

12

EUROPEAN PATENT APPLICATION

21 Application number: **87303199.1**

51 Int. Cl.4: **C 21 C 7/072**
F 27 D 3/16

22 Date of filing: **13.04.87**

30 Priority: **14.04.86 GB 8609063**

43 Date of publication of application:
21.10.87 Bulletin 87/43

84 Designated Contracting States:
BE DE FR IT LU NL

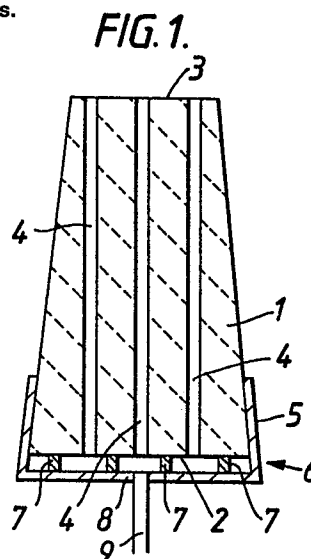
71 Applicant: **British Steel Corporation**
9 Albert Embankment
London SE1 7SN (GB)

72 Inventor: **Normanton, Adrian Stanton**
26 Roseberry Crescent Great Ayton
Middlesbrough Cleveland (GB)

74 Representative: **Heath, Peter William Murray**
FRY HEATH & CO. Seloduct House Station Road
Redhill Surrey RH1 1PD (GB)

54 Improvements in or relating to injection elements for melt containing vessels.

57 The invention provides a gas injection element for use in the side or base wall of a refractory lined melt containing vessel, comprising at least one refractory block (1) arranged in use to extend lengthwise through the vessel lining into the internal cavity thereof wherein a plurality of ceramic pipes (4) pass through bores in the refractory block (1) along the length thereof.



Description

IMPROVEMENTS IN OR RELATING TO INJECTION ELEMENTS FOR MELT CONTAINING VESSELS

This invention relates to gas injection elements for melt containing vessels, and particularly although not exclusively relates to gas-permeable elements mountable in the base or side walls of metallurgical vessels having a refractory material lining.

It is to be understood that whilst the expression "metallurgical vessel" is particularly intended to comprise a steel converter vessel or arc furnace, it also includes within its scope ladles for use in steel production, and indeed melt containing treatment vessels for non-ferrous metals.

It has been proposed that such a gas-permeable element for gas injection may comprise a refractory block, or a collection of refractory blocks having slots or holes cut, formed or provided therein. The arrangement in such cases is such that the refractory block or collection of blocks is mounted in the refractory lining of the vessel and connects through the base or side wall thereof with the slots or holes connected from outside the vessel through to the space within the vessel. A gas conduit from outside enables gas to be passed into the vessel so that a stirring or processing gas can be injected into a melt in the vessel. In relation to steel converter vessels, such gases usually are of a stirring nature to assist the conversion reactions.

A disadvantage of such refractory blocks is that it is difficult to produce the blocks with accurately formed holes or slots necessary for even and controllable gas injection. In addition such slotted or holed blocks, from the nature of refractories, have a significant surface roughness factor within the holes or slots through which the gas passes, so that there is a significant pressure drop along the length of the injection element, leading to the need to utilise relatively high gas injection pressure.

Such refractory blocks may be contained in a metal casing enclosing the sides of the block or blocks, however, such encasings are susceptible to oxidation and melting in use, particularly at the inner end thereof.

It has also been proposed to provide in refractory injection blocks of the above mentioned kind, metal pipes extending through the blocks of small diameter and used either spaced around or through the ceramic blocks. Alternatively metal pipes of a relatively large diameter (greater than 4mm for example) have been proposed as a single injection source.

Such metal pipes are prone to metal wetting leading to blockage problems, the formation of knurdles, unless operated at sonic gas flows, and to oxidation. The oxidation of such pipes renders them subject to very rapid wear of several millimeters per charge. The Knurdle formation is often brought about because of local excessive cooling due to the high conductivity of the metal pipes. Such formation of knurdles can in some circumstances close the pipes or at least impede the desired through-flow of gas. With large diameter pipes it is also necessary to ensure that an adequate quantity of gas is blown

through them at all times whenever a melt is in the vessel to prevent the melt flowing away through the pipes.

