United States Patent

Cessna

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[54] **SLIDING GATE VALVE HAVING SPRING BIASED SLIDE**

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[52] **U.S. Cl.**.....**222/504,** 222/561

[51] **Int. Cl.**.....**B22d 37/00**

[58] **Field of Search**.....222/504, 559, 561, DIG. 7

[56] **References Cited**

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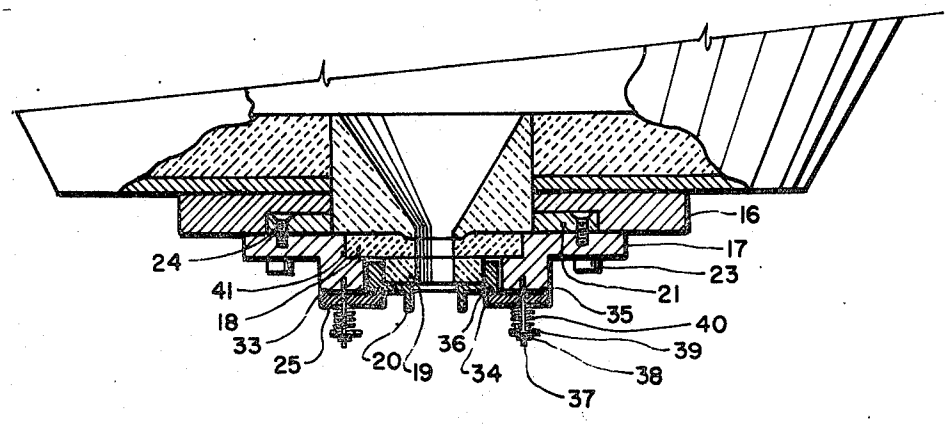
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[57] **ABSTRACT**

A sliding gate valve for a pouring ladle comprises a bottom plate, a gate assembly connected thereto and an extensible means to operate the gate. The gate assembly includes a stationary refractory plate and a slidable refractory plate having at least two aligned openings. The slide plate is held in a metal slide and tension is maintained in the system by means of adjustable tension plates cooperating with a mounting plate at one end and the metal slide at the other.

