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[54] **INLET CONSTRUCTION FOR ENCLOSED VESSELS**
10 Claims, 1 Drawing Fig.

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[50] **Field of Search** ..... 266/34, 38; 164/66; 285/189, 192, 22 (C); 141/383; 220/86

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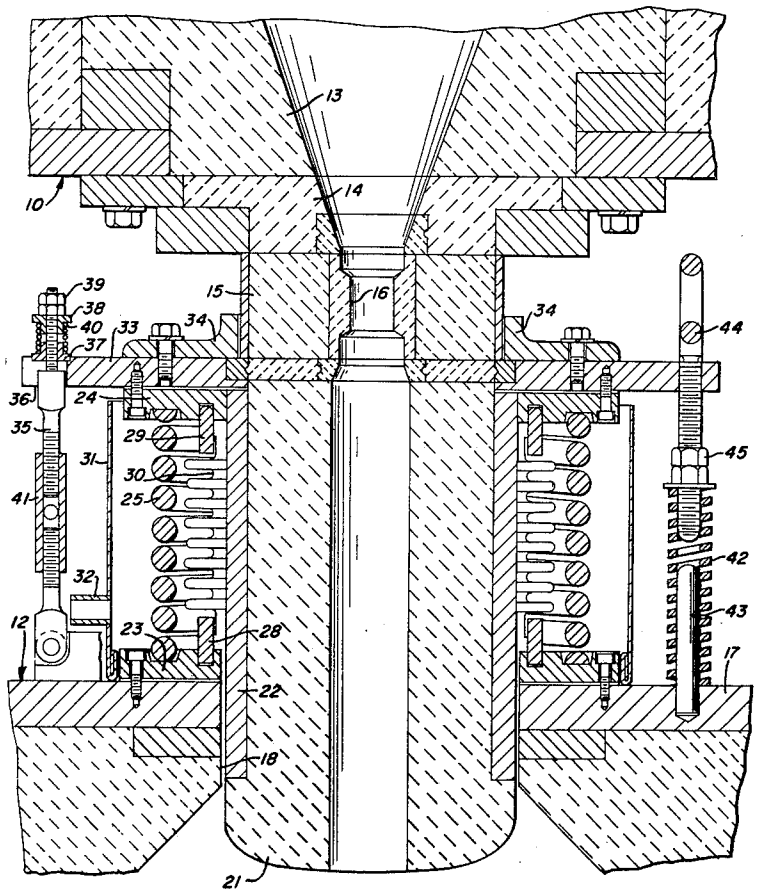
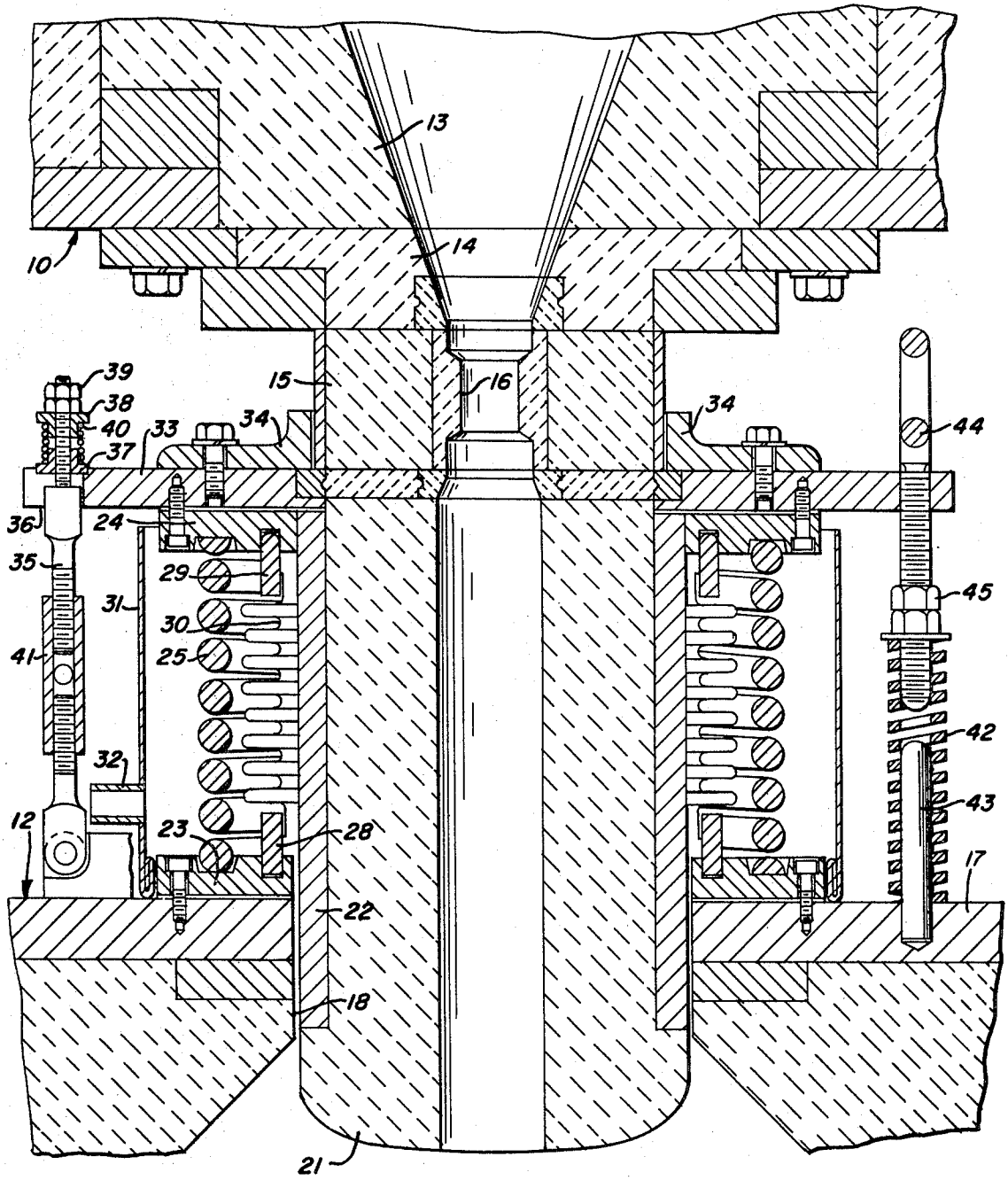
ABSTRACT: An inlet construction especially for vessels which receive molten metal where it is necessary to provide a seal against loss of vacuum or escape of gas. Includes an axially movable tube and spring means urging the tube upwardly. Tube can engage the bottom of a bottom-pour vessel equipped with a sliding-gate-type of closure. Avoids need for tube on bottom of pouring vessel.





