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METHOD FOR PRODUCING STEEL

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FIG. 1.

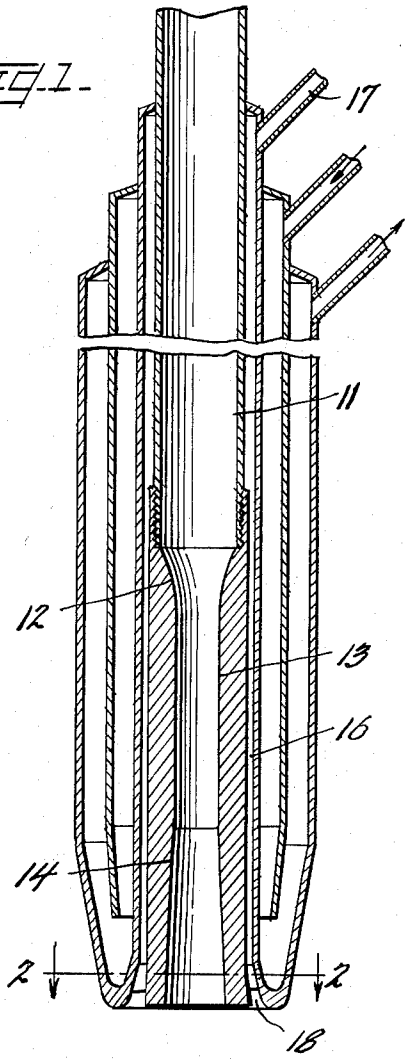
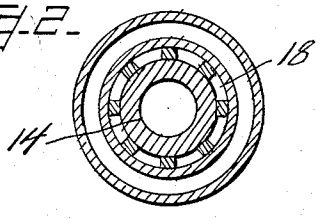


FIG. 2.



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METHOD FOR PRODUCING STEEL

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This invention relates to a method of producing steel.

It is well known at the present time to produce steel in converters having a solid bottom or a bottom provided with tuyeres and/or blow holes, by blowing a gas or a mixture of gases downward onto or into the bath to be treated.

It is well known also to add the dephosphorizers necessary for the operation by injecting them onto or into the bath from above in the form of powder or granules suspended in a gas or a mixture of gases.

In these processes, one or more nozzles are generally introduced into the region of the converter above the bath.

From the technological and operational viewpoints it is obviously of interest to use only a single nozzle. The introduction of two or more nozzles into the region above the bath as a matter of fact raises difficult problems of construction and handling. However, whenever only a single nozzle is employed, this nozzle must permit the separate introduction of gas containing dephosphorizer on the one hand and gas not containing dephosphorizer on the other hand.

Such a type of nozzle has already been proposed for other purposes and in particular for the injection of desulfurization soda by means of oxygen. This nozzle has an inner conduit and an outer conduit concentric to the inner conduit and surrounding it, the outer conduit being provided at the discharge end of the nozzle with a number of holes from which there emerge gaseous jets which surround the gaseous jet emerging from the inner conduit and intended in conventional practice to force the slag toward the outside.

Furthermore, by injecting powdered or granulated dephosphorizers from above, it is possible rapidly to obtain a fluid, highly reactive slag capable of absorbing the phosphoric anhydride formed at the start of the operation. However, actual practice has shown that these dephosphorization reactions are very complicated, and that the conditions which permit the obtaining of the desired result are frequently contradictory or difficult to realize, and that for all practical purposes they escape physical-chemical reasoning.

The object of the present invention is a method for injecting powdered or granular dephosphorizers from above into a metal bath to be defined, in which method there is employed a nozzle of the type described above and which makes it possible to obtain the desired fluid reactive slag without difficulty.

The process which is the subject matter of the invention consists essentially in that during all or part of the process an oxidizing gas or an oxidizing gas mixture having the powdered or granular dephosphorizer suspended therein is injected under high pressure or high speed onto or into the metal bath through the inner conduit of the nozzle while an oxidizing gas or an oxidizing gas mixture which contains no dephosphorizer is injected under low pressure or low speed through the outer conduit of the nozzle onto or into the slag floating on the metal.

The process, in accordance with the invention, makes it possible to introduce through the outer conduit of the nozzle a gas other than the gas injected through the inner conduit of the nozzle with the dephosphorizer.

However, the process in accordance with the invention has proven particularly interesting when technically pure oxygen is injected through both conduits.

The dephosphorizer used may advantageously be lime.

