JRM 1

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

592920

APPLICATION FOR A STANDARD PATENT

I\We,

Micheal D LaBATE

of 115 HAZEN AVENUE
ELLWOOD CITY
PENNSYLVANIA 16117
USA

hereby apply for the grant of a standard patent for an invention entitled:

DUAL ACTION LANCE FOR LADLES

which is described in the accompanying complete specification

Details of basic application(s):

Number of basic application	Name of Convention country in which basic application was filed	Date of basic application
052975	US	22 MAY 87

My/our address for service is care of CLEMENT HACK & CO., Patent Attorneys, 601 St. Kilda Road, Melbourne 3004, Victoria, Australia.

DATED this 12th day of January 1988

Micheal D LaBATE

CLEMENT HACK & CO.

TO: The Commissioner of Patents.

FEE STAMP TO VALUE OF $ 155 ATTACHED
MAIL OFFICER VO

PATENT OFFICE ONE HUNDRED DOLLARS
PATENT OFFICE FIFTY DOLLARS
PATENT OFFICE FIVE DOLLARS
LODGED AT SUB-OF 12 JAN 1988 Melbourne

LODGED AT SUB-OFFICE
12 JAN 1988
Melbourne

APPLICATION ACCEPTED AND AMENDMENTS ALLOWED 15.11.89

CLEMENT HACK & CO.

Australia . Patent Declaration Form
DMO:AL 12/11/1

Forms 7 and 8

AUSTRALIA

Patents Act 1952

DECLARATION IN SUPPORT OF A CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT OR PATENT OF ADDITION

Name(s) of Applicant(s)

In support of the application made by MICHEAL D. LABATE,

Title

for a patent for an invention entitled

DUAL ACTION LANCE FOR LADLES

Name(s) and address(es) of person(s) making declaration

I/We, MICHEAL D. LaBate,
115 Hazen Avenue,
Ellwood City, Pennsylvania 16117
United States of America
do solemnly and sincerely declare as follows:-

1. I am/we are the applicant(s) for the patent, or am/are authorised by the abovementioned applicant to make this declaration on its behalf.

2. The basic application(s) as defined by Section 141 of the Act was/were made in the following country or countries on the following date(s) by the following applicant(s) namely:-

Country, filing date and name of Applicant(s) for the or each basic application

in U.S.A. on May 22 19 87
by Micheal D. LaBate
in _____ on _____ 19____
by _____

3. The said basic application(s) was/were the first application(s) made in a Convention country in respect of the invention the subject of the application.

Name(s) and address(es) of the or each actual inventor

4. The actual inventor(s) of the said invention is/are Micheal D. LaBate, 115 Hazen Avenue, Ellwood Avenue, Pennsylvania 16117, U.S.A.

See reverse side of this form for guidance in completing this part

5. The facts upon which the applicant(s) is/are entitled to make this application are as follows:-

DECLARED at Youngstown, Ohio U.S.A. this 20th day of December, 1987.

Micheal D. LaBate

(12) PATENT ABRIDGMENT (11) Document No. AU-B-10202/88
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 592920

(54) Title
DUAL ACTION TUYERES FOR LADLES

International Patent Classification(s)
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MICHEAL D. LABATE

(72) Inventor(s)
MICHEAL D. LABATE

(74) Attorney or Agent
GRIFFITH HACK & CO. MELBOURNE

(56) Prior Art Documents
US 4588170
US 4179103
US 3980469

(57) Claim

1. Apparatus for refining molten metal including:

a vessel and lance supported by and held substantially vertically in the vessel and terminating adjacent the bottom of said vessel for the separate subsurface injection of refining and stirring agents unto molten metal in the vessel;

the lance including at least a pair of conduits surrounded by a refractory material;

one of the pair of conduits communicating at one end with a source of said refining agents and terminating in an unobstructed right angular opening above the bottom of said lance;

the other of said pair of conduits communicating at one end with a source of gas and terminating in a right

angular opening below said unobstructed opening;

a portion of said refractory material extending across a portion of the top of said vessel in a hook shape for engagement thereover.

6. In a method of refining molten metal in a vessel by injecting additives thereinto, the steps comprising:

transferring molten metal into a vessel;

supporting on the vessel refractory protected vertically positioned conduits at least one of which has an unobstructed outward opening positioned at a fixed location adjacent the bottom of said vessel and at least another of which conduits has an outward opening positioned below said unobstructed opening;

introducing said ~~additives~~ additives adjacent the bottom of said vessel through said conduit and unobstructed opening; and

simultaneously introducing gas flow through said conduit and opening below said unobstructed opening; and

continuing the introduction of gas flow and additives into the vessel until a predetermined quantity of additives has been introduced.

