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(12) # EUROPEAN PATENT APPLICATION

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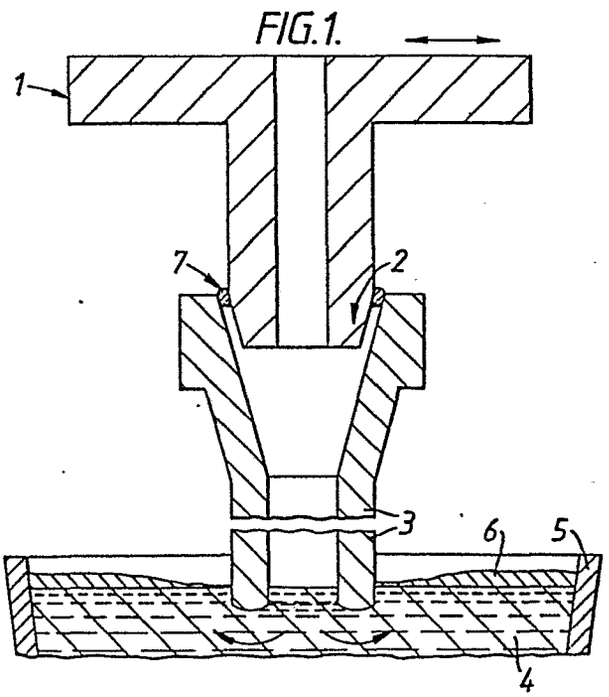
(54) **Metal teeming seals.**

(57) A seal at a junction between a refractory nozzle 2 dependent from a veseel containing a molten metal charge and a tubular shroud 3 for enveloping the molten metal during teeming, comprising a pliable ring gasket (7 or 8) sandwiched between the nozzle and the shroud, the gasket containing or consisting of a material designed to soften at the operating temperature experienced at said junction sufficient to assume a shape and attitude such as to seal any voids.

FIG.1.



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inhibiting the blockage of the tundish nozzles consequent hitherto on such oxidation. The use of inert gas envelopes is avoided.

Further, the seal can easily be broken at the end of casting one ladle and can be readily re-made on a second ladle to the existing shroud when sequencing casts, that is, discharging in sequence the contents of successive ladles moved into position over the tundish. In addition, because of its complaint mode, the seal maintains its integrity during the movement of the nozzle as the slide gate valve is opened and throttled etc during teeming, ie it adjusts to the positions and attitudes adopted during the stream flow control.

In order that the invention may be fully understood, two embodiments thereof will now be described with reference to the accompanying drawings, in which:

Figure 1 illustrates the general layout with one form of seal and

Figure 2 illustrates another form of seal

Referring now to Figure 1 there is shown only one relevent component of the sliding gate valve, namely the collector 1 having a tapered end 2 on its dependent nozzle.

Mounted beneath the collector nozzle is a flared tubular refractory shroud 3 and this is mounted and supported on a separate platform (not shown). The lower end of the shroud is immersed below the level of the molten steel 4 in the tundish 5, the surface of the steel being covered with a layer of insulating powder 6.The junction between the upper flared end of the shroud 3 and the collector 2 is sealed by an O-ring 7 which is sandwiched in place as the nozzle and shroud mate together. More particularly, this ring comprises a tubular casing of flame retardant or flame resistant

material enclosing within it a powdery composition of eg boric oxide and calcium/alumino silicate.

In operation, steel is teemed through the nozzle as it is moved into alignment with the ladle pour opening (not shown) and as the temperature of the junction rises consequent upon this the composition within the tubular casing of the o-ring softens and the whole assumes a shape and attitude to seal the junction and fill any voids.

The entrainment of air is inhibited and turbulence around the base of the shroud in the tundish is minimised so as not noticeably to disturb the insulation powder 6.

Restricted movement of the collector 1 is readily accommodated by the seal which acts in a self-sealing fashion under the circumstances. The tubular casing should simply be strong enough to withstand minor abrasion so as to retain the composition within it before volatilisation and may be formed from a plastics material e.g polyvinylchloride in the manner of a sausage skin or a plastics hose or even tough paper; each may be treated with sodium silicate for flame resistance.

Figure 2 shows an alternative form of seal in which a tapered ring gasket 8 of conventional design has a cementitious softenable composition 9, as above, layered on to its surface so that when compressed into position this surface layer completes a gas-impervious seal over the normally pervious gasket.

Although this invention has been described with reference to the specific embodiments illustrated, it is to be understood that various modifications may readily be made without departing from the scope of this invention. For example, the precise positioning of the seal is not critical so long as the junction is effectively closed and it is not essential for the collector and the shroud to have mating

tapers. Positioning of the seal may be facilitated by incorporating a protruding handle by which it can be manipulated from a distance. The dependent nozzle may not necessarily be a component of a slide gate valve.

Claims:-

1. A seal at a junction between a refractory nozzle dependent from a vessel containing a molten metal charge and a tubular shroud for enveloping the molten metal during teeming, characterised by a pliable ring gasket (7 or 8, 9) sandwiched between the nozzle and the shroud, the gasket containing or consisting of a material designed to soften at the operating temperature experienced at said junction sufficient to assume a shape and attitude such as to seal any voids.