One advantageous variant of the process, in accordance with the invention, consists in injecting the mixture of gas and dephosphorizers emerging at high speed from the inner conduit of the nozzle in the form of a jet which is as fine as possible. It has been found, as a matter of fact, that in the method of injecting powdered dephosphorizers from the top of the converter, it is advisable for the suspension of the products to penetrate deeply into the molten iron bath. Furthermore, in the known processes for the injection of powdered dephosphorizers from the top of the converter, the apparent density of the suspension (or weight of solid particles per unit of volume of gas of the mixture) is generally less than 2 kg. per cubic meter (S.T.P.) and normally corresponds to a distribution of the products throughout all or a large portion of the gas necessary for the refining. It has been found that it was frequently advisable, at least during certain periods of the operation, to increase this apparent density of the injected mixture so that it penetrates deeply into the molten iron bath to be treated without too large a contribution of oxidizing gases. By the process of the invention, this apparent density of the mixture can be increased while retaining the possibility of distributing it throughout the entire operation or a large part of the operation, and the present invention contemplates that the suspension emerging at high speed from the inner conduit of the nozzle in the form of the finest possible jet has (at least during certain periods of the operation) an apparent density greater than 3 kilograms per cubic meter. Particularly advantageous results have been obtained with apparent densities in excess of 5 kilograms per cubic meter. The fineness of the central jet depends less on the dimensions of the inner conduit than on the shape imparted to the end of said conduit. This variant of the process in accordance with the invention has proven particularly advantageous when the oxidizing gas used in the two conduits of the double lance is technically pure oxygen and when the dephosphorizer is finely divided lime.

However, it has also been found that a fine jet could be obtained at the outlet of the inner conduit of the nozzle even with an apparent density of the suspension of less than 3 kilograms per cubic meter by imparting to the nozzle at the discharge end of the inner conduit of the nozzle a shape already known from prior patents such that the ratio

$$\left(\frac{C}{d}\right)$$

of the length of the orifice to its diameter is greater than 2 and/or such that the diameter (D) of the entrance section of the converging nozzle section, the length (L) of the converging device, the diameter (d) of the section of the neck and the length (C) of the neck are related by the formula

$$\frac{D}{d}=1+K\frac{L}{C}$$

in which K is greater than 2. A nozzle having such internal shape is fully deposed in my co-pending U.S. patent application, Serial No. 770,027, filed October 28, 1958.

The process in accordance with the invention and its different variants described above are applicable to a converter having a solid bottom or a perforated bottom as well as to a rotary furnace and it has been found to be of great utility for the production of a steel of low con-

tent of phosphorus, nitrogen and sulfur, whatever the phosphorus content of the pig iron employed.

It should furthermore be noted that the process, in accordance with the invention contemplates mixing with the dephosphorizer used some other solid material, for instance, powdered ores. fluxes or limestone, which it may be desired to introduce into the bath in order to carry out the metallurgical operation under the best conditions possible.

The method in accordance with the invention also contemplates that a part of the dephosphorizing product, added together possibly with ores or fluxes, is introduced by the conventional method before or during the commencement of the blowing. The method in accordance with the invention can also be combined with the use of a second soda-base slag.

The process, in accordance with the invention, makes it possible to carry out the refining operation with great flexibility and in particular to control the phenomenon of foaming of the slag and utilize it to advantage in the operation.

When it is desired to favor the foaming phenomena, particularly during the first phase of the operation, oxygen is blown in at a low rate, for instance, less than 300 meters per second, through the outer conduit of the nozzle until a slag which is sufficiently foamy for the requirements of the operation is obtained. There may also advantageously be injected at the same time from the start of the operation through the inner conduit of the nozzle a mixture of oxygen and dephosphorizer of low apparent density (for instance, a mixture of oxygen and of powdered lime at a rate of 0.3 kilogram per cubic meter (S.T.P.)) and gradually increase the apparent density of the mixture as the foaming develops. At the time that slag has become sufficiently foamy for the needs of the operation, the flow of oxygen passing through the outer conduit is gradually decreased or suddenly stopped and the injection of the mixture of oxygen and powdered product is continued through the inner conduit.

When the foaming phenomenon has started, it is also possible, while injecting the mixture of oxygen and powdered product through the inner conduit, to replace the oxygen introduced through the outer conduit of the nozzle by a gas of less oxidizing power, such as oxygen-enriched air, a mixture of oxygen and steam or a mixture of oxygen and carbon dioxide. If the foaming has a tendency to become too great, air, pure carbon dioxide or steam will be blown through the said outer conduit of the nozzle for a few moments. On the other hand, if the foaming phenomenon tends to become too slight, the blowing of pure oxygen through the outer conduit of the nozzle will similarly be resumed for the necessary period of time.

