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[21] Appl No. **849,046**
[22] Filed **Aug. 11, 1969**
[45] Patented **June 1, 1971**
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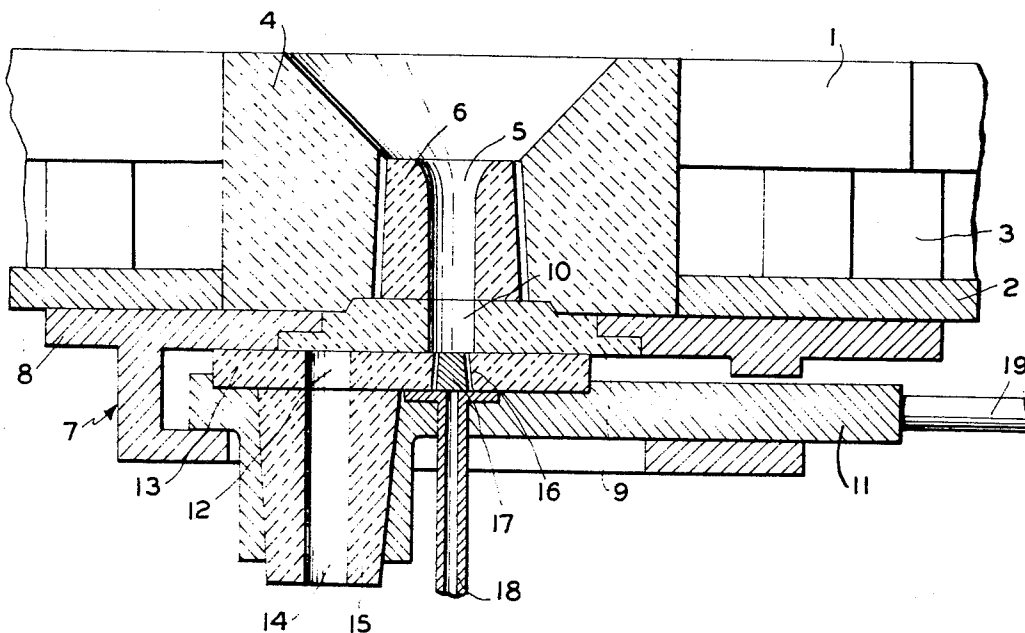
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[54] **SLIDING GATE OF A CASTING LADLE FOR
POURING LIQUID METALS**
8 Claims, 4 Drawing Figs.

[52] U.S. Cl. 222/148,
164/281, 164/337, 222/561, 266/34PP, 266/42
[51] Int. Cl. B67d 1/08
[50] Field of Search 222/484,
559, 561, 146, 1, 148; 266/34 PP, 38, 42; 13/33;
164/136, 281, 337

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ABSTRACT: A sliding gate for a casting ladle provided with a bottom lip, for pouring liquid metals, particularly steel, composed of a fireproof plate provided with an aperture to be firmly set under the bottom of the ladle by means of a metal frame piece, and a further refractory shutter plate provided with an outlet, set on a metal sliding piece which slides on the first plate and is slidably set in the rigid frame piece. A sliding shutter is provided with an installation which will allow the prevention and/or the elimination of the solidification of the melt in the discharge canal of the casting ladle, particularly in the aperture of the firmly set plate of the sliding shutter.



