

- [54] **DOUBLE DELIVERY LANCE FOR REFINING THE STEEL IN THE CONVERTER PROCESSES**
- [75] Inventors: **Aldo Ramacciotti**, Rome; **Alberto Praitoni**; **Bruno Imberti**, both of Genova, all of Italy
- [73] Assignee: **Centro Sperimentale Metallurgico S.p.A.**, Rome, Italy
- [22] Filed: **June 1, 1971**
- [21] Appl. No.: **148,520**

- [30] **Foreign Application Priority Data**
 July 1, 1970 Italy.....51838 A/70
- [52] U.S. Cl.**266/34 L**
- [51] Int. Cl.**C21c 7/00**
- [58] Field of Search266/34 L, 34 LM;
 239/132.3

[56] **References Cited**

UNITED STATES PATENTS

- 3,488,044 1/1970 Shepherd.....266/34 L
- 3,309,195 3/1967 Hutton.....266/34 L

FOREIGN PATENTS OR APPLICATIONS

- 469,943 4/1969 Switzerland.....239/132.3

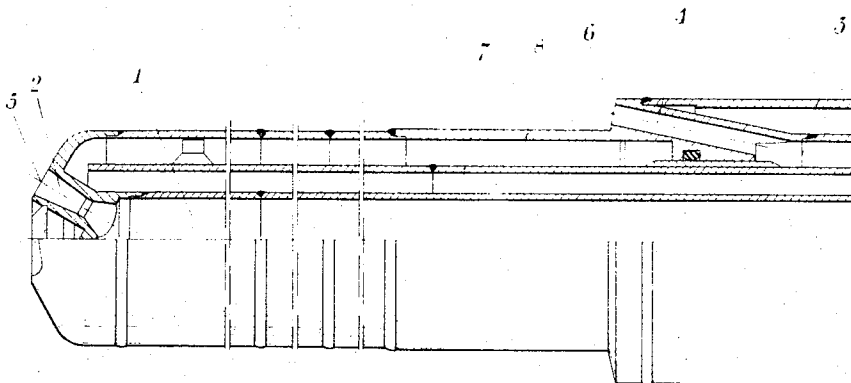
1,908,167 9/1969 Germany266/34 L

Primary Examiner—Gerald A. Dost
Attorney—Young & Thompson

[57] **ABSTRACT**

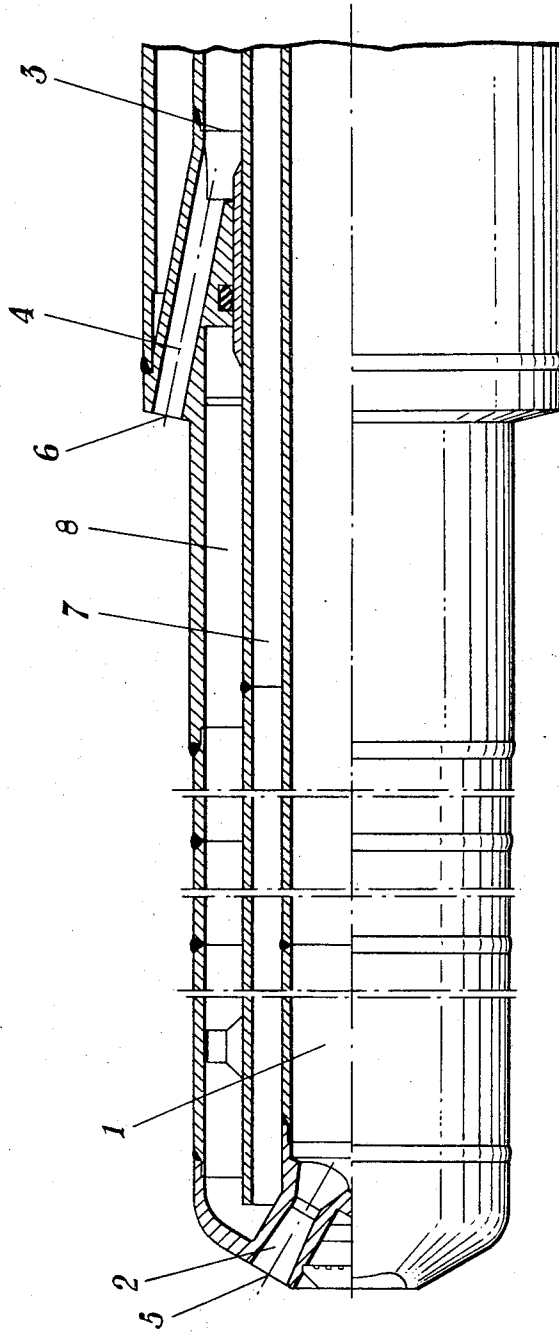
Double-delivery refining lance comprising: a main conduit, in a central location with its axis coinciding with the lance axis, diverging into a set of nozzles; a secondary outer annular conduit disposed concentrically about the main conduit diverging in its turn into a set of nozzles, as well as annular conduits, disposed concentrically about the above mentioned main and secondary conduits for cooling fluid input and output respectively. The discharging nozzles of the main conduit diverge conically with respect to the lance axis downwardly by an acute angle and are arranged symmetrically; also the discharging nozzles of the secondary circuit are downwardly inclined with respect to the lance axis by an acute angle not necessarily coinciding with the former and symmetrically arranged; the inclination of the discharging nozzles of the main conduit and respectively of the secondary conduit, and their respective locations, longitudinally and radially with respect to the lance axis, are such as to make the lance particularly useful in converters rotating around a vertical axis.