The process, in accordance with the invention, also makes it possible to resume the blowing with pure oxygen for a few moments, for instance for 30 seconds to 2 minutes, through the outer conduit of the nozzle before an intermediate deslagging so as at that time to increase the oxidation of the slag which facilitates its deslagging and favors the dephosphorization.

When it is desired to obtain a mild or extra mild steel, or when it is desired to place the bath in balance with the slag, or to lower the temperature of the bath, the oxygen blown in through the inner conduit of the nozzle can advantageously be replaced for the last two or three minutes of the operation by a gas of lesser oxidizing power such as air, oxygen-enriched air, a mixture of oxygen and steam or a mixture of oxygen and carbon dioxide or by a neutral gas such as nitrogen or argon. Depending on the temperature of the bath, the flow of gas blown in through the outer conduit of the nozzle may during this period of time be stopped or consists of air, oxygen-enriched air, a mixture of oxygen and steam, a mixture of oxygen and carbon dioxide or pure oxygen.

In particular it has been found advantageous in accordance with the invention to stop the blowing through the outer conduit of the nozzle as soon as foaming has occurred and to continue the operation, blowing only through the inner conduit of the nozzle, with an increasingly larger pressure either by decreasing the distance between the nozzle and the bath, or by increasing the flow of lime and if necessary decreasing the flow of oxygen.

In many cases, it will be desirable to use oxygen of high purity, preferably greater than 96%, for the inner jet of the nozzle, while oxygen of less purity can be used for the outer jet of the nozzle.

The process in accordance with the invention can be applied both to the refining of pig irons of high phosphorus content and to the refining of so-called hematite pig irons of low phosphorus content.

In the accompanying drawing, there is shown an axial section through a nozzle embodying the invention, and a portion of the delivery conduit on which it is mounted.

The nozzle is preferably of integral metal construction having an axial or longitudinal passage extending rectilinearly therethrough from its intake end through its discharge end. At the intake end the passage is enlarged and externally threaded for coupling to a supply conduit **11**, on which it is supported and through which a suspension of finely divided solids in gases is normally delivered to the nozzle.

The nozzle passage includes an intake section **12** converging from its juncture with conduit **11** in the discharge direction toward the orifice section **13**. A further passage section **14**, communicating with the discharge end of the orifice section **13**, diverges therefrom conically to the discharge end of the nozzle.

Disposed concentrically about and externally of the inner passageway or conduit **12, 13, 14** above described, is an outer conduit shown in this instance as an annular distribution passage **16**, receiving gases through a tube **17** from any suitable source, and discharging them through an annular series of diagonally downwardly and radially outwardly directed openings **18**.

The following examples of the application of the process in accordance with the invention are given by way of illustration and not of limitation.

Example I

Into a solid-bottom converter, there were placed 23 tons of pig iron containing 1.86% phosphorus, 4 tons of scrap, 600 kg. of lime and 500 kg. of ore.

During a first phase of the operation, lasting for 8 minutes, blowing was effected in the following manner with a double nozzle, the discharge end of which was 1.70 meters above the bath.

1st minute:
- Inner conduit with long neck — 90 cubic meters (S.T.P.) per minute of oxygen and 50 kg. per per minute of powdered lime.
- Outer conduit—closed.

2nd, 3rd and 4th minutes:
- Inner conduit—70 cubic meters (S.T.P.) per minute of oxygen without lime.
- Outer conduit—40 cubic meters (S.T.P.) per minute of oxygen.

5th and 6th minutes:
- Inner conduit—70 cubic meters (S.T.P.) per minute of oxygen and 130 kg. per minute of lime.
- Outer conduit—20 cubic meters (S.T.P.) per minute of oxygen.

7th and 8th minutes:
- Inner conduit—70 cubic meters (S.T.P.) per minute of oxygen and 130 kg. per minute of lime.
- Outer conduit—10 cubic meters (S.T.P.) per minute of oxygen.

