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W. O. STAUFFER

3,028,642

APPARATUS FOR TRANSFER OF MOLTEN METAL

Filed Aug. 28, 1958

2 Sheets-Sheet 1

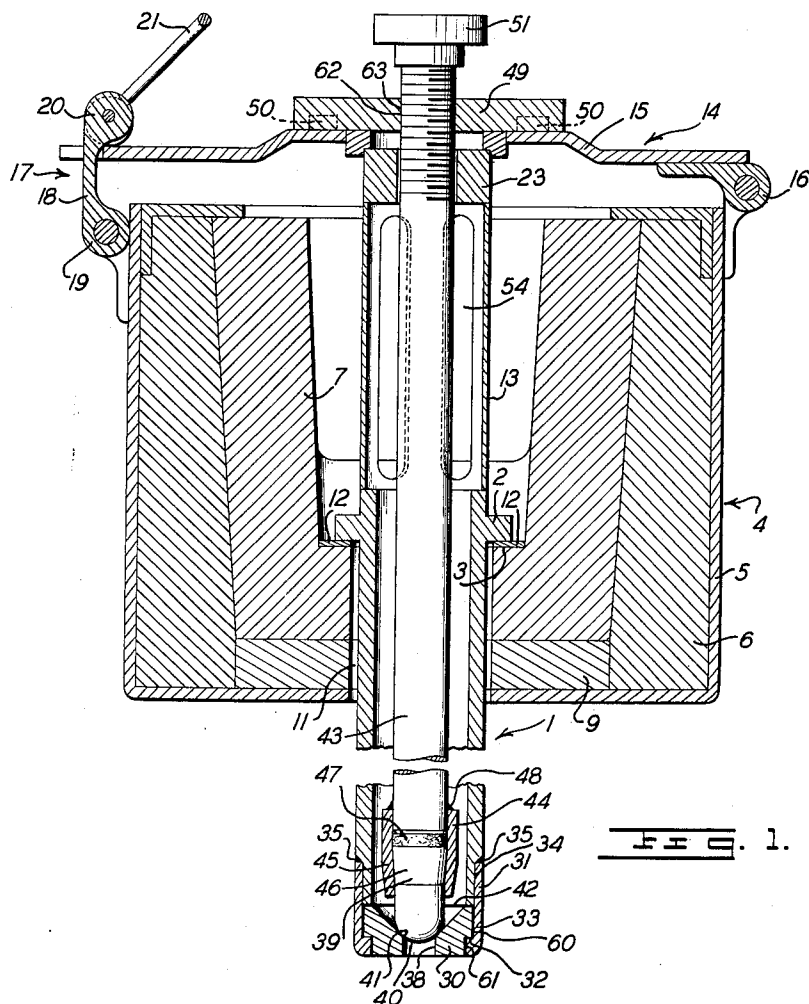


FIG. 1.

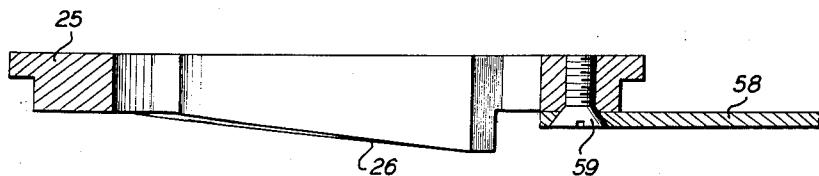


FIG. 4.

