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Description

This invention relates to refractory components and more particularly relates to refractory inserts for use in fixed or slidable plates in vessel equipment commonly known as slide gate valves in metal melting casting shops.

Briefly, slide gate valves are teeming control mechanisms for use on ladles/tundishes and essentially comprise two apertured plates, one fixed and in line with an aperture in the bottom of the vessel and the other slidably mounted beneath the fixed plate, the metal being discharged when the two apertures are aligned with one another. The plates are made from a refractory material and each abut other refractory nozzles, an upper nozzle mounted above the stationary plate and a lower or collector nozzle mounted below the sliding plate. In use the apertures (bores) are eroded by the hot metal and repairs are then effected to enable the components, particularly the more expensive fixed and sliding plates, to be re-used.

The use of pre-formed shapes inserted into used plates as a means of bore renovation is well known. Such inserts have been annular in cross-section, and have been fitted into a space produced by drilling out the worn section of the used plate around the original bore *e.g.* as typically depicted in DE—A—2820685. In the case of the sliding plate such drilling normally extends beyond the plate itself into the collector nozzle below it *e.g.* as depicted in GB—A—2081431, and the inserted cylinder is made to a height such that it extends from the newly formed surface in the body of the nozzle to the working face of the sliding plate. The surfaces between the base of the insert and nozzle, and between the vertical sides of the nozzle and the plate are bonded by a refractory cement. One disadvantage of such an arrangement is that vertical movement of the cylindrical insert can take place either during the use or during subsequent cooling of the system.

A second disadvantage is that the travel of the sliding plate during operation can frequently bring the cemented joint between the insert and plate across the bore in the stationary upper place, exposing the joint to molten metal, and thus promoting erosion.

A third disadvantage is that the wall thickness of the cylindrical insert is limited by the geometry of the sliding plate in some systems, thereby restricting the useful life of a repaired plate to the degree of bore erosion extending to the cemented joint.

It is an object of this invention to provide an improved refractory component to mitigate this problem.

This invention provides a refractory component for use in equipment in metal melt-holding vessels, comprising a parallel-faced elongated plate, a circular section apertured nozzle mounted on one surface thereof, and an apertured refractory insert having a parallel-faced elongated head of elliptical form sited in the plate and an integral stem of circular cross-section, the apertures in the insert and the nozzle being aligned with one another and lying coaxially with both the stem and the nozzle, characterised in that the stem protrudes into the nozzle thereby presenting a step-shaped insert-to-nozzle contact which inhibits the escape of molten metal along this route.

The major portion of the outer periphery of the component, other than the plain face on the other side of the plate, may be bounded by a metal casing, the whole forming a sliding plate/collector nozzle unit.

The length of the insert can be such as to exceed the longitudinal movement of the mechanism, thus removing the cement joint out of the range of metal attack and eliminating the second and third disadvantages of the cylindrical insert. Moreover, because of the increased mass of the insert, and its broad base, the chances of vertical movement are greatly reduced. In addition to mitigating the problems recited, the provision of the stem to protrude into the nozzle provides an additional advantage in the sense that it "bridges" what would otherwise be a plain joint between the plate and the nozzle.

It has traditionally been a weak point in the assembly of such components where the lower surface of the plate contacts the upper surface of the dependent collector nozzle. Given metal turbulence during operation, this horizontal avenue can provide a potential escape route for molten metal should the cemented joint be attacked or loosened, whereas with the stem protruding into the nozzle this route is made much more tortuous.

Consequently, the advantages of both the elongated and circular inserts are realised by this invention. In particular, the function of the elongated head is that of the flat elongated insert first recited while the cylindrical stem affords a secure attachment to the nozzle and introduces a step-shaped insert-to-nozzle contact which inhibits the escape of molten metal from the system. It may be convenient here to advise that a T-shaped insert per se is known for example GB—A—1322764 but this does not protrude into the collector nozzle and thus does not realise the advantage just recited.

