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(11) **EP 1 087 025 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.03.2001 Bulletin 2001/13

(51) Int. Cl.⁷: **C21C 7/00, F27D 3/00**

(21) Application number: **00102943.8**

(22) Date of filing: **14.02.2000**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **24.09.1999 GB 9922543**

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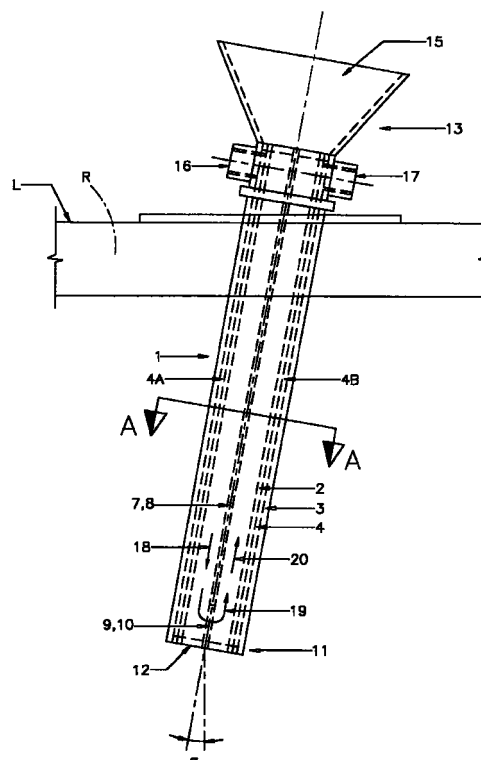
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(54) **Wire feed unit**

(57) A wire feed unit (1) for the controlled feeding of wire from a coil into a steel melt in a ladle for purposes of introducing additives into the melt, comprises a water cooled guide tube (2, 3) of length capable of imparting a straightening effect on wire fed along the guide tube (2, 3) and of allowing the uncontrolled wire leaving the guide tube to be close to its point of penetration of the steel in the ladle. The invention also includes a ladle arc furnace (L) provided with a unit (1).

Figure 1



EP 1 087 025 A1

Description**FIELD OF THE INVENTION:**

[0001] This invention relates to a wire feed unit for the controlled injection of wire into a melt.

BACKGROUND OF THE INVENTION:

[0002] Wire feed units are known and are intended to be used during the so-called "Secondary steelmaking" process to enable wires to be fed directly into a ladle.

[0003] The process of wire feeding is well established and is usually carried out in a tube. These tubes quickly burn away due to the heat load from the ladle and need to be replaced regularly. They are also prone to slag adhesion which builds up at the tip of the tube thereby obstructing the feeding of the wire.

[0004] Typically wire feeding is carried out to enable calcium silicide, ferro titanium, sulphur and carbon to be injected into molten steel contained in a ladle, and clearly the introduction of wire needs to be carefully controlled so as to ensure correct dosing of the melt with the additive(s) required.

[0005] In practice, the length of the tube down which the wire is fed is important as this has the dual effect not only of guiding the wire, but also straightening the wire, which assists the penetration of the wire into the molten steel.

[0006] In detail, the tube is inserted into the roof of a ladle arc furnace with an optimum length to enable the straightening of the wire prior to penetration of the steel. As indicated previously, the high heat flux results in the tubes quickly burning away, which progressive shorting soon eliminates the straightening effect required. This leads to the wire not penetrating the steel and results in a coiling effect of the wire on top of the usual slag covering of the melt, and tube burn back, together with slag adhesion at the tip have presented practical difficulties.

OBJECT OF THE INVENTION:

[0007] A basic object of the invention is the provision of an improved wire feed unit.

SUMMARY OF THE FIRST ASPECT OF THE INVENTION:

[0008] According to a first aspect of the invention, there is provided a wire feed unit for the controlled feeding of wire from a coil into a steel melt in a ladle for purposes of introducing additives into the melt, comprising a water cooled guide tube of length capable of imparting a straightening effect on wire fed along the guide tube and of allowing the uncontrolled wire leaving the guide tube to be close to its point of penetration of the steel in the ladle.

SUMMARY OF THE SECOND ASPECT OF THE INVENTION:

[0009] According to a second aspect of the invention, there is provided a ladle arc furnace to operate the argon stirring process and incorporating at least one wire feed unit in accordance with the first aspect of the invention, which unit is positioned at such an angle to enable the wires to penetrate the steel adjacent to the bubble created during the argon stirring process.

ADVANTAGE(S) OF THE INVENTION

[0010] Due to the fact that tube is water cooled, then burning back is no longer a problem and also because of the water cooling the adhesion of slag to the tip is minimised, if not eliminated.