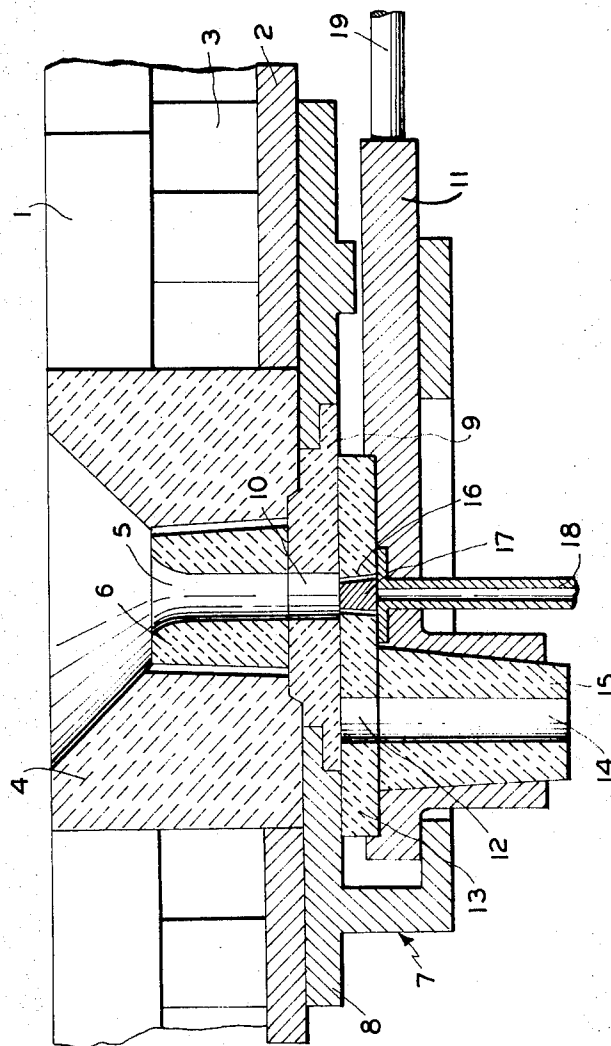


FIG. 1

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FIG. 2

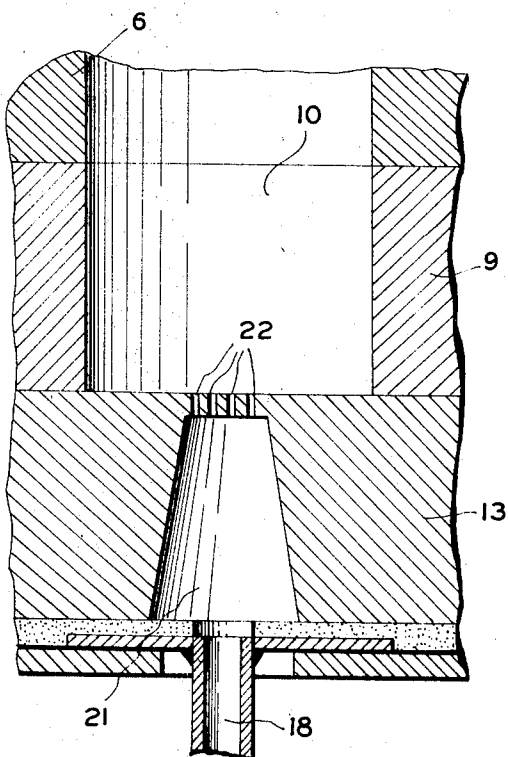
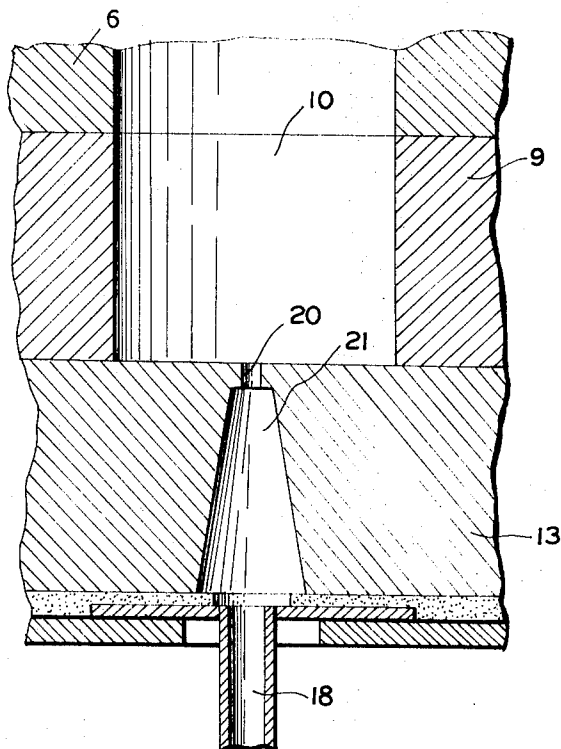


FIG. 3

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SLIDING GATE OF A CASTING LADLE FOR POURING LIQUID METALS

The invention relates to a sliding gate for a casting ladle or similar container, provided with a bottom lip, for pouring liquid metals, particularly steel, said gate comprising a fireproof plate provided with an aperture to be firmly set under the bottom of the ladle by means of a metal frame piece, and a further refractory shutter plate provided with an outlet, set on a metal sliding piece which slides on the first plate and is slidably set in the rigid frame piece.

