

(19) AUSTRALIAN PATENT OFFICE

(54) Title
Immersion probe

(51)⁶ International Patent Classification(s)
G01N 1/12 (2006.01) 5BHAU **C21B**
C21B 7/24 (2006.01) 7/24
G01N 1/12 20060101ALI2006082
20060101AFI2006082 8BHAU

(21) Application No: 2006203594 (22) Application Date: 2006 .08 .18

(30) Priority Data

(31) Number	(32) Date	(33) Country
10 2005 043 852.0	2005 .09 .13	DE

(43) Publication Date : 2007 .03 .29
(43) Publication Journal Date : 2007 .03 .29

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(56) Related Art
GB 1274618
FR 2546625
JP 11-304669

2006203594 18 Aug 2006

IMMERSION PROBE

Abstract

The invention relates to an immersion probe comprising a probe body (1) having a longitudinal axis and an outer surface surrounding the longitudinal axis, wherein a
s portion of the outer surface has sampling elements (4), which extend around the longitudinal axis in the peripheral direction and which have a radial dimension. A protective layer (5), which can be dissolved or combusted in molten steel or slag, is arranged around the sampling elements (4).

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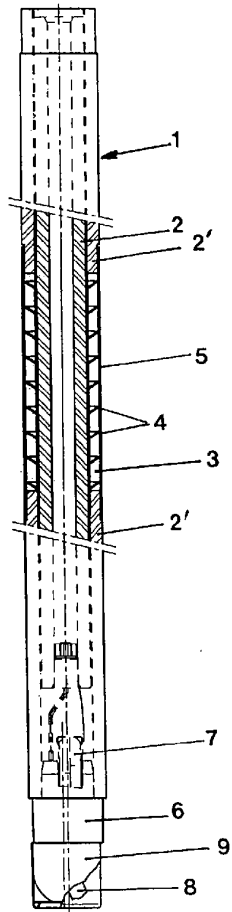


Fig. 1

2006203594 18 Aug 2006

S&F Ref: 775613

AUSTRALIA

PATENTS ACT 1990

COMPLETE SPECIFICATION

FOR A STANDARD PATENT

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Invention Title:	Immersion probe

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

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IMMERSION PROBE

Field of the Invention

The invention relates to an immersion probe comprising a probe body having a longitudinal axis and an outer surface surrounding the longitudinal axis, wherein one
5 portion of the outer surface has sampling elements, which have a radial dimension and which extend around the longitudinal axis in the peripheral direction.

Background of the Invention

Such immersion probes are known from US 5,435,196. Here, a probe is described for collecting slag samples. The probe body has a carrier tube, around which a
10 ring structure composed of twisted wire is arranged. The ring structure is movable in the longitudinal direction. The slag arranged on the molten metal is to remain adhered to the ring structure when the probe is immersed in a molten metal. The slag can then be analyzed after pulling the probe out of the melt. Depending on the viscosity of the slag, the adhering quantity is more or less large, so that even under some circumstances, too
15 little slag is available for an analysis.

Similar samplers are known from JP 14805/80 and JP 24456/74. In US 5131633 A, a rod-shaped sampler is described, in which the slag sample is to remain adhered to the jacket surface of the rods.

It is therefore desirable to improve the known immersion probes and enable
20 effective slag sampling.

Object of the Invention

It is an object of the present invention to substantially overcome or at least ameliorate one or more of the disadvantages of the prior art, or to at least provide a useful
25 alternative.

Summary of the Invention

Accordingly, in a first aspect, the present invention preferably provides an immersion probe comprising a probe body having a longitudinal axis and an outer surface surrounding the longitudinal axis, wherein a portion of the outer surface has sampling
30 elements, which extend around the longitudinal axis in the peripheral direction and which have a radial dimension, wherein a protective layer, which can be dissolved or combusted in the molten steel or slag, is arranged around the sampling elements.

In a second aspect, the present invention preferably provides an immersion probe comprising a probe body having a longitudinal axis and an outer surface surrounding the longitudinal axis and an immersion end, wherein a portion of the outer surface has

sampling elements, which extend around the longitudinal axis in the peripheral direction and which have a radial dimension, wherein the sampling elements have a flat or concave surface, which faces away from the immersion end, and which is inclined relative to the longitudinal axis in the direction of the end of the probe body opposite the immersion end.