7 Claims, 3 Drawing Figures



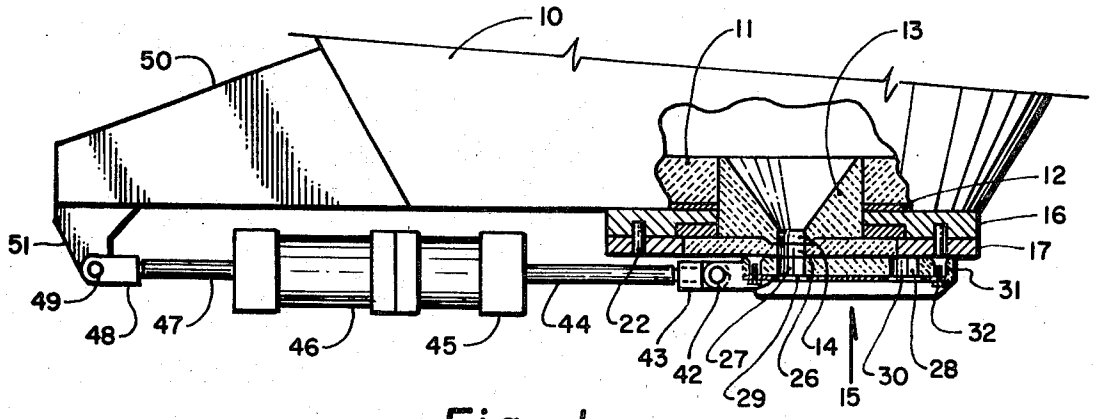


Fig. 1

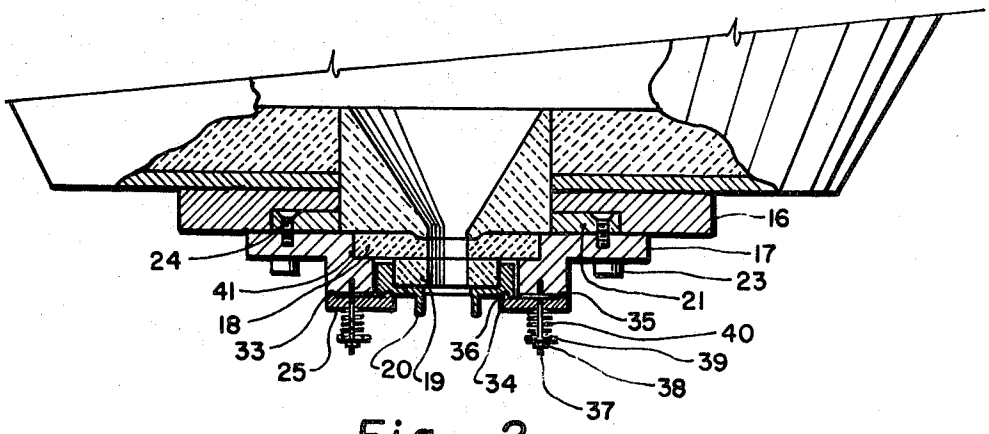


Fig. 2

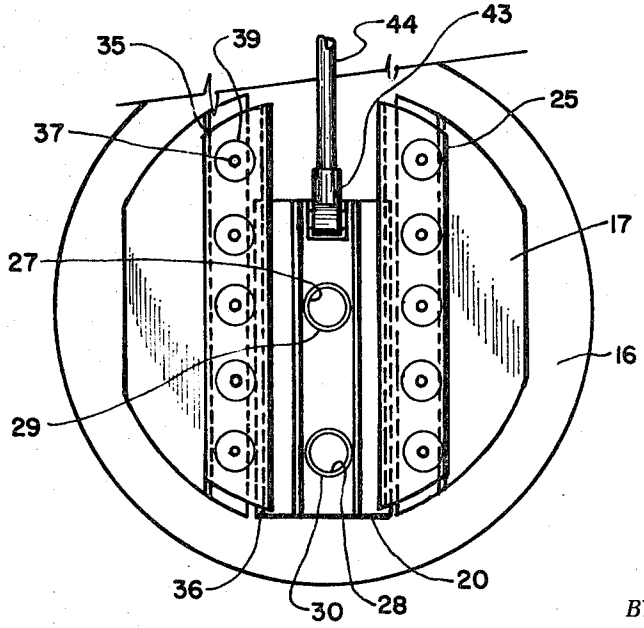


Fig. 3

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SLIDING GATE VALVE HAVING SPRING BIASED SLIDE

My invention is directed to a sliding gate valve and, more particularly, to the gate assembly attached to the bottom of a molten metal pouring ladle to provide at least two openings through which molten metal can be poured.

As a result of numerous inherent problems associated with standard stopper rods and the like, there has been a constant demand for an acceptable ladle control valve mounted external to the ladle. Several complex external sliding valves have been developed as a result thereof, but their complexity of design and installation and their cost are prohibitive in many applications. In addition, positive shut-off control has remained a problem.

My apparatus is simple in construction yet provides a true control of the molten metal pouring rate. My sliding gate valve also maintains proper alignment and various slide plates can be easily inserted and interchanged. Further, each slide plate contains at least two openings, either of which can be employed for pouring. Because the tension is evenly distributed within the assembly, positive control of pouring is achieved and it is unnecessary to throttle or choke down the opening during pouring. In addition, my invention can be completely installed external to the ladle and, therefore, the normal ladle cooling operation to permit men to enter therein for purposes of installing valving is eliminated.

My invention is a sliding gate valve employing a refractory slide plate having at least two alternative pouring openings which is maintained in engagement with a refractory stationary plate through adjustment means and tension plates which also provide the tracks upon which the slide plate slides.

In the accompanying drawings, I have shown one preferred embodiment of my invention in which:

FIG. 1 is a frontal elevation partly in section of my sliding gate valve;

FIG. 2 is an end elevation partly in section of my sliding gate valve; and

FIG. 3 is a bottom view of my sliding gate valve.

My sliding gate valve is adaptable to any standard ladle **10** which will normally have a refractory brick **11** interior and a steel bottom **12**. Cooperating with the brick **11** interior and the steel bottom **12** is a refractory pocket block **13** having an opening **14** therethrough to exit the molten metal from the interior of the ladle **10**, FIGS. **1** and **2**.

