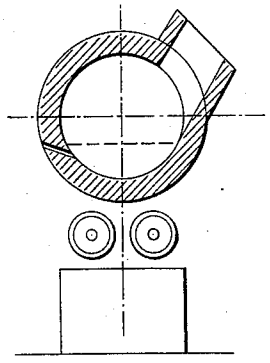


FIG. 5

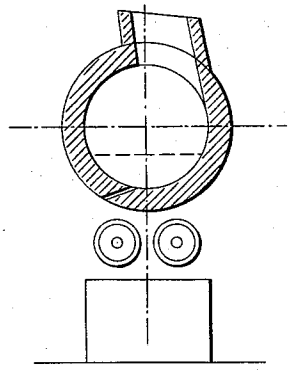
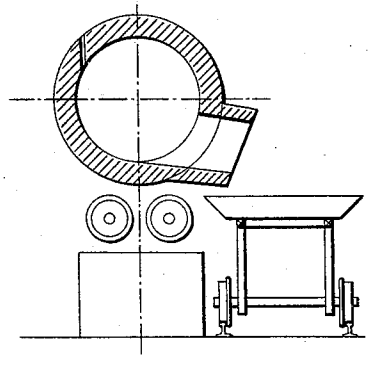


FIG. 6



Witnesses

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UNITED STATES PATENT OFFICE.

PIERRE MANHES, OF LYONS, FRANCE.

PROCESS OF TREATING NICKEL-MATTE.

SPECIFICATION forming part of Letters Patent No. 479,290, dated July 19, 1892.

Application filed December 19, 1888. Serial No. 294,112. (No specimens.)

To all whom it may concern:

Be it known that I, PIERRE MANHES, engineer and metallurgist, a citizen of the Republic of France, and a resident of Lyons, France, have invented a new and useful Process of Reducing Ores of Nickel and Cobalt, of which the following is a specification, reference being had to the accompanying drawings.

The process hereinafter described, which forms the subject of the present application, has for its object the treatment of nickel and cobalt ores in a simple, rapid, and economical manner. It can be applied to any ores of these metals, whatever may be their composition, to mattes resulting from the fusion of sulphurated ores, as well as to products resulting from the fusion of oxidized ores. The present process is based upon the successive elimination by oxidation of all the materials having more affinity for oxygen than nickel and cobalt.

The apparatus employed is that known under the general name of "converter," and I reserve the right to employ all or any of the various constructions of this apparatus which have been devised.

It has been proved by experience that in order to effect the operation under favorable conditions and to keep the metal fluid toward the end of the operation it is expedient that the air should enter the converter at a certain height above the bottom of the apparatus, or, better still, that a special arrangement be provided which enables the air to enter at a certain height which can be varied at will. I employ, by preference, a converter such as shown in the accompanying drawings, and which it is only necessary to incline more or less in order to allow the air to enter the said converter at a higher or lower level.

Figure 1 is a front elevation of the converter. Fig. 2 is an end elevation of the same, and Figs. 3, 4, 5, and 6 show the various positions of the converter in the various periods of the treatment.

A indicates a sheet-metal casing, forming the body of the furnace; B, the lining of bricks or refractory earths of variable composition; C, the air-box in which the air arrives from the general pipe through the medium of jointed metal pipes, enabling the displacement of the said air-box in the movement of the cylinder upon its horizontal axis. These pipes can be replaced by a flexible pipe of copper or india-rubber.

D D indicates the exterior orifices of the air-box, each of which orifice is arranged in front and in the prolongation of the tuyeres, which permits their operation to be observed during the whole time of the said operations and enabling them to be always kept open. These orifices may be closed by wood or metal plugs.

E E are tuyeres passing through the interior lining and conveying the fluids injected at a certain inclination to the mass in fusion.

F indicates the admission for the flames of any independent fireplace in which either coke, coal, or gas is burned.

G is the outlet for the flames or products of combustion passing to the chimney and passing, if necessary, through condensing-chambers.

H is the central orifice serving for the introduction of the material to be treated and for the discharge of the cinder and finished products.

I I are hooks serving to remove the upper part of the furnace to permit of repairs to the lining.

J J are rollers upon which the furnace oscillates.

K K are half-rings fixed to the cylinder and rolling upon the said rollers.

L indicates a toothed sector fixed upon the cylinder for causing it to oscillate.

M is a pinion actuating the sector L.

N is a crank keyed upon the shaft of the pinion M and serving to turn the same.