2. A seal according to claim 1, characterised in that the gasket (7) is in the form of a circular tube of circular cross-section.

3. A seal according to claim 2, characterised in that the material is a powder composition (at normal room temperature) encased in a pliable flame retardant or flame resistant casing.

4. A seal according to claim 3, characterised in that the casing is a hose made of paper or a plastics material.

5. A seal according to claim 4, characterised in that the plastics material is polyvinylchloride.

6. A seal according to any one of the claims 1 to 5, characterised in that the ring gasket incorporates a protruding handle by which the gasket can be positioned from a remote site.

7. A seal according to claim 1, characterised in that the gasket comprises a compressible refractory body incorporating the said material in the form of a cementitious product.

8. A seal according to claim 1, characterised in that the gasket comprises a compressible refractory body (8) on the surface of which has been spread the said material in the form of a cementitious product (9).

9. A seal according to any one of the claims 1 to 8, characterised in that the said material is calcium or alumino silicate or lead glass.

10. A seal according to any one of the claims 1 to 9, characterised in that the said material incorporates boric acid as the softening agent.

surface. This in turn causes heat losses, and the build up of frozen steel around the exposed shroud metal interface.

It is an object of this invention to provide an air-tight seal, specifically at the junction of the shroud and collector nozzle.

From one aspect the present invention provides a seal at a junction between a refractory nozzle dependent from a vessel containing a molten metal charge and a tubular shroud for enveloping the molten metal during teeming, comprising a pliable ring gasket sandwiched between the nozzle and the shroud, the gasket containing or consisting of a material designed to soften at the operating temperature experienced at said junction sufficient to assume a shape and attitude such as to seal any voids.

Preferably the gasket is in the form of a circular tube of circular cross section, the material being a powder composition (at normal room temperature) encased in a flame resistant casing; the gasket is slipped onto the end of collector nozzle or into the inside of the flared mouth of the shroud.

Alternatively, the said material may be in the form of a cementitious product layered on the surface of a conventional compressible refractory gasket disposed as above or indeed the material may be incorporated as an inherent constituent of the gasket itself.

The said material may comprise calcium silicate or alumino silicate and embody boric oxide as the softening agent, or alternatively powdered lead glass or lead borax glass.

In accordance with this invention then, the design provides a very efficient seal against the ingress of air during teeming, minimising nitrogen pick-up and the oxidation of the steel in the tubular refractory shroud and effectively

This invention related to metal teeming seals and more particularly relates to sealing refractory components which are mounted in juxtaposition in teeming metal, eg steel, from a ladle to a tundish.

During continuous casting of steel, it is now common practice to teem the ladle stream through a slide gate valve into the tundish through a refractory tube (known as a shroud).

This reduces the reaction of the atmosphere with the ladle stream; minimises temperature fall from the steel and generally makes the casting environment more tolerable from the presence of flying droplets of steel.

This shroud is fitted on to the bottom of the dependent ladle nozzle just before the gate is opened. A form of gasket of sometimes used at the junction but although compressible it is still permeable. More frequently, the 'seal' is generally a simple surface contact between the refractory shroud and the nozzle but unless a perfect gas-tight seal is achieved, the flow of steel through this arrangement induces a suction effect exploiting any weakness in the seal, particularly since the internal diameter of the shroud is larger than the bore in the nozzle, the shroud acting as a mixing chamber promoting air entrainment. This results in the pick up of nitrogen, the oxidation of dissolved elements such as aluminium, and the entrapment of such oxides in the solidifying steel leading to an accumulation on the tundish/mould nozzle with the danger of an eventual blockage.

If an inert gas such as argon envelopes the head of the shroud and is allowed to be sucked in these problems are prevented, but since argon does not dissolve in steel, the release of this gas in the tundish can cause turbulence which drives away any insulation powder floating on the

inhibiting the blockage of the tundish nozzles consequent hitherto on such oxidation. The use of inert gas envelopes is avoided.

Further, the seal can easily be broken at the end of casting one ladle and can be readily re-made on a second ladle to the existing shroud when sequencing casts, that is, discharging in sequence the contents of successive ladles moved into position over the tundish. In addition, because of its complaint mode, the seal maintains its integrity during the movement of the nozzle as the slide gate valve is opened and throttled etc during teeming, ie it adjusts to the positions and attitudes adopted during the stream flow control.