In a preferred embodiment, because the protective layer, which can be dissolved or combusted in molten steel or slag, is arranged around the sampling elements, the slag layer lying, for example, on molten steel, thereby reaches the sampling element only after a certain delay. In this way, it has been surprisingly shown that just by these means, a sufficient amount of slag is captured and thus a sufficiently large sample can be made available for analysis. The protective layer prevents the molten slag from reaching the sampling elements too quickly and from damaging these elements, before the probe body is pulled out of the molten slag. In particular, this has proven to be advantageous in immersion probes, which contain additional sensors and/or sample chambers, because the following measurement or sampling therewith lasts a few seconds longer than the removal of the slag sample. The protective layer is preferably made of cardboard or paper. In particular, it can have a tubular shape. The sampling elements can have a flat or concave surface facing away from the immersion end of the probe body. Here, the flat or concave profile should extend in the radial direction. The sampling elements can be formed as disks running around the longitudinal axis or in the form of a spiral made of a band wound around the longitudinal axis. The flat or concave surface can be inclined to the longitudinal axis in the direction of the end of the probe body opposite the immersion end. The angle formed here between this surface and the longitudinal axis can advantageously amount to approximately between 45° and 90°. Upon immersion or after the protective layer dissolves, slag flows onto these sampling elements, adheres there, and then can be removed after the immersion probe is pulled out of the melt. For this purpose, the sampling elements are pressed together, so that the slag falls off. It is then granulated and fed to the analysis device.

Preferably, the sampling elements are made of steel, which has a wall thickness that can be less than 1 mm. The sampling elements are advantageously formed as a separate part of the probe body and comprise a different material than the remaining parts of the probe body, thus, for example, made of steel, while the other part of the probe body can be made of cardboard. The probe body preferably has a tubular shape. At least one sensor or a sampler for molten metal can be arranged on or in the probe body. It is

possible to form the sampling elements as one or more ring elements arranged one behind the other in the direction of the longitudinal axis, whereby an easier assembly is possible.

Brief Description of the Drawings

A preferred embodiment of the present invention will now be described, by way of an example only, with reference to the accompanying drawings wherein:

Fig. 1 an immersion probe according to the invention in section,

Fig. 2 a detail view of the sampling element,

Fig. 3 the sampling element in section, and

Fig. 4 a possible construction of the sampling element.

Detailed Description of the Preferred Embodiments

The immersion probe has a probe body 1, which is formed from two cardboard tubes 2; 2' fixed one over the other. The outer cardboard tube 2' is composed of two parts, which are arranged one behind the other in the longitudinal direction and which have a spacing between them, so that a wide groove 3 is created on the periphery of the probe body 1. In this groove 3 there are sampling elements 4. The sampling elements 4 are formed as flat rings, which are angled upwardly, so that slag can collect in them. Around the sampling elements 4 there is a 1 to 5 mm thick protective layer 5 made of cardboard. The protective layer 5 dissolves when the immersion probe is immersed into the melt, so that slag reaches the sampling elements 3 [sic 4] and remains adhered there. The probe body 1 has an immersion end, on which an immersion head 6 is arranged. In the immersion head 6 there is a sample chamber 7 for removing samples of the molten steel arranged under the slag layer. The molten steel flows through an inlet tube 8 into the sample chamber 7. The opening of the inlet tube 8 is protected by a cardboard cap 9. This cardboard cap 9 leaves the inlet opening of the inlet tube 8 open to the molten steel.

In Fig. 2 the sampling elements 4 are shown. These are arranged in a ring shape one behind the other on a steel tube 10. The sampling elements 4 themselves are likewise made of steel. The thickness (wall thickness) of the sampling elements 4 and the steel tube 10 amounts to approximately 1 mm or even less. The sampling elements 4 are angled upwardly, that is, opposite to the immersion direction. They form an angle of approximately 60° with the longitudinal axis of the probe body 1. After the sampling the probe body 1 is pulled out of the melt. A radial pressure is exerted on the sampling elements 4, so that these are crushed. In this way, the very brittle slag falls from the sampling elements in a coarse-grained form. The slag is reduced in size and fed to an analysis device. Fig. 3 shows the sampling elements 4 in section.