INVENTOR.
WILLIAM O. STAUFFER

BY

James B. Conroy
ATTORNEY

April 10, 1962

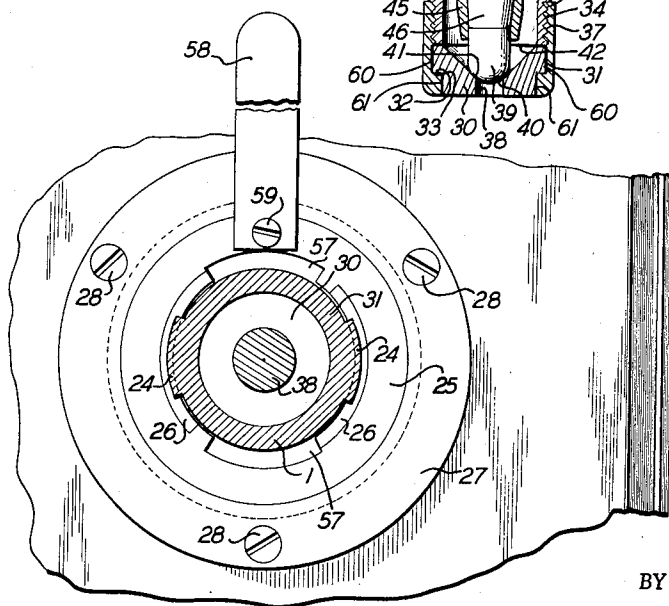
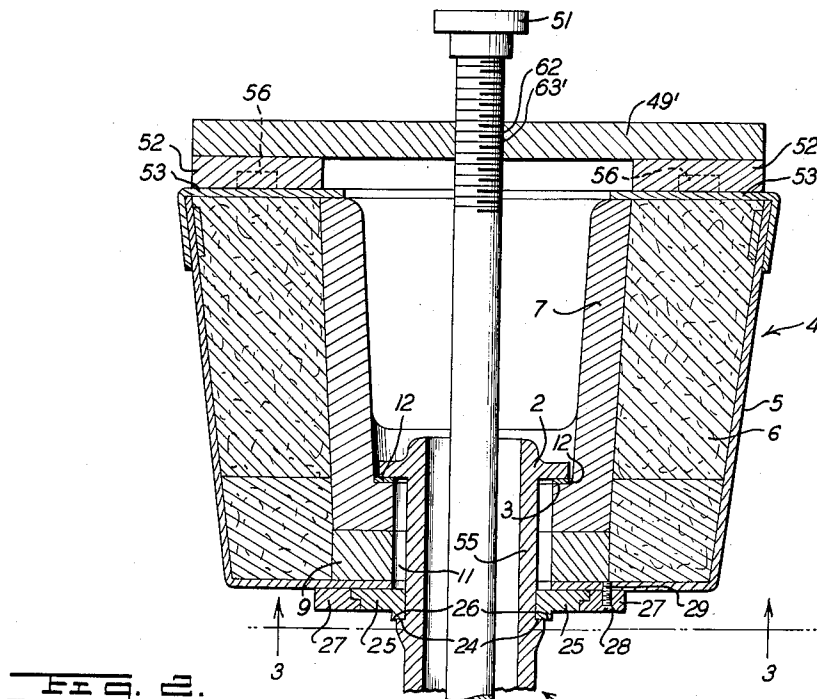
W. O. STAUFFER

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APPARATUS FOR TRANSFER OF MOLTEN METAL

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2 Sheets-Sheet 2



INVENTOR.
WILLIAM O. STAUFFER

BY *James O. Ramsey*
ATTORNEY

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APPARATUS FOR TRANSFER OF MOLTEN METAL
William O. Stauffer, New Orleans, La., assignor to Kaiser
Aluminum & Chemical Corporation, Oakland, Calif.,
a corporation of Delaware

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This invention relates to improvements in apparatus for transferring molten metal from one receptacle to another, e.g. from a transfer trough to a second trough or a casting mold.

In the casting of metals, e.g. aluminum and aluminum alloys, it is common practice to provide a body of molten metal in a suitable holding receptacle, e.g. oil, gas, coal or coke fired open hearth or reverberatory furnace, electrical resistance heated furnace or induction heated furnace. The molten metal is then transferred from the holding receptacle to the casting station. In general, casting operations of the type dealt with in this invention necessitate the transfer of the molten metal from the furnace to the casting station by means of a transfer trough. The reason for this lies not only in the obvious operational difficulties encountered in attempting to place the casting station closely adjacent to the furnace tap hole but also in the desirability of placing the casting station such that it can be supplied with molten metal from a plurality of furnaces. Accordingly, a long transfer trough is generally employed to transfer the molten metal from the furnace to the casting station.