The usage of sliding gate on casting ladles is particularly useful for the pouring of metals, especially steel, as compared to the currently used and known stopping mechanisms of pouring containers which comprise stoppers and stopper rods. The installation of sliding plugs on casting containers is of great advantage in case of special procedures as for instance when casting in vacuum and continuous casting, because in this case there are not any operating mechanisms leading out from the casting container to manipulate the stopper rod and the stopper. Nor is there any damaging effect of the high temperatures, as is desirable in present day casting procedures, upon the tightness of the sliding gate, as is the case in stopping systems comprising a stopper rod and a stopper, which cannot resist the current present day high temperatures and which cannot provide in such case a tight stopping of the casting ladle. Furthermore the customary stopper rods are exposed to the chemical corrosive action of the slag, which does not occur with sliding gate.

It has been proven when using sliding gate on casting ladles, that the steel around the aperture of the nonsliding fireproof plates solidifies very quickly, which means that out of the sliding stopper, which after the filling of a mould has been closed and is opened again for the filling of the next mould, no steel can flow out. The solidification of the melt is caused by the excessive heat dissipation which the melt suffers because of the refractory materials used for the plate and the stopping plate of the sliding stopper. These materials in order to be especially wear-resistant, have to be not only highly refractory but also very dense. These materials are at the same time good heat conductors, which causes the above-mentioned shortcomings.

Until now, when such difficulties occurred oxygen was blown into the passage canal to free it, so that by burning the metal the temperature would rise enough to reestablish the melt flow. This method presents many inconveniences, because the burning with oxygen can only be done when the sliding shutter is entirely opened, that is to say, when the aperture of the firmly set plate and that of the sliding plate are aligned exactly axially. Which means that after the burning up, the whole casting jet flows immediately out, thus producing great losses of steel and the danger of accidental burning with liquid steel becomes unbearable. Oxygen burning with only a partially open sliding shutter is not possible, because the edges of the passages on both plates become damaged and make the shutter inoperative.

An object of the invention is to manufacture a sliding shutter of the above-mentioned type, provided with an installation which will allow the prevention and/or the elimination of the solidification of the melt in the discharge canal of the casting ladle, particularly in the aperture of the firmly set plate of the sliding shutter.

A further object of the invention consists in that in the shutter plate next to the aperture there is at least one boring, which when the sliding shutter is closed is located under the aperture of the firmly set plate and with a gas supply line positioned at its lower end.

A further object of the invention is to prevent the solidification of the liquid melted metal column resting above the shutter plate and also to recondition back into a casting condition of the already solidifying melt by forcing gas through the borehole.

A still further object is to provide a construction wherein into the borehole a gas permeable plug can be set in firmly which should be resistant to the liquid metal and should be refractory. It is advantageous that this plug should have a conical

cal shape with the broadside toward the gas supply, in order to prevent the rising up of this plug into the melt because of the gas pressure. The gas is supplied under such pressure that it allows overcoming the static pressure over the gas permeable plug, so that due to the streaming gas, the liquid metal is pushed to a turbulent current above the gas permeable plug. This allows the hotter parts of the melt during the circulation to come into the area of the bottom casting lip and the aperture of the refractory plate. Inert gases, for example argon, nitrogen, etc. which may also be heated are used in the application of these measures. Obviously also air or oxygen can be used, because the burning takes place now when the shutter is closed. It can further be noted that the above-mentioned danger of accident diminishes considerably. It may be advantageous, instead of a gas permeable plug, such as a refractory plug provided with capillary tubes and/or pores, to use in the shutter plate a plug with one or several boreholes. It can also be advantageous to make one or several perforations in the shutter plate, where gases are then forced through.

With the above and other objects in view which will become apparent from the detailed description below, some modifications of the invention are shown in the drawings, in which:

FIG. 1 is a first longitudinal cross-sectional view of a sliding shutter according to the invention, and

FIGS. 2 to 4 enlarged cross sections of modifications of the sliding shutter according to FIG. 1.

In all the drawings the same reference numbers designate the same parts.

The casting ladle 1 shown in FIG. 1 has, as is customary, a bottom 2 of iron or steel plate. The inside of the casting ladle 1 is covered with a refractory material 3. In the refractory covering material 3, bedstone 4 is installed, into which runout stone 6 provided with a discharge canal 5 are set.

Under the bottom 2 there has been installed the sliding shutter 7. The sliding shutter 7 is composed of a metal frame piece 8 which is firmly connected with the bottom 2 of the casting ladle 1, and which also holds immovably the plate 9 of highly refractory material provided with an aperture 10, so that runout canal 5 of runout stone 6 and aperture 10 of plate 9 are axially aligned with each other.