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Form 10

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE

Short Title:

Int. Cl:

Application Number:
Lodged:

Complete Specification-Lodged:
Accepted:
Lapsed:
Published:

Priority:

Related Art:

This document contains the amendments made under Section 49 and is correct for printing.

TO BE COMPLETED BY APPLICANT

Name of Applicant:
Micheal D LaBATE

Address of Applicant: 115 HAZEN AVENUE
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USA

Actual Inventor:

Address for Service: CLEMENT HACK & CO.,
601 St. Kilda Road,
Melbourne, Victoria 3004,
Australia.

Complete Specification for the invention entitled:
DUAL ACTION LANCE FOR LADLES

The following statement is a full description of this invention including the best method of performing it known to me:-

DUAL ACTION LANCE FOR LADLES

Description of the Invention

Technical Field:

This invention relates to a method and apparatus for simultaneously introducing a refining agent and bubbling gas, such as argon, through molten metal in a ladle so as to immediately mix the refining agent in the molten metal.

Background Art:

Apparatus for introducing gases into molten metal for various purposes are disclosed in U.S. Patents 3,230,075 of Jan. 18, 1966 to Nakamura and 3,945,820 of March 23, 1976 to Brotzmann, et al., which disclose immersion lances for refining metal melts in hearth-type vessels. Apparatus for introducing gas into a ladle is disclosed in U.S. Patent 3,961,779 of June 8, 1976 to Tiberg, et al and a lance useful for the same practice is disclosed in U.S. Patent 4,179,103 of Dec. 18, 1979 to Bentz et al. A lance for refining a melt by means of a pulverous solid material and a carrier gas is disclosed in U.S. Patent 4,211,553 of July 8, 1980 to Honkaniemi, et al, and a lance positioned in a ladle in fixed relation to the side wall thereof is disclosed in U.S. Patent 4,588,170 of May 13, 1976 to Towns.

In the prior art patents 3,230,075 and 3,945,820, the lances are introduced through an angularly arranged opening in the side wall of a hearth vessel and a similar arrangement for introducing

a lance into a ladle is disclosed in U.S. Patent 3,961,779.

The other prior art inventions referred to hereinbefore are arranged to be positioned directly into the open top of the ladle and no prior art is known wherein a modified lance construction enables it to be used to simultaneously introduce and mix a refining agent into the molten metal in a ladle at or near the bottom thereof so that the bubbling gas, such as argon, emerging below the refining agent will always create a desired mixing and stirring action of the refining agent and the molten metal in the ladle which is essential in deoxidizing and desulphizing or otherwise treating the molten metal as the case may be.

Summary of the Invention

The present invention provides apparatus for refining molten metal including:

a vessel and lance supported by and held substantially vertically in the vessel and terminating adjacent the bottom of said vessel for the separate subsurface injection of refining and stirring agents unto molten metal in the vessel;

the lance including at least a pair of conduits surrounded by a refractory material;

one of the pair of conduits communicating at one end with a source of said refining agents and terminating in an unobstructed right angular opening above the bottom of said lance;

the other of said pair of conduits communicating at one end with a source of gas and terminating in a right angular opening below said unobstructed opening;

a portion of said refractory material extending across a portion of the top of said vessel in a hook shape for engagement thereover.

The present invention also provides in a method of refining molten metal in a vessel by injecting additives thereinto, the steps comprising:

transferring molten metal into a vessel;

supporting on the vessel refractory protected vertically positioned conduits at least one of which has an unobstructed outward opening positioned at a fixed location adjacent the bottom of said vessel and at least another of which conduits has an outward opening positioned below said unobstructed opening;

introducing said additives adjacent the bottom of said vessel through said conduit and unobstructed opening; and

simultaneously introducing gas flow through said conduit and opening below said unobstructed opening; and

continuing the introduction of gas flow and additives into the vessel until a predetermined quantity of additives has been introduced.

Description of the Drawings

Figure 1 is a side elevation of a portion of a ladle showing the dual action lance positioned therein with parts broken away;

Figure 2 is an enlarged side elevation of the dual action lance with parts broken away and parts in cross section;

Figure 3 is a top plan view on line 3-3 of Figure 2; and

Figure 4 is a side view on line 4-4 of Figure 2.

