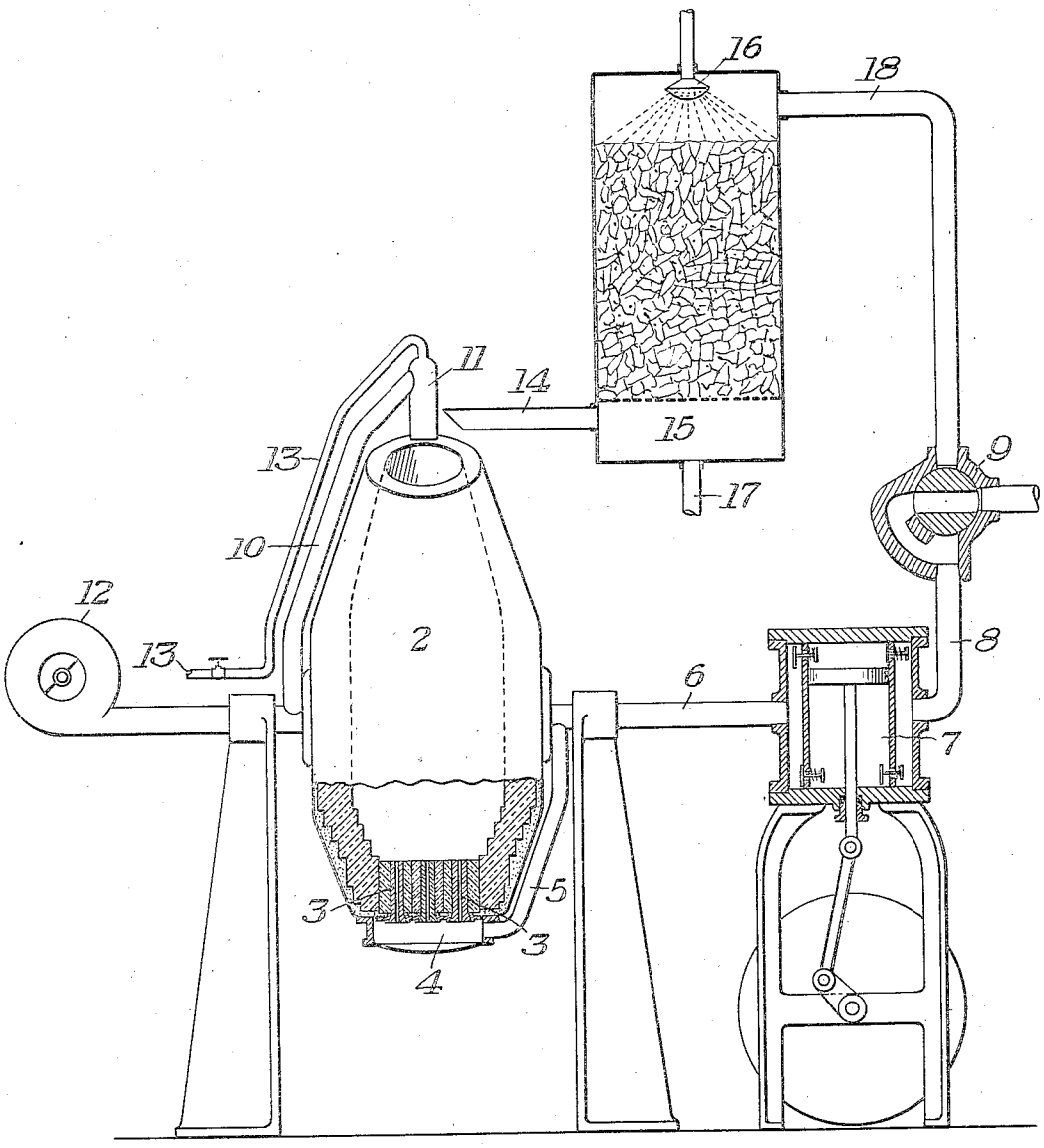
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METHOD OF CONVERTING NICKEL CONTAINING MATTE

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METHOD OF CONVERTING NICKEL-CONTAINING MATTE.

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The figure is a diagrammatic view showing one form of apparatus for carrying out my process.

The possibility of the direct converting of nickel-containing mattes into metallic nickel or a metallic nickel alloy has been generally denied in the metallurgical art. All publications relative thereto show that attempts to convert nickel-containing mattes in the same way as copper mattes have failed. Such failures have been due to the preferential oxidation of the metal or alloy after the sulphur has been lowered to a certain extent in the molten bath.

After long experimenting on a large scale, I have found that such mattes can be successfully converted by adding heat to that developed by the converting action itself and by lowering the oxygen content of the blast during the last stages of converting.