Fig. 4 shows another possible construction of the sampling elements 4. The sampling elements 4 are formed as annular flat rings as the bottom part of a relatively short metal sleeve 11, whereby they are created by bending back the metal sleeve 11. An annular groove 12 is created at the bending point. This groove 12 is set on the top edge of a metal sleeve 11 placed underneath, so that by stacking several segments, a sampling body similar to the one shown in Fig. 2 is created.

The claims defining the invention are as follows:

1. Immersion probe comprising a probe body having a longitudinal axis and an outer surface surrounding the longitudinal axis and an immersion end, wherein a portion of the outer surface has sampling elements, which extend around the longitudinal axis in the peripheral direction and which have a radial dimension, wherein the sampling elements have a flat or concave surface, which faces away from the immersion end, and which is inclined relative to the longitudinal axis in the direction of the end of the probe body opposite the immersion end and

wherein the sampling elements are formed as one or more ring elements arranged one behind the other in the direction of the longitudinal axis.

2. The immersion probe according to claim 1, wherein the sampling elements are made of steel.

3. The immersion probe according to claim 1 or claim 2, wherein the sampling elements are formed as a separate part of the probe body and made of a different material than the remaining part of the probe body.

4. The immersion probe according to any one of claims 1 to 3, wherein the remaining part of the probe body is made of cardboard.

5. The immersion probe according to any one of claims 1 to 4, wherein the probe body has a tubular shape.

6. An immersion probe substantially as hereinbefore described with reference to the accompanying drawings.

Dated 7 May, 2008

Heraeus Electro-Nite International N.V.

Patent Attorneys for the Applicant/Nominated Person

SPRUSON & FERGUSON

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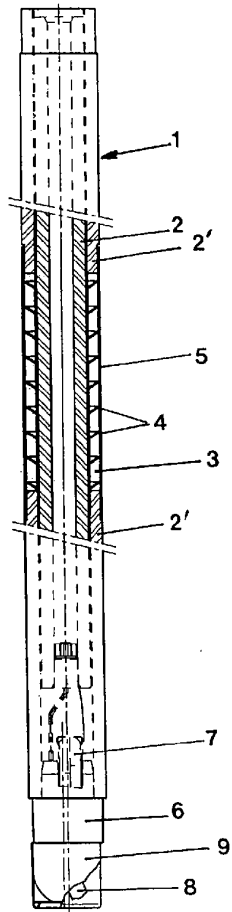


Fig. 1

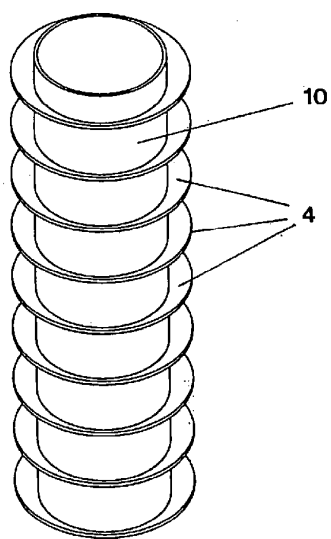


Fig. 2

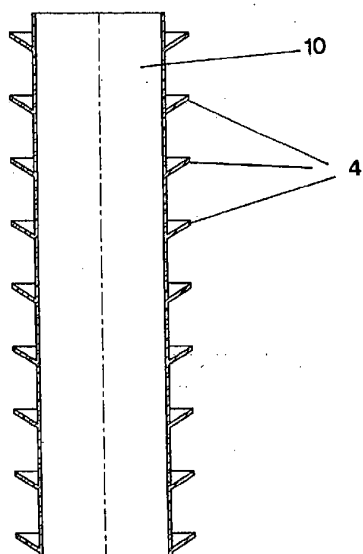


Fig. 3

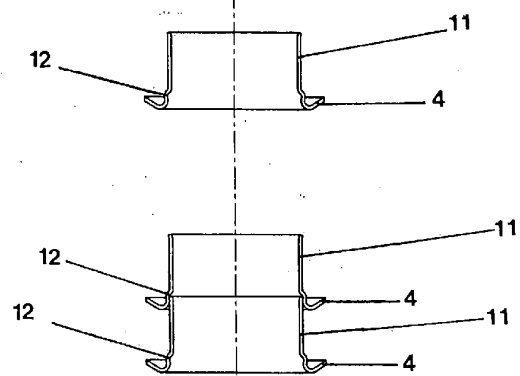


Fig. 4