At this time it was noted that foaming commenced. The outer conduit was then closed and there was further injected through the inner long-neck conduit, for 4 min-

utes, 70 cubic meters (S.T.P.) per minute of oxygen and 150 kg. per minute of lime, while gradually decreasing the distance between the discharge end of the nozzle and the bath as follows:

1st minute: 1.60 meters
2nd minute: 1.50 meters
3rd minute: 1.40 meters
4th minute: 1.30 meters

Thereupon, the outer conduit was again opened in order to permit 20 cubic meters (S.T.P.) of oxygen to pass per minute while reducing the oxygen injected through the inner conduit to 50 cubic meters (S.T.P.) of oxygen, maintaining a distance between the nozzle and the bath equal to 1.20 meters.

At the end of this first phase, the foaming slag having an iron content of 8.2% was carefully deslagged.

The steel at this time contained 0.70% carbon and 0.18% phosphorus and had a temperature of 1625° C.

After having added 2 tons of scrap, the blowing was again effected for 3 minutes as follows:

1st minute: distance between nozzle and bath 1.40 meters, 50 cubic meters (S.T.P.) per minute of oxygen and 250 kg. per minute of lime through the inner conduit; 20 cubic meters (S.T.P.) per minute of oxygen through the outer conduit.

2nd and 3rd minutes: distance between nozzle and bath: 1.20 meters, 70 cubic meters (S.T.P.) per minute of oxygen and 250 kg. per minute of lime through the inner conduit; outer conduit closed.

The steel thus obtained contained 0.10% carbon and 0.021% phosphorus and had a temperature of 1630° C.

In order to obtain an extra-mild steel, there was furthermore blown for 1 minute through the inner conduit 70 cubic meters (S.T.P.) of air and 30 kg. of lime, the end of the nozzle being 1.20 meters from the bath.

There was finally obtained a steel containing 0.04% carbon and 0.015% phosphorus which, after the normal additions of ferromanganese, was cast in ingot molds. The nitrogen content of the steel had not been increased by the air blasting.

Upon applying this method of operation to other heats, but effecting two intermediate slaggings, the first at about 1.3% carbon in the bath and the 2nd at about 0.3% carbon, there was obtained a steel which contained on the average at the end of the blowing 0.011% phosphorus.

The last slag was kept in the converter in order to recover the iron upon the next heat.

Example II

After having introduced into a solid-bottom converter 23.5 tons of basic Bessemer steel containing 2% phosphorus, 4 tons of scrap, 600 kg. of lime and 500 kg. of ore, the refining was started by bringing the nozzle to a distance of 1.70 meters from the bath and injecting for one minute 90 cubic meters (S.T.P.) of oxygen and 50 kg. of powdered lime through the inner long-neck conduit.

The blowing was continued for 7 minutes; bringing the nozzle alternately for 1 minute each time to a distance of 1.90 meters or 1.20 meters. During these 7 minutes, 20 cubic meters (S.T.P.) of oxygen were injected per minute through the outer conduit, and 70 cubic meters (S.T.P.) per minute of oxygen with 70 kg. per minute of lime through the inner conduit.

Thereupon, the blowing was continued for 5 minutes while gradually lowering the nozzle from 1.60 meters to 1.20 meters, the descent being 10 cm. per minute at the end of each of the first 4 minutes of blowing. During the first two minutes, 70 cubic meters (S.T.P.) per minute of oxygen and 130 kg. per minute of lime were blown through the inner conduit. During the last 3 minutes, 50 cubic meters (S.T.P.) per minute of oxygen and 180 kg. per minute of lime were blown through the inner conduit while 30 cubic meters (S.T.P.) of carbon dioxide were introduced through the outer conduit. At the end of this first phase, the steel contained 0.78% carbon and 0.15% phosphorus. The slag which contained 7.7% iron was well foamed and was removed easily and almost completely.

After introduction of 2.5 tons of scrap, the injection was continued with 70 cubic meters (S.T.P.) of oxygen per minute and 250 kg. per minute of powdered lime through the inner conduit. During this 2nd phase which lasted 4 minutes, the tip of the nozzle was alternately 1.90 meters and 1.20 meters from the surface of the bath, each time for one minute.

At the end of this 2nd and last phase, the steel contained 0.05% carbon and 0.017% phosphorus. There was concerned the production of an extra-mild steel for deep-stamping.