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INLET CONSTRUCTION FOR ENCLOSED VESSELS

This invention relates to an improved inlet construction through which liquids can be introduced to an enclosed vessel.

Although my invention is not thus limited, my inlet construction is particularly useful as applied to a vessel which receives molten metal from a bottom-pour teeming vessel. For example, in a degassing operation for molten steel, the steel may be teemed from a ladle or tundish into a receiving vessel which is maintained under vacuum. The teeming vessel has an outlet opening in its bottom wall and a closure mechanism for controlling flow of metal through this opening. To maintain the vacuum, it is necessary to provide an enclosed passage between the two vessels. A similar need arises where it is desired to exclude air from a pouring stream of metal to prevent oxidation, as in teeming metal from a ladle into a tundish. Commonly the enclosed passage is in the form of a tube which extends downwardly from the teeming vessel into the receiving vessel, or into contact therewith.

It is known to use closures of the sliding-gate-type on bottom-pour vessels, as shown for example in my earlier U.S. Pat. No. 3,352,465 or in Grosko application Ser. No. 781,929, filed Dec. 6, 1968, of common ownership. This type of closure has a number of advantages over the more commonly used stopper rods, as explained in my patent. However, there are problems in equipping such vessels with enclosed pouring tubes.

An object of my invention is to provide an improved inlet construction applied to a receiving vessel to furnish an enclosed passage from a bottom-pour teeming vessel.

A further object is to provide an inlet construction which furnishes an enclosed passage for use with a sliding gate or other closure on a teeming vessel, yet does not necessitate any special design of closure on the teeming vessel.

A more specific object is to provide an inlet construction which includes an enclosed tube mounted on a receiving vessel for axial movement, and means urging the tube into engagement with the underside of a teeming vessel.

In the drawing:

The single FIG. is a vertical sectional view of portions of a teeming vessel and a receiving vessel, the latter being equipped with my improved inlet construction.

The drawing shows portions of a teeming vessel 10 and receiving vessel 12, both of which are refractory lined for containing molten metal. The bottom wall of the teeming vessel has an outlet opening 13 and carries a nozzle 14 fixed to its underside aligned with the opening. A sliding gate closure member 15 is mounted beneath the nozzle and has an opening 16 which can be aligned with the nozzle opening to permit teeming. The gate can be supported and operated in any desired manner; hence I have not shown the supporting and operating mechanism. The top wall of the receiving vessel 12 has a metal cover plate 17 and an inlet opening 18 through the cover plate and refractory lining.

In accordance with my invention, I mount a refractory tube 21 in the opening 18. The tube is axially movable and it has a metal casing 22 over the portion which extends upwardly of the vessel wall. I affix lower and upper annular collars 23 and 24 to the cover plate 17 and to the upper end of the casing 22 respectively. A compression spring 25 encircles tube 21 and bears at its ends against the two collars and thus urges the tube upwardly with respect to the vessel. The confronting faces of the collars have annular grooves which receive lower and upper annular followers 28 and 29 respectively. An expansible metal bellows 30 is joined at its ends to the two followers and encircles tube 21 within spring 25. The bellows provides a seal around the outside of tube 21 and prevents loss of vacuum or escape of any special atmosphere used in vessel 12. A cylindrical shield 31 rests on the cover plate 17 and surrounds the spring 25, bellows 30 and tube 21. The shield has an inlet 32 for admitting cooling air. For vessels not under vacuum or not containing any special atmosphere, I can omit the bellows. Although I show a mechanical spring 25, I could use a pneumatic or hydraulic spring.