7 Claims, 1 Drawing Figure



PATENTED MAY 1 1973

3,730,505



INVENTORS

ALDO RAMACCIOTTI
ALBERTO PRAITONI
BRUNO IMBERTI

BY

Young & Thompson

ATTORNEYS

DOUBLE DELIVERY LANCE FOR REFINING THE STEEL IN THE CONVERTER PROCESSES

The present invention relates to a double-delivery lance for steel refining in the top-blown converter processes. Particularly, this invention concerns a lance, which can be used in the steel refining processes in converters, capable of supplying, simultaneously and with separate jets, the oxygen and/or other gases, and as the case may be, other substances necessary for the development of the refining reactions as well as the oxygen and/or other oxidizing gases as necessary to the combustion, inside the converter, of the carbon monoxide produced by said reactions.

It is known that the combustion of the carbon monoxide to carbon dioxide is a highly exothermic process. The developed heat can be therefore advantageously utilized if said combustion is caused to occur inside the converter. In this case it is in fact possible to melt a greater amount of cold metal charge and/or to carry out subsequent metallurgical operations, for instance alloying operations, without having to resort to supplying heat from external sources.

The attempts made in the past for carrying out the combustion of the carbon monoxide within the converters met a double set of difficulties which can be considered due, on the one hand to the formation inside the converter itself and as a result of the blowing of oxygen, of preferential paths of the gas flow, limiting the mixing of the oxygen with the carbon monoxide thus rendering incomplete the combustion of the latter, and on the other hand due to the remarkable thermal stresses to which the refractory will be submitted during the combustion.

The purpose of the present invention is that of providing a lance capable of ensuring, as a result of the structural features of its component parts and of their mutual position, both lengthwise and radially with respect to the axis of the lance, a satisfactory mixing of the oxygen, blown through a separate duct from the refining jet, with the carbon monoxide developed by the bath. In order to render more clear the purpose of this invention it will be stated also that the lance is particularly useful in converters rotating about a vertical axis embodying a process like that described in the Italian Pat. application No. 50,894A/70. In fact only the particular shape taken in this case by the bath, which moves upwards along the walls owing to the rotation, can ensure, on the one hand, a satisfactory thermal protection of the refractory during the combustion of the carbon monoxide and, on the other hand, due to the increased exposed surface, a more favorable thermal exchange between the bath surface and the superposed atmosphere where the combustion occurs.

If said lance is located along the geometrical axis of the converter, and if this axis is coincident with the axis of rotation of the converter itself, the advantage is obtained that, as the combustion occurs inside of said of said converter and as it is thereby possible to charge it with solid scraps (which in the initial stages of the process could emerge from the liquid bath), under these conditions the possible impacts of the lance against the solid scraps have insignificant effects, the linear rotational speed of the bath relative to the head of the lance being practically nil.

The lance forming the object of this invention provides: a single feed for the oxygen and/or other gas

necessary for refining (primary jet) and for the oxygen and/or other gas necessary for combustion of CO (secondary jet); or: separate feeds when the primary jet consists of gases (as the case may be, also mixed with other refining substances) the quality and/or rates of which are different from those used for the secondary jet. Both the supply conduit for the primary jet and that for the secondary jet end in a group of nozzles among which are called main nozzles those supplying the primary jet, and barrage jets those supplying the secondary jet, respectively, all nozzles being divergent from the axis of the lance, with which they form an acute angle, and located symmetrically with respect to it.

Barrage nozzles at 90° with respect to the axis of the lance or divergent therefrom through an obtuse angle, are not as satisfactory. The drawbacks associated with this arrangement can be attributed to the fact that the oxygen path, inside the converter, is less than that travelled in the case of barrage nozzles diverging through an acute angle with respect to the axis of the lance. In fact it is obvious that if the path travelled by the oxygen inside the converter is short, the pre-heating of the oxygen and the amount of its mixing with the carbon monoxide and therefore the amount of the combustion of the carbon monoxide will also be reduced.