Primarily, the insert would be used in repaired plates but it could alternatively be adopted in new or prime plates; after use the insert may readily be removed and a further one introduced thus avoiding the necessity for cutting and drilling.

The insert may not necessarily be pre-formed and the invention also comprises a modification of the various aspects referred to above in which the insert is a monolithic refractory rammed in situ and cured.

In order that the invention may be fully understood, an embodiment thereof will now be described by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows a plan view of a plain generally elliptical insert,

Figure 2 and 3 show plan and side elevations, respectively, of a T-shaped insert according to this invention, and

Figure 4 shows a side elevation of a sliding plate/collector nozzle component incorporating this latter insert.

Referring now to Figure 1 the insert comprises a moulded and fired refractory component of *e.g.* magnesia or high-purity alumina, shaped so as to define a plain parallel-faced generally elliptical body having a bore centrally disposed therethrough.

Referring now to Figures 2 and 3 the alternative form of insert comprises a moulded and fired T-shaped refractory component of *e.g.* magnesia or high-purity alumina, shaped so as to define a generally elliptical head portion 1 and a dependent circular section stem 2; a circular section bore 3 extends through this component.

Figure 4 shows the latter insert mounted in the sliding element of a slide gate valve comprising a generally elliptical parallel-sided plate 4 and a refractory collector nozzle 5 having a bore 6. These may be made from magnesite chrome. A metal casing 7 is provided around the bulk of this unit, and this may be bedded-in with a refractory cement 8.

In this example shown the insert is used as a repair in the sense that an elliptical shaped hollow is machined from the plate 4 to the dimension of the head portion 1 of the insert and a circular section hole is drilled in the upper portion of the nozzle 5 to the dimensions of the stem 2. The insert is then cemented into position as shown and the through bore is made up to a smooth contour by cement 9. The exposed upper face of the component is then ground to present a flat uniform surface.

Whereas the above description relates to a fixed moulded insert the repair may equally well be effected by ramming a refractory cement into the T-shaped hollow, a circular spigot being positioned in the central bore. A typical ramming mix which might be used may be alumina containing a chemical bonding agent such as phosphate, the cement then being cured at *e.g.* 350°C and the plate ground as before.

The insert may be replaced more than once, whether it be from a repair (as shown) or from a prime component incorporating an insert.

Although the invention has been described with reference to the particular embodiment illustrated, it is to be understood that various modifications may readily be made without departing from the scope of this invention as defined by the attached claims. For example, the insert may be differently dimensioned and shaped consistent with the T-shaped concept and different materials may be utilised. In addition, the insert may be used for the repair of the fixed plates/upper nozzles in slide gate valves.

Claims

1. A refractory component for use in equipment in metal melt-holding vessels, comprising a parallel-faced elongated plate (4), a circular-section apertured nozzle (5) mounted on one surface thereof, and an apertured refractory insert (1) having a parallel-faced elongated head of elliptical form sited in the plate and an integral stem (2) of circular cross-section, the apertures in the insert (1) and the nozzle (5) being aligned with one another and lying coaxially with both the stem (2) and the nozzle (5), characterised in that the stem (2) protrudes into the nozzle thereby presenting a step shaped insert-to-nozzle contact which inhibits the escape of molten metal along this route.

2. A refractory component according to claim 1 or claim 2 characterised in that the insert is a moulded and fired pre-formed item.

3. A refractory component according to any one of claims 1 to 3 characterised in that the insert is a monolithic refractory mix rammed in situ and cured.

4. A refractory component according to any one of claims 1 to 4 characterised in that the major portion of the outer periphery of the component, other than the plain face of the surface of the said plate and the adjoining head, is bounded by a metal casing (7), the whole forming a sliding plate/collector nozzle unit of a slide gate valve.