It is an object of the present invention to overcome or at least substantially reduce the above mentioned disadvantages.

According to one aspect of the present invention there is provided a gas injection element for use in the side or base wall of a refractory lined melt containing vessel, comprising at least one refractory block arranged in use to extend lengthwise through the vessel lining into the internal cavity thereof wherein a plurality of ceramic pipes pass through bores in the refractory block along the length thereof.

One end of the refractory block or blocks may be provided with a metal manifold box comprising a surrounding open topped container within which the block or blocks are seated and having means for separating the refractory block or blocks from the base of the container and having a gas injection conduit connected thereto. By this means gas for injection will enter the manifold box and then pass in parallel through the plurality of ceramic pipes.

The means for separating the block or blocks from the base of the container may be refractory or metal spacer members.

The refractory block or blocks may taper inwardly from the manifold box, so that in use it tapers towards the internal cavity of the melt vessel.

The ceramic pipes may be spaced across the block or blocks, or may be spaced around the outer periphery thereof.

In one embodiment of the invention a total of between 15 and 25 ceramic pipes may be set around the edge of a refractory block.

The block or blocks may be of generally rectangular section, and the pipes may be disposed along at least one edge of the block or blocks. Where a plurality of blocks are used the pipes may be disposed between at least two of the blocks.

The pipes may be of any convenient cross section. Thus they may be circular or oval in section, or may for example be in the form of an elongate slot in section.

It has been found that the use of ceramic pipes is advantageous in that they are less prone to wetting than metal pipes because of the different contact angle with steel for example, and that they will not oxidise and that knurdles cannot readily attach to the relatively smooth surface thereof. Again the required injection pressure can be less since the pressure drop along the element due to the relatively smooth surface of the internal bore of the ceramic pipes, is significantly lower.

The invention includes within its scope a melt containing vessel incorporating an insert member according to the invention.

The invention also includes within its scope a method of refining metal incorporating gas blown through an insert member according to the inven-

tion.

In order that the invention may be more readily understood one embodiment thereof will now be described by way of example with reference to the accompanying drawings in which:-

Figure 1 is a schematic sectional side elevation of an embodiment of the present invention;

Figure 2 is a top plan view of the element of Figure 1;

Figure 3 is a schematic sectional elevation of a steel converter incorporating an injection element according to the invention.

Referring now to Figures 1 and 2 of the drawings it will be seen that the gas injection element comprises a refractory block 1 of generally square section tapering from a gas injection end 2 to an outlet surface 3. Typically the block may be 800mm long, and have an outlet face 145mm by 99mm. The block may be formed of magnesia and carbon, possibly with anti-oxidant additions such as aluminium or silicon or magnesium or mixtures thereof, or may be a phosphate bonded castable magnesia.

The block is arranged in use to be seated within the lower wall of a steel converter vessel (not shown) with the outlet surface 3 generally in line with the inner wall of the lining of the vessel and extending at its inlet end 2 towards the outer side of the converter vessel.

As can be seen from Figure 2 most clearly a plurality (twenty in this case) of ceramic pipes 4 are set into the edge of the block extending from end to end thereof, the pipes 4 having been cast with the block during manufacture or inserted into prepared holes. Alternatively as shown in Figure 1 the ceramic pipes 4 may be disposed throughout the body of the block 1 extending from end to end thereof. The block tapers from its inlet end to its outlet. The ceramic pipes may be formed of alumina or zirconia for example.

At its inlet end the block is contained within the side walls 5 of a manifold box 6. It is to be noted that the side walls extend up the refractory block sufficiently to hold the block in position therewithin. The side walls however do not extend to the outlet end of the block and the hot fume therepresent which would otherwise lead to oxidation and melting of the walls.