PREFERRED OR OPTIONAL FEATURES OF THE INVENTION

[0011] The tube comprises two co-axial, mild steel tubes, being an inner tube along which the wire passes and an outer tube, with an annular, water flow gap between the external periphery of the inner tube, and the internal periphery of the outer tube.

[0012] The inner tube is of a sufficient internal diameter to allow the free passage of wire therethrough, without the possibility of jamming.

[0013] The outer tube is longitudinally split into two halves with sufficient material removed from each half to accommodate two dividing strips.

[0014] In the vicinity of the wire outfeed end of the tube, gaps are created at either side of the dividing strips.

[0015] The annular gap at the outfeed end of the unit is sealed eg using a 5mm thick annulus of mild steel.

[0016] At the wire infeed end of the tube a water inlet connection is provided to one half of the annular gap, and a water outlet connection is provided to the other half of the annular gap.

[0017] A conical guide is provided at the wire infeed end.

[0018] The unit fabrication is carried out using low hydrogen welding electrodes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The invention will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic side elevation of a wire feed unit in accordance with the invention shown passing through the roof of a ladle arc furnace in accordance with the second aspect of the invention, and

Figure 2 is a section on the line A - A of Figure 1.

DETAILED DESCRIPTION OF THE DRAWINGS

[0020] In the drawings is shown a wire feed unit (1) in Fig. 1 projecting through a ladle roof (R) of a ladle (L), the unit (1) being basically constructed from two co-axial, mild steel tubes, being an inner, wire guide tube (2) and an outer tube (3), with an annular gap (4) between the external periphery (5) of the inner tube (2) and the internal periphery (6) of the outer tube (3). The inner tube (2) is of a sufficient internal diameter (D) to allow the free passage of wire (not shown) there-through, without the possibility of jamming. For example, for wire of diameter approximately 10mm - 12mm the internal diameter (D) of the inner tube (2) should be no less than 35mm and the wall thickness of this tube should be 6mm.

[0021] The annular gap (4) in use, conveys cooling water and should be approximately 6mm, as this will determine the flow velocity of cooling water along the annular gap (4).

[0022] The outer tube (3) is longitudinally split into two halves (4A, 4B) with sufficient material removed from each half to accommodate two dividing strips (7, 8) shown in Fig. 2.

[0023] Gaps (9) are created at either side of the dividing strips (7, 8) to create orifices (10) to allow the passage of water from one half (4A) to the other half (4B) of the tube. The annular gap (4) at the outfeed end (11) of the unit (1) is sealed eg using a 5mm thick annulus (12) of mild steel. The annular gap (4) is sealed at the wire infeed end (13) eg using a 5mm thick annulus (14) of mild steel. A conical guide (15) is provided at the wire infeed end (13). The unit is fabricated using low hydrogen welding electrodes.

[0024] The outer tube (3) is provided with inlet and outlet water connections (16, 17 respectively) at the wire infeed end (13) of the unit (1) as shown in Fig. 1, with inward water flow as indicated by arrow (18), reversal by arrow (19), and return by arrow (20).

[0025] The flow of water to the unit (1) should be of a sufficient volume and velocity to prevent nucleate boiling taking place inside the unit (1) and specifically within the annular gap (4). This amount of water should be in the order of 7 gallons/min per 1m length of wire feed tube. Therefore the inlet and outlet connection (16, 17 respectively) should be 1" B.S.P.

[0026] As indicated in Fig. 1, the unit (1) is located at an angle ∞ with respect to the vertical to suit the argon stirring bubble that is created in the known, argon stirring process.

Claims

1. A wire feed unit (1) for the controlled feeding of wire from a coil into a steel melt in a ladle (L) for purposes of introducing additives into the melt, charac-

terised in that the unit (1) comprises a water cooled guide tube (2, 3) of length capable of imparting a straightening effect on wire fed along the guide tube (2, 3) and of allowing the uncontrolled wire leaving the outfeed end (12) of the guide tube to be close to its point of penetration of the steel in the ladle.