Example III

After introducing 23.2 tons of basic Bessemer pig iron containing 1.9% phosphorus, 3.8 tons of scrap, 600 kg. of lime and 400 kg. of ore, into a solid-bottom converter, the refining was started by injecting 90 cubic meters (S.T.P.) of oxygen and 50 kg. of lime, for one minute through the inner long-neck conduit. The tip of the nozzle was 1.70 meters from the bath. The nozzle was then brought alternately to a distance of 1.90 meters and 1.20 meters from the bath. At the upper position, 50 cubic meters per minute of oxygen were injected for one-half minute through the inner conduit. In the lower position, 70 cubic meters (S.T.P.) per minute of oxygen and 95 kg. per minute of lime were injected for 1½ minutes through the inner conduit. During 8 minutes of refining, the nozzle was thus brought 4 times to 1.90 meters from the bath and 4 times to 1.20 meters from the bath and during these 8 minutes, 20 cubic meters (S.T.P.) per minute of oxygen were injected through the outer conduit. After the 9th minute of refining, the method of application employed in Example I was adopted for the last five minutes of the first phase of the operation. After this first phase, the steel contained 0.82% carbon and 0.21% phosphorus. The foamy, iron-poor slag (8.3% Fe) was removed almost completely.

In the case of the 2nd phase, which started immediately after the intermediate deslagging and after the introduction of 3.4 tons of scrap, the same method of operation was employed as in the 2nd phase of Example I.

The steel finally obtained contained 0.04% carbon and 0.014% phosphorus. As in Example II, the final slag was retained in the converter to be used upon the following heat.

I claim:

1. The method of producing steel by refining of pig iron in which the major part of the dephosphorizers in finely divided form are suspended in a gas and injected into the bath to be treated from above the surface of said bath by means of a nozzle having an inner conduit and an outer conduit concentric to the inner conduit and surrounding it, characterized by the fact that during at least a part of the process an oxidizing gas containing the dephosphorizer in suspension is injected into the bath of metal through the inner conduit of the nozzle at a speed sufficiently high to cause it to penetrate the slag on the surface of said bath and into said bath, while an oxidizing gas which contains no dephosphorizer is injected onto slag floating on top of the metal through the outer conduit of the nozzle at a speed sufficiently low to avoid its pene-

tration of the slag on the surface of said bath, said last mentioned oxidizing gas consisting of oxygen during the first part of the operation until the slag has become sufficiently foamy, while at the same time there is injected through the inner conduit of the nozzle a mixture of oxygen and powdered lime, the apparent density of which is at first no higher than 3/10 kilograms per cubic meter (S.T.P.), and then gradually increased as the foaming develops, said injection through the outer conduit of the nozzle being stopped as soon as the foaming has occurred, and the operation being continued, injecting solely through the inner conduit of the nozzle with an increasingly larger pressure.

2. The method of producing steel by refining of pig iron in which the major part of the dephosphorizers in finely divided form are suspended in a gas and injected into the bath to be treated from above the surface of said bath by means of a nozzle having an inner conduit and an outer conduit concentric to the inner conduit and surrounding it, characterized by the fact that during at least a part of the process an oxidizing gas containing the dephosphorizer in suspension is injected into the bath of metal through the inner conduit of the nozzle at a speed sufficiently high to cause it to penetrate the slag on the surface of said bath and into said bath, while an oxidizing gas which contains no dephosphorizer is injected onto slag floating on top of the metal through the outer conduit of the nozzle at a speed sufficiently low to avoid its penetration of the slag on the surface of said bath, said last mentioned oxidizing gas consisting of oxygen during the first part of the operation until the slag has become sufficiently foamy, while at the same time there is injected through the inner conduit of the nozzle a mixture of oxygen and powdered lime, the apparent density of which is at first no higher than 3/10 kilogram per cubic meter (S.T.P.), and then gradually increased as the foaming develops, said quantity of oxygen injected through the outer conduit being gradually decreased after the foaming.

3. The method of producing steel by refining of pig iron in which the major part of the dephosphorizers in finely divided form are suspended in a gas and injected into the bath to be treated from above the surface of said bath by means of a nozzle having an inner conduit and an outer conduit concentric to the inner conduit and surrounding it, characterized by the fact that during at least a part of the process an oxidizing gas containing the dephosphorizer in suspension is injected into the bath of metal through the inner conduit of the nozzle at a speed sufficiently high to cause it to penetrate the slag on the surface of said bath and into said bath, while an oxidizing gas which contains no dephosphorizer is injected onto slag floating on top of the metal through the outer conduit of the nozzle at a speed sufficiently low to avoid its penetration of the slag on the surface of said bath, said last mentioned oxidizing gas consisting of oxygen during the first part of the operation until the slag has become sufficiently foamy, while at the same time there is injected through the inner conduit of the nozzle a mixture of oxygen and powdered lime, the apparent density of which is at first no higher than 3/10 kilogram per cubic meter (S.T.P.), and then gradually increased as the foaming develops, said injection through the outer conduit of the nozzle being stopped suddenly as soon as the foaming has started.