Description of the Preferred Embodiment

By referring to the drawings and Figures 1 and 2 in particular, it will be seen that a portion of a ladle 10 has

been disclosed which is a vessel of any suitable or conventional construction as well known in the steel making industry. The ladle 10 has a protective refractory lining 11 such as refractory brick or the like. The upper end of the ladle 10 is illustrated at 12. The lance comprises an elongated refractory body member generally indicated at 13 and having an upper portion 14 which is of inverted U-shape and a lower portion 15 which is cross sectionally rectangular. Tubular members 16 formed of pipe are positioned longitudinally in the elongated refractory body member of the lance 13 and extend outwardly of the upper portion 14 thereof and communicate with vertically spaced and aligned openings 18 in the lower portion 15 thereof. Secondary tubular members 20, also formed of pipe, are positioned longitudinally in the elongated refractory body member of the lance 13 and communicate with vertically spaced and aligned openings 22 in the upper and lower portions 14 and 15 respectively of the lance 13. The openings 18 and 22 are on a common vertical plane. An elongate reinforcing rod 24 is embedded in the elongate refractory body 13.

By referring to Figure 1 of the drawings, it will be seen that one vertical surface of the lance 13 is positioned against the refractory lining 11 of the ladle 10 and the inverted U-shaped upper portion 14 of the lance 13 is hooked over the upper end 12 of the ladle 10 so as to hold the lance 13 securely in position.

By referring to Figures 1 and 2 of the drawings, it will be seen that the lower ends of the tubular members 16 communicate with porous plugs 23 positioned in the openings 18 in the lower portion 15 of the lance 13 and that the lower ends of the secondary tubular members 20 defined by the openings 22 in the lower portion 15 of the lance 13 are simply open so that a refining or reaction agent or agents may be delivered outwardly therefrom.

Still referring to Figures 1 and 2 of the drawings, and Figure 4 of the drawings, it will be seen that each of the openings 22 are located vertically above the openings 18 in which the porous plugs 23 are positioned and through which argon gas or the like is introduced into molten metal in the ladle 10.

It will be thus be seen that the simultaneous introduction of the refining agent such as aluminum or any metallurgical alloy in wire or powder form through the openings 22 will be immediately dispersed to the maximum degree through the molten metal in the ladle by the action of the argon or other gas introduced immediately below the refining agent and adjacent the bottom of the ladle. It will occur to those skilled in the art that such introduction of the refining agent or agents at or near

the bottom of the ladle with the simultaneous introduction of the argon gas or the like, effectively treats all of the molten metal from the bottom up as the refining agent and gas rise through the total molten mass.

It will also occur to those skilled in the art that a highly reactive agent can be introduced near the bottom of the ladle by the method and apparatus disclosed herein, whereas the prior art practice of introducing reactive agents into the molten mass often results in pre-ignition and loss of the reaction desired. This is particularly true of desulphurizing or grain refining or shaping or homogenizing agents which can, with the present invention and apparatus, be introduced into the bottom of the molten metal and thoroughly dispersed therein prior to any pre-ignition that otherwise occurs.

Again referring to Figure 2 of the drawings, it will be seen that the upper end of the tubular members 16 extend outwardly of the inverted U-shaped upper portion 14 of the lance 13 and communicate with valves 25 and a source of argon, or other gas, which may be a cylinder gas source 26 rendering the apparatus portable. While not illustrated, the refining agent or agents in wire or powder form are introduced into the secondary

tubular members 20 through the openings 21 by suitable means that insures their introduction into the molten metal when they emerge from the openings 22 in the lower portion 15 of the lance. A reel mechanism serves to suitable feed wire forms of the refining agent and an additional supply of argon or other gas under suitable pressure will serve to insure the injection of powdered form of refining or reactive agents by the tubular members or conduits 16 and 20.

Still referring to Figures 1 and 2 of the drawings, it will be seen that an inverted U-shaped handle 27 is attached to the upper portion 14 of the lance 13 and extends above the upper portion 14 so that the lance 13 can be conveniently attached to a supporting and positioning device and held thereby as the lance 13 is positioned in the ladle with the inverted U-shaped upper portion 14 thereof acting to hold the lance 13 against the side wall of the ladle 10. An apertured bracket 28 is engaged on the inverted U-shaped handle 27.

It will occur to those skilled in the art that additional openings for the introduction of argon or another gas and a refining or reaction agent may be provided in the lower portion 15 of the lance and in communication with additional tubular members in the lance which in turn communicate with the hereinbefore

mentioned sources of the refining or reactive agents or additives and gas.

It will also occur to those skilled in the art that the conduits or tubular members 16 through which the refining or reactive agents or additives are introduced with a propelling agent can be of any configuration through which the agents or additives can be moved. While the illustration of the preferred embodiment shows the conduits 16 as having turns of about 90° radius, the turns may be greater to assure the relative friction free movement of wire forms of additives, etc.