In order that the invention may be fully understood, two embodiments thereof will now be described with reference to the accompanying drawings, in which:

Figure 1 illustrates the general layout with one form of seal and

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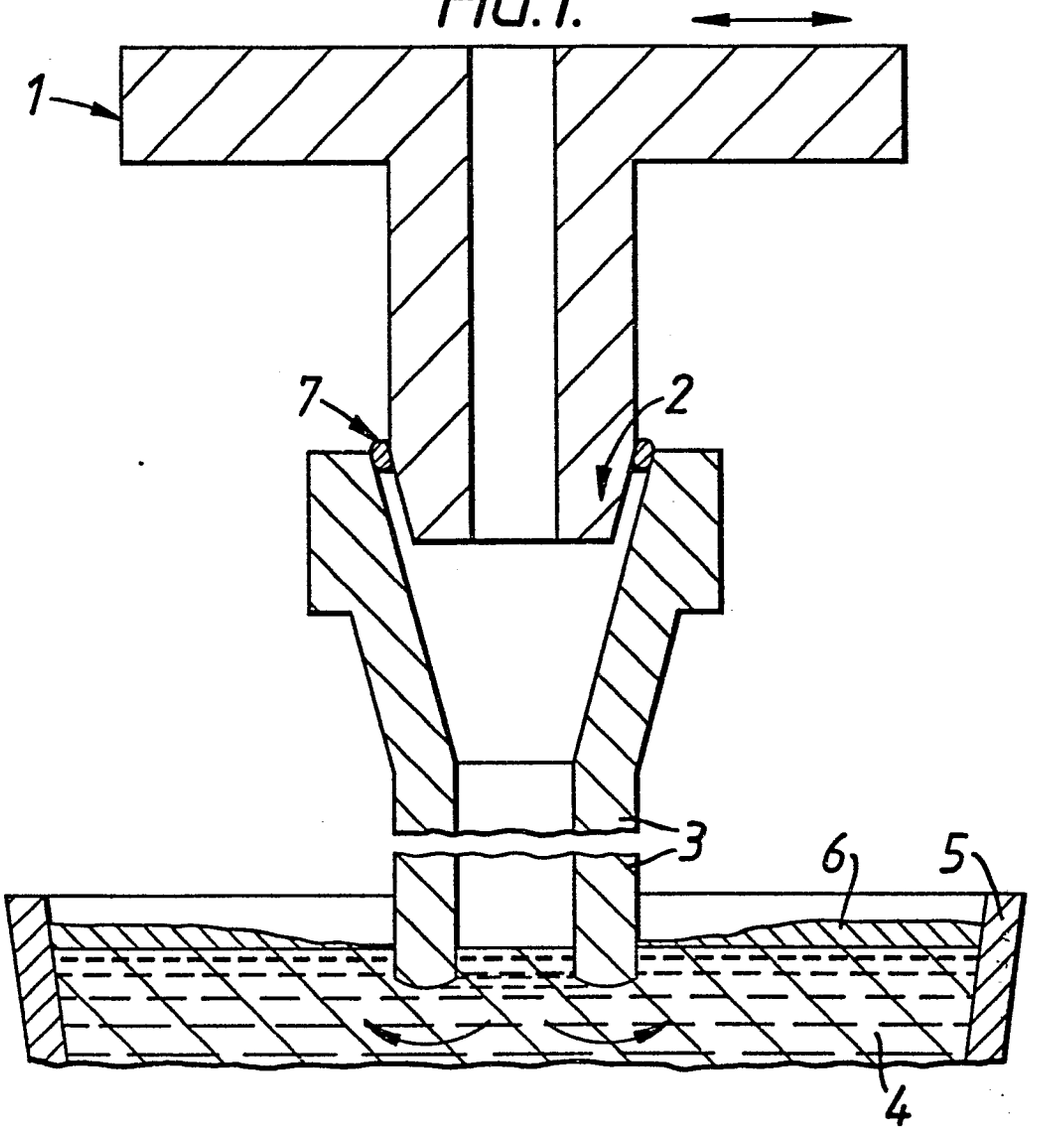
FIG.1.



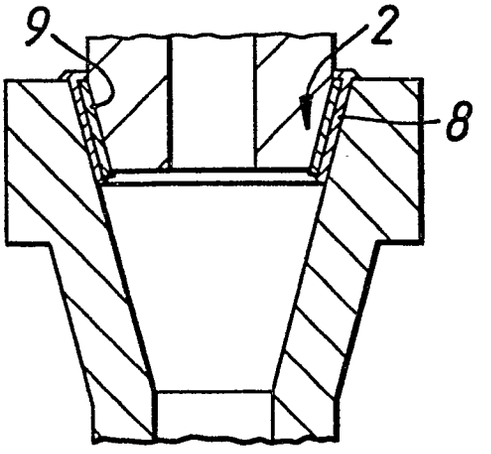


FIG.2.

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EUROPEAN SEARCH REPORT

0136733
Application number

EP 84 20 1089

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	US-A-3 877 675 (J.T. SHAPLAND) * Column 2, lines 19-41 *	4	B 22 D 11/10 B 22 D 41/08
A	DE-A-2 919 880 (DIDIER WERKE) * Claim 2 *	8,9	
A	US-A-4 165 026 (I.J. HAZLEHURST et al.) * Claim 1 *	1	
A	DE-A-2 625 742 (CENTRE DE RECHERCHES METALLURGIQUES) * Claims 1, 2 *	4,5	
A	DE-A-2 743 312 (DIDIER WERKE)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 22 D 11/00
B 22 D 41/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	06-11-1984	GOLDSCHMIDT G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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