CONTAINERS WITH SLIDING VALVE
FOR LIQUID SMELT

Inventor: Hans-Joachim Kutzer, Wiesbaden-Rambach, Germany

Assignee: Didier-Werke A.G., Wiesbaden, Germany

Filed: July 24, 1970

Appl. No.: 57,979

Foreign Application Priority Data
July 26, 1969 Germany

U.S. Cl. 266/38, 222/561, 266/34 PP
Int. Cl. C21b 7/14
Field of Search 75/49; 222/561; 266/34 PP, 38

References Cited

UNITED STATES PATENTS
3,337,329 8/1967 Fink 75/49
2,943,370 7/1960 Marasheed 266/38 X
3,253,307 5/1966 Griffiths et al. 222/561 X

ABSTRACT
A container has a sliding valve for a liquid smelt. A refractory block with an insert is set in the bottom of the container. An orifice plate of refractory material is connected to the block and has a flow passage, and a valve plate having a flow passage for the smelt is located therebelow. A support on the bottom of the container on which the valve plate slides provides a sealing action upon being linearly and rotatively displaceable in relation to the orifice plate. An outflow and a driving device is combined with the valve plate. A refractory body is set in a bore in the orifice plate and has means to feed an inert gas into the smelt.

6 Claims, 1 Drawing Figure
CONTAINERS WITH SLIDING VALVE FOR LIQUID SMELT

The invention refers to a container for liquid smelt provided with a sliding valve for regulating the quantity discharged and for completely shutting off the discharge outlet, particularly for use in pouring ladles containing liquid metallic smelt in the metallurgical industry, as for instance when pouring steel.

Such containers, particularly pouring ladles for melted metal, are lined with refractory material. In the container bottom there is a refractory block with an outlet insert and a channel which extends downward through an orifice plate made of refractory material. The channel cooperates with the flow passage of a valve plate located at the underside of the fixed orifice plate. The valve plate is displaceable and is made of refractory material for regulating the quantity of smelt discharged and for completely shutting off this discharge. The valve plate can be set so that it either moves linearly or rotatively with respect to the orifice plate which is essentially a matter of construction and drive.

The unavoidable temperature fluctuations to which the parts of refractory material which come into contact with the liquid smelt are exposed, not only require the highest quality, particularly concerning the stability of the refractory material which is exposed to temperature fluctuations, but often also leads to considerable temperature drops inside some individual parts, which can cause many difficulties. One of the difficulties can be the well known phenomenon of "freezing" of the liquid smelt in the sealing area of the valve plate, as soon as the sliding valve is completely closed after pouring and remains in its closed position for some time. The temperature drop which extends from the flow passage of the valve plate in the direction of the sealing surface of the valve plate as compared to the temperature of the smelt, causes a relative cooling of the valve plate in the area of its sealing surface, causes this "freezing" of the liquid smelt around the valve plate. Difficulties arise when the valve plate has to be opened again for another pouring, which often has to be done by burning with an oxygen blast and thus decreases the reliability of the sliding valve.

An object of the invention is to avoid such disadvantages and prevent a "freezing" of the liquid smelt when the sliding valve is in a closed position.

A further object is to provide a container with a sliding valve which has a body permeable to gas made of refractory material set in the flow passage of the orifice plate, through which, preferably in a closed position of the sliding valve, an inert gas, for instance, argon or nitrogen is supplied to the smelt. This causes the prima crystallization processes (freezing) to be disturbed due to the heat flow acting as the closing down of the heat flow at the time of the closing of the sliding valve, whereby the crystal nuclei which begin to form, are washed away by the inert gas into the overheated smelt. The "freezing" of the smelt in the flow passage of the orifice plate up to the insert can thus be avoided. The crystal nuclei, which are specifically heavier, through the upthrust of the inert gas bubbles into the overheated smelt, are homogenized at the same time. Actually the feeding of inert gas causes a regular temperature distribution over the total height of the smelt in the container, starting from the orifice plate, so that the usually relatively colder smelt layer in the area of the container bottom shows a higher temperature.

A further object of the invention is to provide a ring jacket as the body which is permeable to gas which is set into the orifice, plate, whereby its axial bore forms the flow passage of the orifice plate, which in an open position of the slide coincides axially with the flow passage of the slide valve. The outer surface of the ring jacket facing the valve plate converges downwardly, whereby a good fit of the ring jacket in the orifice plate against the pressure of the outflowing smelt is provided. The ring jacket may also include in its height and shape, the insert inside the refractory block, in order to adapt itself to the existing weight of the charge.