It will further be observed that the novel and highly efficient dual action lance is ideally suited for side mounting in a transport ladle for molten metal as it will maintain its desired position and effectively introduce the refining and/or reaction agents and the argon or other propelling gas into the ladle and the molten metal therein at points near the bottom of the ladle and that the design of the dual action lance enables it to occupy a minimum of space therein such as for example mounting the same in a vertical groove in the refractory lining of the side of the ladle as disclosed in Patent 4,588,170.

~~Having thus described my invention, what I claim is:~~

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Apparatus for refining molten metal including:

a vessel and lance supported by and held substantially vertically in the vessel and terminating adjacent the bottom of said vessel for the separate subsurface injection of refining and stirring agents unto molten metal in the vessel;

the lance including at least a pair of conduits surrounded by a refractory material;

one of the pair of conduits communicating at one end with a source of said refining agents and terminating in an unobstructed right angular opening above the bottom of said lance;

the other of said pair of conduits communicating at one end with a source of gas and terminating in a right angular opening below said unobstructed opening;

a portion of said refractory material extending across a portion of the top of said vessel in a hook shape for engagement thereover.

2. The apparatus of claim 1 wherein the conduits are pipes and the refractory material is formed thereabout.

3. The apparatus of claim 1 wherein the conduits are pipes and the refractory material is formed thereabout, the pipes and refractory material extending across the top of the vessel and the pipes extending out of said hook shape on one side thereof.

4. The apparatus of claim 1 wherein said opening below and unobstructed opening is enlarged and a porous plug is positioned in said enlarged opening so as to form multiple openings to create bubbles of the gas introduced therethrough below and around and above said unobstructed opening.

5. The apparatus of claim 1 wherein there are at least two unobstructed openings and at least two openings therebelow and wherein said unobstructed openings and the openings therebelow are positioned in vertically arranged spaced relation to one another.

6. In a method of refining molten metal in a vessel by injecting additives thereinto, the steps comprising:

transferring molten metal into a vessel;

supporting on the vessel refractory protected vertically positioned conduits at least one of which has an unobstructed outward opening positioned at a fixed location adjacent the bottom of said vessel and at least another of which conduits has an outward opening positioned below said unobstructed opening;

introducing said ~~additives~~ additives adjacent the bottom of said vessel through said conduit and unobstructed opening; and

simultaneously introducing gas flow through said conduit and opening below said unobstructed opening; and

continuing the introduction of gas flow and additives into the vessel until a predetermined quantity of additives has been introduced.

7. In a method of refining molten metal in a vessel by injecting additives thereinto, the steps comprising:

transferring molten metal into a vessel;

supporting on the vessel refractory protected vertically positioned conduits at least one of which has an unobstructed sideward opening positioned at a fixed location adjacent the bottom of said vessel and at least another of which conduits has an opening positioned below said unobstructed opening;

introducing a wire additive adjacent the bottom of said vessel through said conduit and unobstructed opening; and

simultaneously introducing gas flow through said conduit and opening below said unobstructed opening; and

continuing the introduction of gas flow and wire additive into the vessel until a predetermined quantity of wire additive has been introduced.

8. In a method of refining molten metal in a ladle by injecting additives thereinto, the steps comprising:

transferring molten metal into a vessel;

supporting on the vessel refractory protected vertically poisition conduits at least one of which has an unobstructed opening positioned at a fixed location adjacent the bottom of said vessel and at least another of which conduits has an opening positioned below said unobstructed opening;

introducing a powdered additive adjacent the bottom of said vessel through said conduit and unobstructed openings; and

simultaneously introducing gas flow through said conduit and opening below said unobstructed opening; and

continuing the introduction of gas flow and powdered additive into the vessel until a predetermined quantity of powdered additive has been introduced.

9. In the method as set forth in claims 6 or 7 or 8, the step of introducing said gas flow at a relative high pressure and flow rate to create turbulence around said unobstructed opening to stir and mix said additives into said molten metal.

DATED THIS 12TH DAY OF JANUARY 1988

Micheal D LaBATE

By his Patent Attorneys:

CLEMENT HACK & CO,

Fellows Institute of Patent Attorneys of Australia

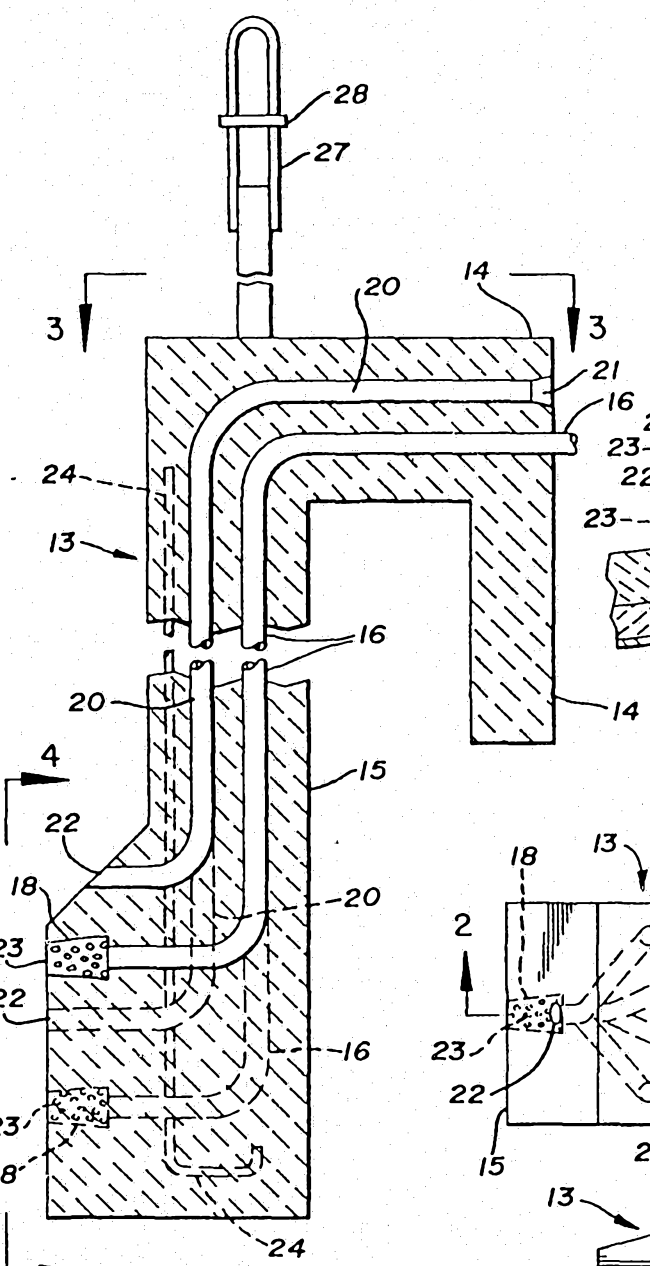

FIG. 2

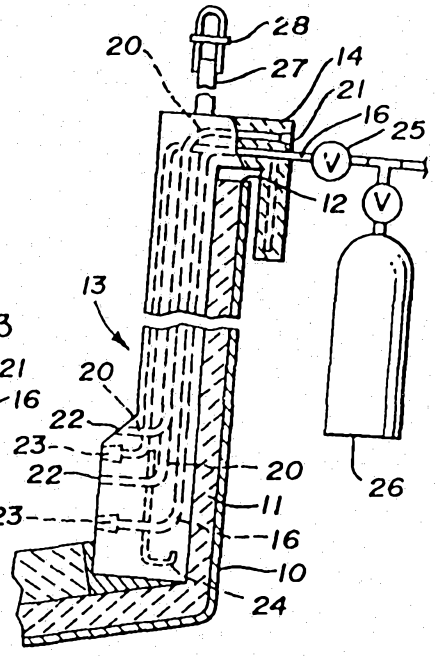

FIG. 1

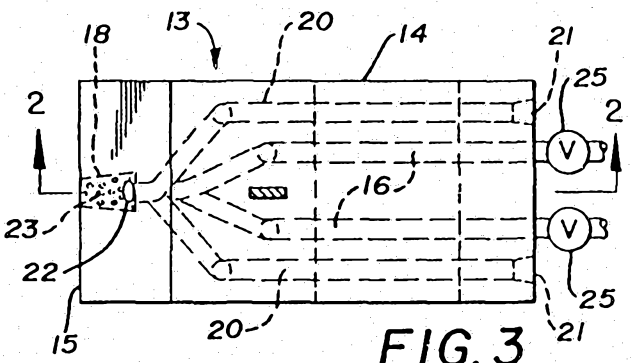

FIG. 3

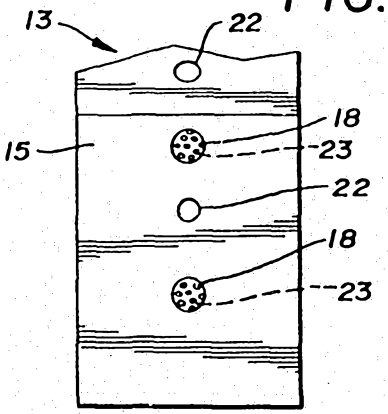

FIG. 4