In my previous patent applications, Serial No. 630,618 filed April 7, 1923 and Serial No. 671,496, filed October 29, 1923, I have disclosed several methods of adding heat beyond that developed by the converting action. In further work, I have found that the best method for this purpose is to use a burner projecting a flame into the converter above the level of the molten bath. I have also found that excessive oxidation of metal, which otherwise takes place after the sulphur has been largely reduced, can be avoided by greatly lowering the percentage of oxygen in the blast in the last stages of converting. I have also found the use of slag-forming material is important if not essential to successful large scale operation, to prevent dust losses during converting; and have found a highly refractory material which will sufficiently withstand the high temperature and erosive action of the charge, this being preferably fused alumina bonded with china clay. Close control of the temperature is also an important feature. Pure nickel matte converts most successfully at a temperature of about 1600° C., while a matte containing copper and nickel in the ratio of 1 to 3 will be converted at about 1500° C. My process is preferably carried out in a fuel-heated Bessemer converter of the type commonly used in making Bessemer steel.

Referring to the diagrammatic figure of the drawing, 2 presents such a converter having tuyères 3 supplied with air or gases from a wind-box 4, to which supply pipe 5 leads. This pipe 5 connects with the hollow trunnion at the right of the figure, to which pipe 6 leads from a blowing engine or compressor 7. To this blowing engine, which has the usual valves, a supply pipe 8 leads from a three-way valve 9, and when the valve is in the position shown, air is forced into the wind-box and tuyères in the usual way.

From the other hollow trunnion at the left of the figure a low pressure air pipe 10 leads to a fuel burner 11, projecting toward the open mouth of the converter. Air is forced through this trunnion by any suitable blower, such as shown at 12, and in the form shown, fuel is supplied to the burner through pipe 13. Over the mouth of the converter when in blowing position is located the open end of an exit gas intake pipe 14, which leads into the lower part of a cooling and scrubbing chamber 15. This chamber may be provided with lump coke over which cooling water is sprayed by the spray device 16, the excess water passing out through pipe 17. From the upper part of the chamber, the cooled and scrubbed exit gas is led through pipe 18 to the casing of the three-way valve 9.

In carrying out my process with such apparatus, the nickel-containing matte is blown with air in the usual way, except that extra heat is supplied by the burner which projects a flame into the converter above the bath, and that slag-forming material such as sand is supplied to flux and form a slag, until the sulphur in the charge has been lowered to a point where oxidation of the metal begins. When Monel metal matte is being converted, this point is in the neighborhood of 2%. Below that percentage, the normal air blast would oxidize a considerable amount of metal while burning out the further sulphur. Hence, if continued, a large percentage of metal would pass into the slag. To prevent this and further reduce the sulphur without materially oxidizing the metal, the strongly oxidizing blast to the tuyères is then replaced by a mildly oxidizing, neutral, or even slightly reducing blast. In the form shown, this is done by using the exit gases of the converter itself. At this stage, the three-way valve 9 is turned 90°, so that exit gas from the converter, cooled and scrubbed, is sucked into the compressor 7 and forced to the tuyères. In the

scrubber, the temperature of the exit gas is reduced, the dust is precipitated and substantially all of the sulphur dioxide is absorbed by the water.

The purified gas consists mainly of nitrogen mixed with carbon dioxide from the burning of the fuel and contains a small percentage of free oxygen. This percentage of oxygen is preferably not over 3% and should be reduced as the sulphur is lowered and approach zero when the sulphur in the Monel metal has reached 0.5% or below. This regulation of free oxygen is easily carried out by proper regulation of the fuel and air fed to the heating burner. An experienced operator can easily determine this by the appearance of the heating flame and can regulate the supplies accordingly.

In practice, about 30% of the total air or gases used in converting passes through the tuyères and about 70% is injected through the burner.

In case of a substantially pure nickel matte, the air should be changed to reduce the free oxygen earlier than with a Monel metal matte. Usually the change to exit gases should be made in such case when the sulphur is down to about 4%. Also, the oxygen content in the exit gas should be lower for nickel matte than for Monel metal, while the temperature should be kept higher.

The blown metal may be refined in an electric furnace; the way of reducing the oxygen content may be changed; other lining material may be used; and other changes may be made without departing from my invention.

I claim:

1. In the converting of nickel-containing matte, the steps consisting of forcing oxygen-containing gases through the molten matte and reducing the content of free oxygen in the blast during the later stage of blowing.

2. In the converting of nickel-containing matte, the steps consisting of forcing oxygen-containing gases through the molten matte, supplying slag-forming material, and reducing the content of free oxygen in the blast during the later stage of blowing.

3. In the converting of nickel-containing matte, the steps consisting of forcing oxygen-containing gases through the molten matte, supplying additional heat, and reducing the content of free oxygen in the blast during the later stage of blowing.

4. In the converting of nickel-containing matte, the steps consisting of forcing air through the molten matte and later in the blow forcing waste gases of combustion through the matte.

5. In the converting of nickel-containing matte, the steps consisting of forcing air through the molten matte and later in the blow forcing waste gases of combustion through the matte while supplying additional heat.

6. In the converting of nickel-containing matte, the step consisting of withdrawing a part of the exit gases and forcing them through the charge in the later stage of the blow.

7. In the converting of nickel-containing matte, the step consisting of withdrawing a part of the exit gases and forcing them through the charge in the later stage of the blow, while supplying heat above the level of the bath.

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