A further object is to provide the feeding of the inert gas through a bore extending radially through the orifice plate, which leads to the ring jacket and which has an outside connection piece.

A still further object in addition to definitely preventing the "freezing," is to achieve a homogenization and degasification of the smelt as well as an uplift of the deoxidation and segregation products.

With the above and other objects in view which will become apparent from the detailed description below, a preferred embodiment of the invention is shown in the drawing in which:

The FIGURE shows a partial representation of the lower part of a pouring ladle with a sliding valve in a longitudinal section.

The metal jacket 1 of the pouring ladle has refractory lining 2 covering the outer wall and the bottom. Metal jacket 1 and refractory lining 2 are perforated on one spot of the bottom of the ladle for the outflow of the liquid smelt. Positioned in the perforation is a rectangular refractory block 3 with a funnel-shaped inlet hole 3' and an opening which diverges downwardly therefrom. An outlet insert 4 of refractory material is fastened with a correspondingly refractory cement within the opening.

The sliding valve is composed essentially of a cast iron housing plate 5 with a cast iron lid 5' which can be removed, the housing plate being screwed onto the jacket 1 on the bottom of the ladle (not shown). An orifice plate 6 of refractory material which has a borehole in the middle and is fastened axially below the insert 4 and the block 1. A cast iron supporting body 7 has a spout 7', and supports a valve plate 8 provided with a flow passage and having an outflow jacket 9 connected to the bottom thereof. Plate 8 and jacket 9 are made of refractory material, and set in a refractory cement. A number of expansion bolts 10 hinged to the housing plate over spring elements 11 of the plate through nuts 12 secure the valve plate 8 together with the supporting body 7 and the outflow jacket 9 slidingly and sealing against orifice plate 6.

The supporting body 7 which carries the valve plate 8 and the outflow jacket 9 has cam grooves therein which slide on guideways 5' on lid 5'. A hydraulic drive by 13 engages the supporting body so that the latter can be linearly displaced.

A jacket shaped gas sink 14 made of a porous refractory material, i.e., Mullit, is positioned, before the orifice plate is fastened, into the borehole which is in the middle of orifice plate 6 with a refractory putty which has also a Mullit base. An inert gas, i.e., argon or
nitrogen is fed into sink 14 through a radial bore 6' in the orifice plate (vertical to the drawing surface, dotted). The inside diameter of the gas sink 14 coincides and aligns axially with the flow conduit of the insert 4. The inert gas can be fed in any position of the valve plate to the gas sink. Its feeding with a closed sliding valve prevents the "freezing" of the smelt in the area of the orifice plate and of the sliding and sealing surface of the valve plate. Furthermore, feeding of the gas all in valve plate positions contributes to the homogenization and degasification of the smelt and produces a good uplift of the deoxidation and segregation products. The height of the ring of cleansing gas can be varied in relation to the height of the smelt for instance it can stretch over the total height of the block 1.

I claim:
1. A container for a liquid melt and having a slide valve, said container comprising:
   a refractory block having an opening therethrough;
   an outlet insert of refractory material positioned in said opening, said insert having a flow passage therethrough;
   an orifice plate having an orifice therethrough attached to said block;
   a valve plate having a flow passage therethrough;
   support means for pressing said valve plate sealingly against said orifice plate and including means for allowing said valve plate to be slidingly movable against said orifice plate;
   outflow jacket means attached to said valve plate and having a flow passage aligned with said flow passage of said valve plate;
   driving means operatively connected to said valve plate for selectively moving said valve plate from an open position wherein said flow passage of said valve plate aligns with said flow passage of said insert and said orifice of said orifice plate, to a closed position wherein such alignment is blocked;
   a porous refractory body positioned in said orifice of said orifice plate, and
   means extending to said porous body for feeding inert gas thereto, whereby said inert gas passes through said porous body.

2. A container as claimed in claim 1, wherein said porous body comprises a ring-shaped jacket having a flow passage therethrough, said flow passage aligning with said flow passage in said insert.

3. A container as claimed in claim 2, wherein the outer surface of said ring-shaped jacket converges downwardly.

4. A container as claimed in claim 2, wherein said means for feeding an inert gas comprises a bore extending radially through said orifice plate to the outer surface of said ring-shaped jacket.

5. A container as claimed in claim 1, wherein said inert gas is argon.

6. A container as claimed in claim 1, wherein said inert gas is nitrogen.