The metal frame piece 8 holds and has slidably set into it metal slider 11. The metal slider 11 carries shutter plate 13 provided with an aperture 12 which lies against the underside of the plate 9 and which can be displaced according to the displacement of metal slider 11 in relation to plate 9. The metal slider 11 also carries spout 15 with passage 14 located under sliding plate 13, and the passage aperture 12 of shutter plate 13 and passage 14 of spout 15 are axially aligned.

In shutter plate 13 there is an additional boring 16. Boring 16 is made at such a distance to the runout aperture 12 in the shutter plate 13, that when the metal slide 11 and with it shutter plate 13 are in a closed position, boring 16 is located under the runout aperture of the firmly set plate 9.

Into boring 16 is firmly set a stone 17 made of gas permeable and refractory material. This stone 17 should have a conical shape upwards with its broad base on the gas supply line 18, in order to avoid the rising of the stone under gas pressure into the melt. A gas supply line 18 discharges onto the lower transverse plane of stone 17. The gas supply line 18 is firmly connected with metal slide 11 and leads to a container of gas under pressure (not shown). The metal slide can be actuated with a hydraulic or other adequate drive 19, whereby the switching on and off of the gas under pressure can be combined herewith. There is no possibility of clogging of the capillary and pores of the gas permeable stone 17 because the gas is led in only until the filtering stone 17 is taken out from the boring of the plate.

FIG. 2 shows only a part of the firmly set plate 9 and a part of the movably placed shutter plate 13 of the shutter 7.

In plate 13 there is a boring 20 and a recess 21, which when the slide is closed, is located under the aperture 10 of plate 9. The gas supply line discharges under recess 21, and from there the gas enters the melt through boring 20. Recess 21 tapers off

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streamlined from the gas inlet spot to boring 20. Boring 20 should have a diameter up to 2 mm. and a length of more than 5 mm., whereas recess 21 depends on its length on boring 20 and the strength of plate 13 and should show at the gas inlet spot a clear diameter of more than 10 mm. Recess 21 can have on the gas inlet spot also other shapes, for instance an oval or rectangular shape.

For the gas not to have an opportunity to go uncontrolled from recess 21 into plate 13 and from there into the open air, the inside wall of recess 21 can be covered with a refractory layer which is highly gas permeable or impermeable.

If argon or nitrogen, that is to say inert gases are blown in, then the quantity of gas has to be measured in such a way that on one hand the circulation of the hot metal is guaranteed and on the other hand the cooling of said metal is avoided. It is preferable to use relatively small quantities at high entrance speed.

In order to adapt the gas pressure to all static pressures, well-known pressure regulation means are used to control the pressure of the gas.

FIG. 3 shows of shutter 7 only a part of the firmly set plate 9 and of the movable shutter plate 13. In plate 13 there are several borings 22 and a recess 21', which when the slide is closed are located under aperture 10 of plate 9.

FIG. 4 shows, like FIGS. 2 and 3 only part of the firmly set plate 9 and of the movable shutter plate 13. In shutter plate 13 there are several borings 23, which when the slide is closed are located under the aperture 10 of plate 9.

I claim:

1. Sliding gate for a casting ladle or similar container, provided with a bottom lip, for pouring liquid metals, particularly steel, comprising a rigid metal frame piece 8 under the bottom

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of the ladle; a fireproof plate 9 provided with an aperture firmly set in said frame piece; a sliding piece 11 under said fireproof plate, slidably set in said frame piece and having a pair of spaced apertures; a refractory shutter plate 13 having an outlet 12 cooperating with one of said apertures of the sliding piece, and being supported on said sliding piece 11, said shutter plate 13 having adjacent said outlet 12 at least one boring 16 cooperating with the other of said apertures of said sliding piece and having shutter means 17 under said aperture 10 of said fireproof plate whereby a gas supply line may discharge onto the lower end of said boring.

2. Sliding gate according to claim 1 wherein said shutter means is a gas permeable plug set into said boring 16.

3. Sliding gate according to claim 2 wherein said plug is a stone made of a gas permeable and refractory material.

4. Sliding gate according to claim 2 wherein said boring 16 and said plug taper off upwards conically.

5. Sliding gate according to claim 1 wherein at least the upper end of said boring 16 has a smaller cross section than said aperture 10 of said fireproof plate.

6. Sliding gate according to claim 2 wherein the operative cross section of said plug is smaller on its upper end than that of said aperture 10.

7. Sliding gate according to claim 2 wherein said plug is made of a gas permeable material which does not react with the liquid metal.

8. Sliding gate according to claim 1 wherein a plurality of borings are provided which when said shutter means is closed cover part of said aperture 10 of said fireproof plate and are connected with a common gas supply line.

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