The manifold box is provided with spacers 7 to separate the block from the base wall 8 of the box. An inlet for gas is provided by means of a conduit 9 welded to the base wall 8. In practice gas for injection is passed through the inlet conduit 9 into the manifold box 6 where it is dispersed and travels in parallel with equal speed and flow up each of the ceramic pipes 4.

The ceramic pipes may be of between 2 and 4mm internal diameter.

In one example, a typical block there may be disposed 24 pipes of 2.5mm internal diameter providing in use a gas flow of 250 m³/hr with a system pressure of approximately 12 bar.

In a second example, 40 pipes of 2.00mm internal diameter may be provided in a block, with the same gas flow in use and a system pressure of approxi-

mately 10 bar.

In a third example, 20 pipes of 3.00mm internal diameter may be used in a block, providing a gas flow of 400 m³/hr and using a system pressure of approximately 10 bar.

In Figure 3 can be seen a steel converter vessel 21 having an overhead refining lance 25 and a lining 22. In the base of the vessel are located injection elements 23 according to the invention, connected as shown at 24 to a source of stirring gas (not shown).

By means of the present invention we have provided an effective element of enhanced performance for the injection of gas into melt containing vessels.

Claims

1. A gas injection element for use in the side or base walls of a refractory lined melt containing vessel, comprising at least one refractory block arranged in use to extend lengthwise through the vessel lining into the internal cavity thereof wherein a plurality of ceramic pipes pass through bores in the refractory block along the length thereof.

2. An element as claimed in Claim 1 wherein one end of the refractory block or blocks is provided with a metal manifold box comprising a surrounding open topped container within which the block or blocks are seated and having means for separating the refractory block or blocks from the base of the container and having a gas injection conduit connected thereto.

3. An element as claimed in Claim 2 wherein the means for separating the block or blocks from the base of the container are refractory or metal spacer members.

4. An element as claimed in Claim 1, 2 or 3 wherein the refractory block or blocks tapers inwardly from the manifold box, so that in use it tapers towards the internal cavity of the melt vessel.

5. An element as claimed in any one of the preceding claims wherein the ceramic pipes are spaced across the block or blocks.

6. An element as claimed in any one of Claims 1 to 4 wherein the ceramic pipes are spaced around the outer periphery of the block or blocks.

7. An element as claimed in any one of Claims 1 to 4 wherein the block or blocks are of generally rectangular section, and the pipes are disposed along at least one edge of the block or blocks.

8. An element as claimed in any one of Claims 1 to 4 including a plurality of blocks and wherein the pipes are disposed between at least two blocks.

9. An element as claimed in any one of the preceding claims wherein the pipes are of circular cross-section.

10. A melt containing vessel incorporating a gas injection element as claimed in any one of the preceding claims.

5

10

15

20

25

30

35

40

45

50

55

60

65

4

FIG. 1.

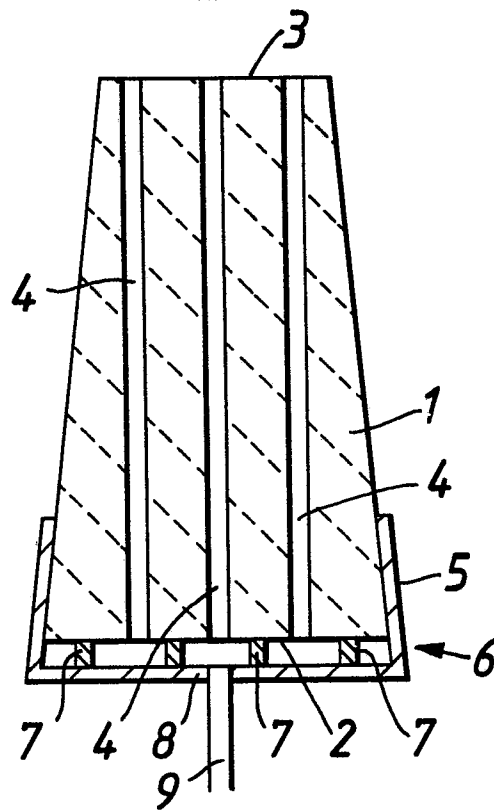


FIG. 2.