Collar 24 carries a plate 33 fixed to its upper face. In the construction illustrated, the plate carries angle iron guides 34 for the sliding gate closure member 15. Preferably a plurality of holddowns 35 are pivoted to the top of the cover plate 17 and are received in notches 36 in the side edges of plate 33. The upper end of each holddown carries a pair of spaced collars 37 and 38, nuts 39 holding the upper collar, and a compression spring 40 between said collars. The lower collar 37 bears against the upper face of plate 33. The central portion of each holddown includes a turnbuckle 41 for adjusting the force of its spring 40. In some instances I may omit the holddowns and rely on the weight of tube 21 to hold it in position. Preferably I mount a plurality of auxiliary compression springs 42 between plates 17 and 33. The respective plates carry a plurality of aligned upstanding studs 43 and depending eyebolts 44 which fit within the springs. The eyebolts carry nuts 45 which bear against the upper ends of the springs and can be adjusted to regulate the force of the springs. When the auxiliary springs are included, it is possible to dispense with spring 25.

In operation, I lower the teeming vessel 10 to a position in which its outlet opening 13 is aligned with the inlet opening 18 of the receiving vessel 12. Gate 15 lies between the two guides 34 and abuts the top of tube 21. The compression springs 25 and 42 force the upper end of the tube into close engagement with the gate. Thereafter I open the gate to permit molten metal or other liquid to flow from vessel 10 to vessel 12.

From the foregoing description it is seen that my invention affords a simple effective inlet construction for maintaining a sealed passage between a teeming vessel and a receiving vessel. Since all parts are located on the receiving vessel, it is not necessary to resort to any special design of teeming vessel, and the latter can be equipped with any desired form of closure.

I claim:

1. In combination:
   - a refractory lined bottom-pour vessel adapted to contain liquid metal and having a discharge opening in its bottom wall;
   - a refractory gate slidably mounted on the underside of the bottom wall of said vessel and having an opening adapted to be moved into and out of alignment with said discharge opening to control teeming of metal therethrough;
   - a refractory lined receiving vessel having an inlet opening in its top wall with which said discharge opening may be aligned; and
   - an inlet construction for protecting the liquid metal from exposure to air as it passes between vessels, said construction comprising:
     - a refractory tube mounted for axial movement in said inlet opening and having a portion extending upwardly of the top wall of said receiving vessel into abutting relation with said gate;
     - spring means;
     - spaced-apart means on the top wall of said receiving vessel and on the upwardly extending portion of said tube against which said spring means bears at its opposite ends to urge said tube upwardly against said gate; and
     - guides mounted on the top of said tube for slidably receiving said gate.

2. A combination as defined in claim 1 in which said spring means is in the form of a compression spring encircling said tube.

3. A combination as defined in claim 2 in which the means against which said spring bears includes lower and upper annular collars encircling said tube and being affixed respectively to the top wall of said receiving vessel and to said tube adjacent its upper end.

4. A combination as defined in claim 2 comprising in addition auxiliary springs urging said tube upwardly with respect to said vessel.

5. A combination as defined in claim 1 comprising in addition an expansible bellows encircling said tube in the space between said spaced-apart means and furnishing a seal around the outside of said tube.

6. A combination as defined in claim 1 in which said spring means is in the form of a compression spring encircling said tube, the means against which said spring bears includes lower and upper annular collars encircling said tube and being affixed respectively to the top wall of said receiving vessel and to said tube adjacent its upper end, and comprising in addition an expansible bellows encircling said tube within said spring in the space between said collars and furnishing a seal around the outside of said tube.

7. A combination as defined in claim 1 comprising in addition holddown means connected to the top wall of said vessel and to the upwardly extending portion of said tube to limit upward movement of said tube.

8. The combination, with a receiving vessel having an inlet opening in its top wall, of an inlet construction comprising a tube mounted in said opening for axial movement and having a portion extending upwardly of the top wall of said vessel, spring means, spaced-apart means on the top wall of said vessel and on the upwardly extending portion of said tube against which said spring means bears at its opposite ends to urge said tube upwardly with respect to said vessel, and holddown means to limit upward movement of said tube, the means on the upwardly extending portion of said tube including a plate having notches in its side edges, said holddown means including turnbuckles pivoted to the top wall of said vessel and engaging said notches.

9. A combination as defined in claim 8 in which said vessel is refractory lined and adapted to contain molten metal, and said tube is of a refractory having a metal casing over the portion which extends upwardly from the top wall of said vessel.

10. A combination as defined in claim 8 comprising in addition a cylindrical shield surrounding said tube, and means on said shield for admitting cooling air.