Revendications

1. Pièce réfractaire utilisable pour l'équipement de récipients de métal en fusion, comprenant une plaque oblongue (4) à faces parallèles, une busette (5) de section circulaire, munie d'un orifice et montée sur un côté de la plaque, et un élément rapporté réfractaire (1) muni d'un orifice, élément qui présente une tête oblongue à faces parallèles, en forme d'ellipse et montée dans la plaque, et un fût (2) de section circulaire et solidaire de la tête, les orifices prévus dans l'élément rapporté (1) et dans la busette (5) étant alignés les uns avec les autres et étant coaxiaux avec le fût (2) et la busette (5), caractérisée en ce que le fût (2) fait saillie dans la busette, réalisant ainsi un contact à gradin entre l'élément rapporté et la busette, qui empêche la fuite du flux de métal en fusion.

2. Pièce réfractaire selon la revendication 1, caractérisée en ce que l'élément rapporté est une pièce moulée et préformée à chaud.

3. Pièce réfractaire selon la revendication 1 ou la revendication 2, caractérisée en ce que l'élément rapporté est un mélange réfractaire monolithique damé en place et durci.

4. Pièce réfractaire selon l'une quelconque des revendications 1 à 3, caractérisée en ce que la majeure partie de la périphérie extérieure de la pièce réfractaire — à l'exception de la surface plane de ladite plaque et de la tête contiguë — est entourée d'une enveloppe métallique (7), le tout formant l'ensemble busette collectrice/plaque coulissante d'une vanne à tiroir.

Patentansprüche

1. Feuerfestbestandteil für die Ausrüstung von Warmhaltebehältern für Metallschmelzen, bestehend aus einer planparallelen, langgestreckten Platte, einer auf der einen Plattenseite montierten Lochdüse mit kreisrundem Querschnitt und einem feuerfesten, gelochten Einsatz mit einem in der Platte angeordneten planparallelen Kopf von elliptischer Form und einem angeformten Ansatz mit kreisrundem Querschnitt, wobei die Lochungen des Einsatzes und der Düse miteinander fluchten und koaxial mit dem Ansatz und der Düse verlaufen, dadurch gekennzeichnet, daß der Ansatz (2) in die Düse (5) hineinragt und dadurch ein stufenförmiger Kontakt zwischen Einsatz und Düse erzielbar ist, wodurch ein Entweichen von Metallschmelze längs dieses Weges blockierbar ist.

2. Feuerfestbestandteil nach Anspruch 1, dadurch gekennzeichnet, daß der Einsatz (1) ein vorgeformtes und gebranntes Teil ist.

3. Feuerfestbestandteil nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Einsatz (1) aus einem an Ort und Stelle eingestampften und erhärteten monolithischen feuerfesten Gemisch besteht.

4. Feuerfestbestandteil nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß der Hauptteil des Außenumfanges des Bauteiles bis auf die glatte Oberseite der Platte und des anliegenden Kopfes von einer metallischen Umhüllung (7) umschlossen ist und das Ganze ein Schieberplatten-Sammel-düsen-Gebilde eines Schieberventils bildet.

FIG.1.

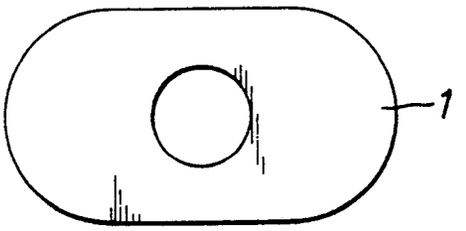

FIG.2.

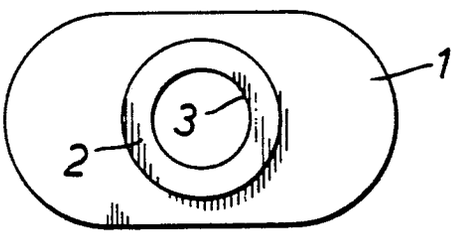

FIG.3.

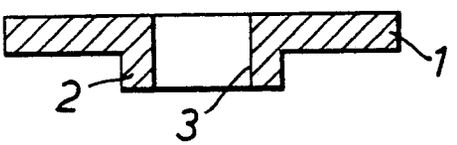

FIG.4.