Mounted to the ladle bottom **12** and surrounding the refractory pocket block **13** is bottom plate **16**. The gate assembly, generally designated **15**, is preassembled and mounted to the bottom plate **16**, as will be described hereinafter, and without need to enter the ladle **10**.

The gate assembly, generally designated **15**, includes mounting plate **17**, stationary refractory plate **18** and its retainer **21**, refractory slide plate **19** and metal slide **20**. The assembly **15** also includes and is kept in assembled relationship and proper tension through tension plates **25** and springs **40**.

In particular, refractory slide plate **19** has two pouring openings **27** and **28** and is cemented into the metal slide **20** between upwardly extending flanges with the use of a fixturing jig. Slide plate **19** is also retained on the slide **20** by means of internally threaded slide

retainer pins **31** extending through the slide plate **19** and threadably engaged by bolts **32** passing through slide **20**. Slide **20** contains openings **29** and **30** which are in alignment with openings **27** and **28** of the slide plate **19**. In addition, the bottom surface of the slide **20** contains two spaced and parallel recessed trackways **36** which extend the length of slide **20** on opposite sides of the aligned openings **29** and **30**.

The stationary refractory plate **18** is cemented into a recessed section **41** of a mounting plate **17**. The mounting plate **17** has along its bottom surface two elongated slots **35** which are spaced and parallel and which run in the same direction and parallel to the trackways **36** on the bottom of metal slide **20**. The stationary plate **18** is further retained in place by retainer plate **21** which is bolted to mounting plate **17** through ring bolts **24**. Retainer plate **21** permits the preassembly of the gate assembly and it surrounds and is sealed to pocket block **13** after the gate assembly **15** is connected to the bottom plate **16**. The mounting plate **17** is readily centered on the bottom plate **16** through the use of the dial pins **22**, and attached thereto by four mounting plate bolts **23**.

The stationary plate **18** engages the bottom surface of the pocket block **13** so that opening **26** is in direct registry with opening **14** of the pocket block **13**. The slide plate **19** is held in engaging relationship with the stationary plate **18** as a result of two parallel tension plates **25**, FIGS. **1–3**. These tension plates **25** include along their upper surface and along opposing sides thereof parallel raised tracks **33** and **34**. One track **33** engages the elongated slot **35** of the mounting plate **17** and the other track **34** engages the trackway **36** in the bottom of the slide **20**. The tension plate **25** is retained by adjusting means including stud bolt **37** which passes therethrough to threadably engage with mounting plate **17**, spring **40** adjacent tension plate **25** and about stud bolt **37**. Washer **39** is positioned adjacent spring **40** and adjusting nut **38** which engages washer **39**, compresses spring **40** and forces slide **19** upward so that the proper engagement between slide plate **19** and stationary plate **18** exists. Five such adjusting means are spaced along each tension plate **25**, FIG. **3**.

The slide **20** is operated through dual piston cylinders **45** and **46**, one of which positions the proper opening **27** or **28** of slide plate **19** in position for registry with opening **26** of stationary plate **18** and the other of which opens and shuts that particular opening. This dual cylinder arrangement is secured to the ladle **10** by means of bracket **50** extending from the ladle and having a downwardly apertured section **51** onto which clevis **48** is connected through pin **49**. Shaft **47** threadably engages clevis **48** and forms the piston shaft in locating cylinder **46**. Adjacent to cylinder **46**, axially aligned therewith and connected thereto is cylinder **45** having piston shaft **44** operating therefrom which threadably engages clevis **48** which, in turn, is connected by pin **42** to slide **20**, FIG. **1**.

My sliding gate valve operates as follows. After the sliding gate assembly **15** is mounted to the bottom plate **16** on ladle bottom **12** and the ladle **10** is heated to the desired preheat temperature, the nuts **37** are tightened in an engineering sequence to the desired operating torque, for example, 60 inch pounds. No leverage is involved since the tension plate **25** is merely moved up-

ward thereby forcing the slide plate **19** into proper engagement with the stationary plate **18** and the stationary plate **18** into proper engagement with the bottom of port block **13**. Since the tension plate **25** includes the trackway **36** for slide **25**, proper alignment and tension are directly controlled.