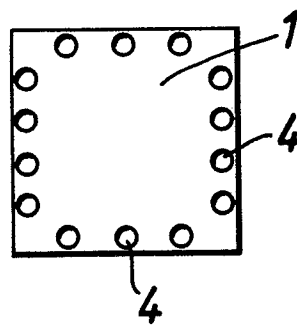
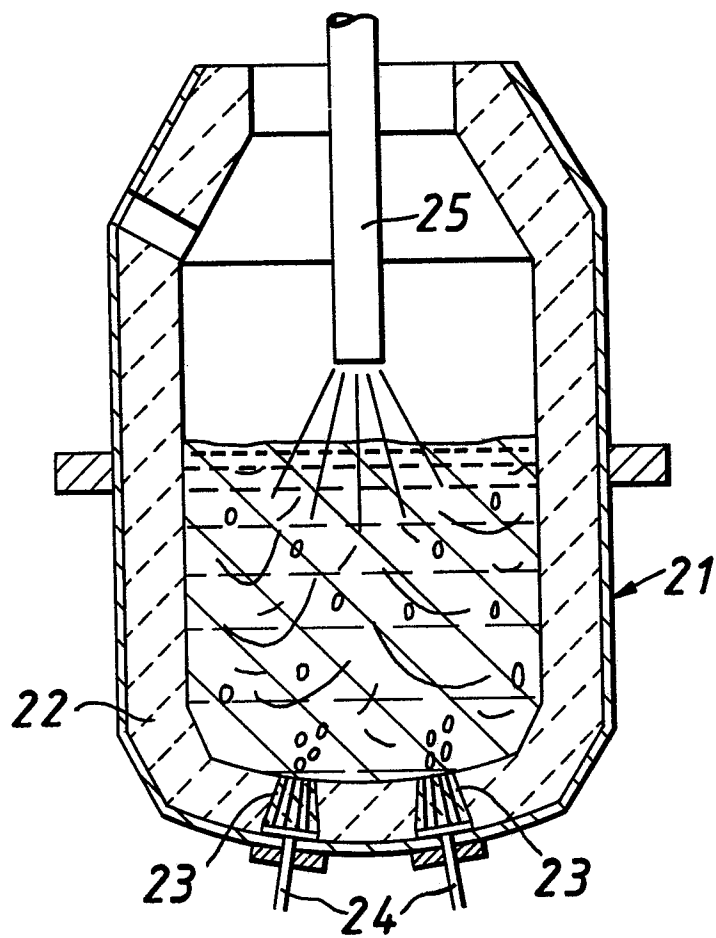


FIG. 3.





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	GB-A-2 120 369 (KSR INTERNATIONAL LTD) * Claims; page 1, lines 118-125; figures *	1,2,5, 7,9,10	C 21 C 7/072 F 27 D 3/16
X,P	GB-A-2 171 187 (DIDIER-WERKE AG) * Claims; figures *	1,4,9, 10	
A	DE-A-3 503 222 (DIDIER-WERKE) * Claims; figures *	2-4,10	
A	US-A-2 947 527 (E. SPIRE) * Claims; figures *	2-4,10	
A	PATENT ABSTRACTS OF JAPAN, vol. 9, no. 108 (C-280)[1831], 11th May 1985; & JP-A-60 2615 (NITSUSHIN SEIKOU K.K.) 08-01-1985	1,2,4, 10	TECHNICAL FIELDS SEARCHED (Int. Cl.4) F 27 D C 21 C
A	FR-A-2 507 208 (NIPPON KOKAN) * Claims; figures *	1-5,7, 9,10	
A	PATENT ABSTRACTS OF JAPAN, vol. 8, no. 52 (C-213)[1489], 9th March 1984; & JP-A-58 210 112 (SHIN NIPPON SEITETSKU K.K.) 07-12-1983		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 24-07-1987	Examiner COULOMB J.C.
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			



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	DE-A-2 719 829 (G. GAIL) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 24-07-1987	Examiner COULOMB J.C.
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	