2. A unit as claimed in Claim 1, characterised in that the tube (2, 3) comprises two co-axial, mild steel tubes, being an inner tube (2) along which, in use, the wire passes and an outer tube (3), with an annular, water flow gap (4) between the external periphery (5) of the inner tube (2), and the internal periphery (6) of the outer tube (3).
3. A unit as claimed in Claim 2, characterised in that the inner tube (2) is of a sufficient internal diameter to allow the free passage of wire therethrough, without the possibility of jamming.
4. A unit as claimed in Claim 2 or Claim 3, characterised in that the outer tube (3) is longitudinally split into two halves (4A, 4B) with sufficient material removed from each half to accommodate two dividing strips (7, 8).
5. A unit as claimed in Claim 4, characterised in that in the vicinity of the wire outfeed end (12) of the tube, gaps are created at either side of the dividing strips (7, 8).
6. A unit as claimed in any one of Claims 2 to 5, characterised in that the annular gap (4) at the outfeed end (12) of the tube is sealed eg using a 5mm thick annulus (12) of mild steel.
7. A unit as claimed in any one of Claims 2 to 6, characterised in that at the wire infeed end (13) of the tube a water inlet connection (16) is provided to one half of the annular gap (4), and a water outlet connection (17) is provided to the other half of the annular gap (4).
8. A unit as claimed in any one of Claims 2 to 7, characterised in that a conical guide (15) is provided at the wire infeed end (13).
9. A ladle arc furnace (L) to operate the argon stirring process characterised in that the furnace incorporates at least one wire feed unit (1) in accordance with any one of Claims 1 to 9, which unit (1) is positioned at such an angle (∞) to enable the wire to penetrate the steel adjacent to the bubble created during the argon stirring process.