When metal is poured into the ladle, both openings of slide plate **19** are out of registry with the opening **26** of stationary plate **18**. When ladle **10** is ready to be poured, cylinder **45** is actuated and opening **27** or **28** of slide plate **19** is moved into registry with opening **26** to permit metal to flow therethrough. The pouring of the metal is controlled by opening and closing the slide plate **19** through actuation of cylinder **45**. Since two pouring holes are provided in the slide plate **19**, an extra pouring capability and added safety factor is present since at any point in time the second opening can be placed in position for registry with the opening **14** of the stationary plate **18** by activating the locater cylinder **46**. When the second opening is in position, then the operating cylinder **45** is employed to control that opening.

After a particular amount of use in which wear has occurred between the two refractory plates, the stud nuts are further tightened to take up the slack and insure a positive pour.

I claim:

1. A sliding gate valve for attachment to a molten metal pouring ladle having an apertured pocket block through which the molten metal flows comprising a bottom plate connected to the ladle and surrounding the pocket block; a gate assembly including:

A. a mounting plate connected to the bottom plate and having two spaced and parallel slots along the bottom surface thereof;

B. a refractory apertured stationary plate connected to the mounting plate and adapted to engage and register with the apertured pocket block;

C. a refractory slide plate having at least two aligned openings therethrough and in sliding engagement with the stationary plate, each opening aligned to register with the stationary plate aperture;

D. a perforate metal slide having the slide plate mounted thereto and in registry therewith, said slide having two parallel recessed trackways extending along a bottom surface thereof, said trackways positioned on opposing sides of said aligned openings;

E. parallel adjustable tension plates secured to the mounting plate and aligned with said metal slide, each tension plate having two parallel raised tracks at opposing ends thereof, one of said tracks cooperating with the metal slide recessed trackway and the other cooperating with the mounting plate slot;

F. spring adjusting means cooperating with the tension plates to adjust the tension between the stationary plate and the slide plate,

extensible means attached to the metal slide to position certain of the slide plate openings in registry with the aperture of the stationary plate.

2. The sliding valve of claim **1** wherein the gate assembly includes a stationary plate retainer secured to the mounting plate to retain the stationary plate and the apertured pocket block in registry.

3. The sliding valve of claim **1** wherein the mounting plate has a recessed section in which said stationary plate is positioned.

4. The sliding valve of claim **1** wherein the spring adjusting means includes a bolt extending through an opening in the tension plate and threadably engaging the mounting plate, a nut and washer engaging the opposite end of the bolt and a spring positioned between the washer and tension plate.

5. The sliding valve of claim **1** wherein the extensible means are piston-cylinder means attached to the ladle bottom at one end and to the metal slide at the other end.

6. The sliding valve of claim **5** wherein two axially aligned piston-cylinder means are employed, said first piston-cylinder means positioning a particular slide plate opening for registry with the aperture of the stationary plate and the second piston-cylinder means opening and closing said particular slide plate opening.

7. In a molten metal pouring ladle having an apertured pocket block and a bottom plate therearound, the improvement comprising a gate assembly including a mounting plate adapted to connect to the bottom plate and with two spaced and parallel slots along the bottom surface thereof, a refractory apertured stationary plate connected to the mounting plate and adapted to engage and register with the apertured pocket block, a refractory slide plate having at least two aligned openings therethrough and in sliding engagement with the stationary plate, each opening aligned to register with the stationary plate aperture, a perforate metal extensible slide having the slide plate mounted thereto and in registry therewith, said slide having two parallel recessed trackways extending along a bottom surface thereof, said trackways positioned on opposing sides of said aligned openings, parallel adjustable tension plates secured to the mounting plate and aligned with said metal slide, each tension plate having two parallel raised tracks at opposing ends thereof, one of said tracks cooperating with the metal slide recessed trackway and the other cooperating with the mounting plate slot, spring adjusting means cooperating with the tension plates to adjust the tension between the stationary plate and the slide plate.

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