O is a frame carrying bearing P P, rollers J J, and resting upon the axles of two pairs of wheels R R, which enable the furnace to be displaced in the works.

S S are toothed wheels fixed upon the aforesaid wheels R R, and operated by two pinions.

T T are double cranks keyed at a right angle and operating the toothed wheels of the wheels R R through the medium of the above-mentioned pinions.

U is a sheet-metal reservoir containing the pulverulent materials injected in order to facilitate the reactions and preserve the lining of the furnace.

V is a pipe conveying the pressure of the reservoir for the compressed fluids.

X indicates a cock for turning on or off the said pressure.

Z is a rod for opening or closing the outlet-orifice for the pulverulent materials.

W is a plug for the introduction of the powder, and Y a cock for turning on or off the low pressure.

I will now describe the course of an operation, which description will enable the whole of the process, which is carried out without any previous roasting being necessary, to be understood. The ores, whatever their nature may be, are melted in any furnace, preferably a blast-furnace, for in concentrating the metallic elements in the matte, if sulphureted ores are treated, and in the ingots or impure crude metal if oxidized ores are treated, it is the product of this melting, either matte or casting, which is received directly in the converter. This apparatus must have been previously heated to a red heat in order that the material when it arrives therein can be kept liquid during the short space of time necessary for the introduction of the air. In fact, to pour the melted materials from the melting-furnace into the converter the latter is inclined so as to place it almost horizontal. Then when it has received its charge the air is let in and the apparatus is gradually moved back to the vertical position, so that the air arrives through the bottom of the converter and traverses the entire metallic mass. The intra-molecular combustion of the sulphur, iron, and any of the other materials which are more oxidable than nickel and cobalt, rapidly causes a great elevation of temperature, the sulphur is eliminated in the state of sulphurous acid, while the iron under the action of an energetic oxidation is transformed into silicate at the expense of the earth or bricks which form the inner lining of the converter. The course of the operation is followed and these various phases are readily observed by examining the flames, either by means of a spectroscope or with the naked eye. I have stated above that at the beginning of the operation the apparatus must be quite vertical, so that the air arrives through the bottom. In fact at this moment the combustible elements are abundant and the operation does not present any difficulty; but in proportion as the iron and sulphur, which are the principal combustible elements, disappear, the temperature tends to get lower and it is then necessary to successively incline the apparatus in order to allow air to arrive at a higher level. By reason of this arrangement the richest parts of the material—the metallic nickel and cobalt—in proportion as they are formed, collect at the bottom below the line where the air arrives, owing to their greater density. From this results two advantages, that of not oxidizing the metals which are to be preserved, and that of maintaining a higher temperature, because the air is always caused to arrive in that part of the materials in fusion, which contains most combustible elements. Despite this, however, and owing to the elevated temperature which the nickel and cobalt require to maintain them in a state of fusion, it is well to let in the converter a small quantity of coke or wood-charcoal, which, floating upon the materials in fusion, will not counteract the oxidation; but the combustion of which powerfully aids in maintaining the high temperature necessary especially toward the end of the operation.

As I have above explained, the course of the operation is followed by examining the flame, and when the nickel and cobalt have become nearly pure, which is very readily recognized by the examination, the casting is effected by turning over the converter, the contents of which are poured into ingot-molds prepared for this purpose. The sides of the converter being impregnated with foreign substances, it is impossible to obtain by this treatment an entirely pure metal, and the nickel produced is in the proportion of from ninety-seven to ninety-eight per cent. It is therefore only necessary to subject it to a suitable refining treatment.

I wish it understood that I reserve the right to make in these processes such modifications as experience may suggest.

What I claim is—

The process of reducing ores of nickel or cobalt, which consists in melting the ore to concentrate the metallic elements, removing the melted ore to a highly heated converter that has been previously rotated or inclined from a vertical position to a nearly horizontal position, then blowing air through the molten metal while in the converter, and gradually turning back the converter to a vertical position, so that the air will pass upward from the bottom of the converter and traverse the entire metallic mass, then gradually inclining the converter to admit air at successively higher levels as the principal combustible elements disappear, whereby the nickel or cobalt will collect below the line where the air is admitted, and thus escape oxidation, then casting the metal product, and subsequently remelting the metal to refine it, substantially as described.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

PIERRE MANHES.

Witnesses:

GEORGES FREYDIER DUBREUL,

XAVIER JANICOT.