Figure 1

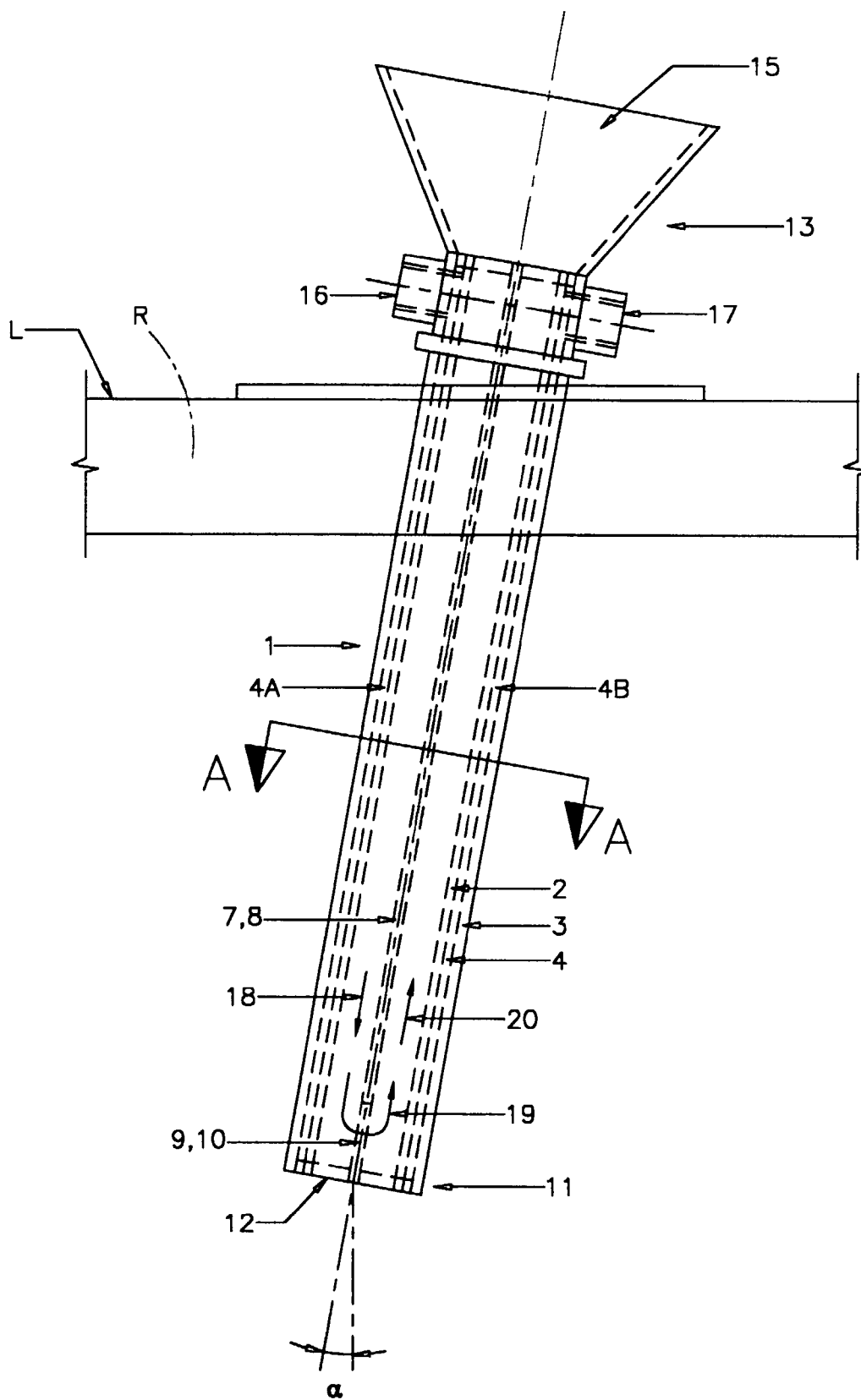
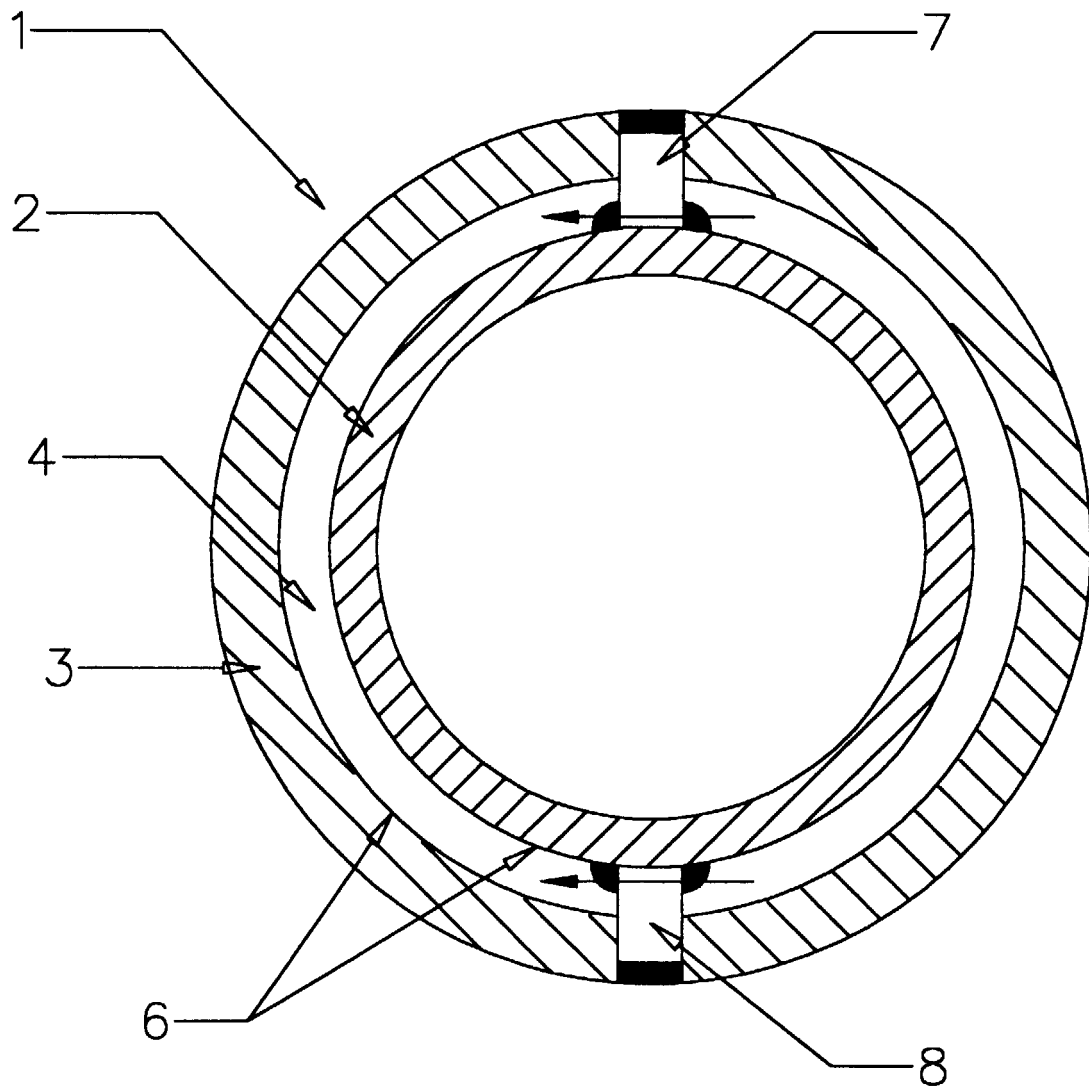


Figure 2





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EUROPEAN SEARCH REPORT

Application Number
EP 00 10 2943

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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		19 December 2000	Ceulemans, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 00 10 2943

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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