4. The method of producing steel by refining of pig iron in which the major part of the dephosphorizers in finely divided form are suspended in a gas and injected into the bath to be treated from above the surface of said bath by means of a nozzle having an inner conduit and an outer conduit concentric to the inner conduit and surrounding it, characterized by the fact that during at least a part of the process an oxidizing gas containing the dephosphorizer in suspension is injected into the bath of metal through the inner conduit of the nozzle at a speed sufficiently high to cause it to penetrate the slag on the surface of said bath and into said bath, while an oxidizing gas which contains no dephosphorizer is injected onto slag floating on top of the metal through the outer conduit of the nozzle at a speed sufficiently low to avoid its penetration of the slag on the surface of said bath, said last mentioned oxidizing gas consisting of oxygen during the first part of the operation until the slag has become sufficiently foamy, while at the same time there is injected through the inner conduit of the nozzle a mixture of oxygen and powdered lime, the apparent density of which is at first no higher than 3/10 kilogram per cubic meter (S.T.P.), and then gradually increased as the foaming develops, and wherein when the foaming has started, the oxygen injected through the outer conduit of the nozzle is replaced by a gas of lower oxidizing power, the injection of said oxidizing gas containing the dephosphorizer in suspension is continued through the inner conduit, said oxidizing gas comprising oxygen.

5. The method of producing steel by refining of pig iron in which the major part of the dephosphorizers in finely divided form are suspended in a gas and injected into the bath to be treated from above the surface of said bath by means of a nozzle having an inner conduit and an outer conduit concentric to the inner conduit and surrounding it, characterized by the fact that during at least a part of the process an oxidizing gas containing the dephosphorizer in suspension is injected into the bath of metal through the inner conduit of the nozzle at a speed sufficiently high to cause it to penetrate the slag on the surface of said bath, while an oxidizing gas which contains no dephosphorizer is injected onto slag floating on top of the metal through the outer conduit of the nozzle at a speed sufficiently low to avoid its penetration of the slag on the surface of said bath, said last mentioned oxidizing gas consisting of oxygen during the first part of the operation until the slag has become sufficiently foamy, while at the same time there is injected through the inner conduit of the nozzle a mixture of oxygen and powdered lime, the apparent density of which is at first no higher than 3/10 kilogram per cubic meter (S.T.P.), and then gradually increased as the foaming develops, any excessive foaming tendencies of the slag being counteracted by injection into said slag through the outer nozzle conduit of a gas of lower oxidizing power than oxygen.

6. The method of producing steel by refining of pig iron in which the major part of the dephosphorizers in finely divided form are suspended in a gas and injected into the bath to be treated from above the surface of said bath by means of a nozzle having an inner conduit and an outer conduit concentric to the inner conduit and surrounding it, characterized by the fact that during at least a part of the process an oxidizing gas containing the dephosphorizer in suspension is injected into the bath of metal through the inner conduit of the nozzle at a speed sufficiently high to cause it to penetrate the slag on the surface of said bath and into said bath, while an oxidizing gas which contains no dephosphorizer is injected onto slag floating on top of the metal through the outer conduit of the nozzle at a speed sufficiently low to avoid its penetration of the slag on the surface of said bath, said last mentioned oxidizing gas consisting of oxygen during the first part of the operation until the slag has become sufficiently foamy, while at the same time there is injected through the inner conduit of the nozzle a mixture of oxygen and powdered lime, the apparent density of which is at first no higher than 3/10 kilogram per cubic meter (S.T.P.), and then gradually increased as the foaming develops, the amount of foaming being increased when desired by injection of pure oxygen through the outer conduit of the nozzle.

(References on following page)

References Cited in the file of this patent

UNITED STATES PATENTS

1,145,506	Pasquier	July 6, 1915
1,826,497	Bicheroux	Oct. 6, 1931
1,968,917	Soldatoff	Aug. 7, 1934
2,140,181	Bangle	Dec. 13, 1938
2,668,759	Tenenbaum	Feb. 9, 1954
2,669,511	Whitney	Feb. 16, 1954
2,789,046	Speith et al.	Apr. 16, 1957
2,817,584	Kootz et al.	Dec. 12, 1957
2,828,956	Bienoisek et al.	Apr. 1, 1958
2,829,960	Vogt	Apr. 8, 1958