Accordingly the specific object of this invention is a double-delivery lance for steel refining in the converter processes, characterized in that it includes a main central conduit co-axial with the lance itself, which diverges into a set of nozzles divergent from the axis of the lance with which they form an acute angle, and symmetrical with respect to it; a secondary outer annular conduit, co-axial with the main conduit, which diverges into a set of nozzles, called barrage nozzles, diverging through an acute angle with respect to the axis of the lance and symmetrical with respect thereto; and finally annular conduits co-axial with said conduits, for cooling fluid input and output, the inclination of the terminal nozzles of the main conduit and of the secondary conduit respectively, and their mutual positions in longitudinal and radial directions with respect to the axis of the lance being such as to render the latter particularly suitable for use in converters rotating about a vertical axis.

This invention will be rendered more evident by the following detailed specification relating to an embodiment of the invention itself, disclosed only by way on non-limitative illustrative example. Reference is made to the attached drawing wherein the partially sectional view of the terminal portion of a lance according to this invention has been shown.

In the embodiment shown in this FIGURE, the lance having a circular cross sectional shape, made of steel with a copper head, includes a conduit 1 for feeding the oxygen of the primary jet which diverges into two main nozzles 2 identical to each other, with a circular cross sectional shape, and divergent with respect to the axis of the lance with which they form an acute angle comprised between 10° and 60°, and symmetrical with respect thereto. Concentrically with the conduit 1 there is the annular conduit 3 for feeding the secondary jet which diverges into six barrage nozzles 4 identical to one another, having a circular cross sectional shape, divergent with respect to the axis of the lance with which they form an acute angle comprised between 10°

and 60° and symmetrical with respect thereto, and from which emerges an oxygen barrier having a substantially conical shape.

Assuming as a reference the lower end of the lance head, the plane where the center 5 of the terminal holes of the main nozzles 2 are located, is lower than the plane parallel thereto in which are located the centers 6 of the terminal holes of the barrage nozzles 4, said planes being perpendicular to the axis of the lance and spaced apart from one another by a distance comprised between 0 and 30 times the diameter of the lance.

Said centers lie on two circumferences, of which the circumference related, as above explained, to the centers of the barrage nozzles, will have a longer radius.

Coaxially with the conduits 1 and 3 annular passages 7 are provided for inlet of the cooling fluid and annular passages 8 are provided for the outlet of said fluid.

The present invention has been described with particular reference to a specific embodiment thereof, it being however understood that changes and variations might be practically adopted without departing from the scope of the claims.

Having thus described the present invention, what is claimed is:

1. A double-delivery refining lance comprising a central main oxygen conduit having its axis coinciding with the lance axis, an input tubular conduit arranged concentrically around said main conduit for introducing a cooling fluid, an annular secondary oxygen conduit arranged concentrically around said input tubular conduit and an output tubular conduit arranged around said secondary oxygen conduit, said main conduit having at least two main discharging nozzles diverging conically downwardly at an acute angle with respect to the lance axis, said secondary conduit having discharging secondary nozzles diverging downwardly at an

acute angle with respect to the lance axis, said main and secondary nozzles being symmetrical to the lance axis and the ratio between the number of said main and secondary nozzles being at least 2 to 1, said nozzles extending at the most through only one conduit wall.

2. A double-delivery lance as claimed in claim 1, wherein the main and secondary nozzles are inclined with respect to the lance axis at an acute angle comprised from 10° to 60°.

3. A double-delivery lance as claimed in claim 1, wherein the distance between the circles passing through the centers of end holes of said main and secondary nozzles is comprised between 0 and 30 times the lance diameter, the circumference on which lie the centers of the end holes of said main nozzles lying closer to the lance tip and having a radius smaller than the radius of the circle on which lie the centers of the end holes of said secondary nozzles.

4. A double-delivery lance as claimed in claim 1, said main oxygen conduit having an outer wall which is the inner wall of said input tubular conduit, said input tubular conduit having an outer wall which is the inner wall of said secondary oxygen conduit, said secondary oxygen conduit having an outer wall which is the inner wall of said output tubular conduit.

5. A double-delivery lance as claimed in claim 4, said output tubular conduit having an outer wall that is the outside wall of the lance.

6. A double-delivery lance as claimed in claim 1, said input tubular conduit having an outer wall that is the inner wall of said output tubular conduit in the region of the lance that extends lengthwise between said main nozzles and said secondary nozzles.

7. A double delivery lance as claimed in claim 6, the last-named wall terminating short of said main nozzles.

* * * * *

40

45

50

55

60

65