According to prior art practice molten metal is poured from the furnace or receptacle into a second receptacle or transfer trough. From the transfer trough it flows into either a distribution pan or trough or directly into a casting mold. A preferred means for transferring molten metal from one receptacle to another is through an underpour outlet spout whereby turbulence, etc. is minimized. According to prior art practice cast iron is generally employed as a spout material.

The prior art spout seat designs generally include a tapered shoulder on the upper end of the spout mating with a tapered seat in the receptacle or trough shell. Generally this taper is of the locking type so that once the spout has been seated firmly it becomes locked or jammed into the spout seat. Stoppage and control of molten metal flow through these spouts is accomplished with a cast iron pin which seats inside the outlet orifice of the spout.

Such practice possesses certain inherent disadvantages with regard to erosion of the valve seat in the spout and the control pin and with regard to removal of the spout from the trough. The most serious disadvantage of the locking taper seat is that drastic measures such as the use of a sledge hammer must be employed to remove the spout from the seat where the locking type is used for a substantial period of time without removing the locked tapered seat. This generally results in destruction of the spout, damage to the refractory lining of the receptacle or trough, or both. The tapered seats have further disadvantages in that metal leakage will occur unless the shoulder and seat are kept scrupulously clean. Further the machined surface on the spout shoulder is easily damaged accentuating the difficulty in accomplishing a tight leak proof seal. Where the spout with the tapered shoulder is removed frequently, the tapered shoulder soon becomes brittle and oxidized whereby maintaining a leak proof seal is virtually impossible.

While the cost of an individual spout is not high the necessity of frequent replacement where they are damaged due to difficulties in removal or due to erosion, amounts to a substantial amount of money in a large scale casting facility.

Further, cast iron is subject to erosion by molten aluminum and aluminum alloys, particularly where high metal velocities are encountered. As a result, considerable erosion may be encountered in the throttling area of the pouring spout and the control pin where a cast iron spout and control pin are employed. Erosion can be so rapid that flow control may be lost during a single cast. Further, build up of intermetallics in the valve seat area is also a problem. This build up fouls the seating area and makes control difficult. Under these conditions, a complete shut off of metal is impossible. The loss of valve action through erosion is particularly serious where casting rates are extremely slow or where long casts are made. Cast iron spouts, even when coated with lime, are generally incapable of lasting through such long drops without serious erosion and loss of flow control.

The consequences of losing metal flow control during casting because of spout failure cannot be measured only in terms of dollars since hazards to personnel and equipment are also involved.

Accordingly, the primary purpose and object of this invention is to provide an improved apparatus for transferring molten metal from one receptacle such as a trough to another receptacle such as a casting mold which eliminates or substantially reduces many of the disadvantages of the prior art techniques.

Another object of this invention is to provide a novel transfer trough outlet spout wherein the spout may be easily removed without damage to either the spout, the receptacle or the receptacle lining.

Another object of this invention is to provide a novel apparatus for releasing, controlling and stopping the flow of molten aluminum metal from a receptacle for molten aluminum such as a transfer trough or distribution trough whereby the problems of short life and loss of control due to erosion are eliminated or substantially reduced.

Another object of this invention is to provide a novel apparatus for transferring molten metal from one receptacle to another including means for releasing, controlling and stopping molten metal flow whereby problems of build up of material in the outlet spout are eliminated or substantially reduced.

Another object of this invention is to provide novel apparatus for transferring molten metal from one receptacle to another, including a novel outlet spout which is easily removable without damage to the spout, receptacle or receptacle lining, an erosion resistant orifice at the outlet of the spout and an erosion resistant control pin for controlling the flow of molten metal through the orifice.

In accordance with this invention there is provided an outlet spout provided with a flange located near the inlet end thereof. The lower surface of this flange mates with a surface inside the receptacle which surrounds the receptacle outlet or opening. A resilient refractory gasket is provided between the lower surface of the flange and the mating surface inside the receptacle. Said flange is maintained in contact with said gasket by means of a holding device. Control of molten metal flow through the outlet is provided by means of a control pin and an orifice in the outlet. The lower end of the control pin takes the form of a spherical segment whereby line of contact seating is obtained between the tip and the inlet edge of the orifice. The inlet of the orifice has a conical configuration whereby better flow control is obtained through the use of the pin tip. Since the most suitable materials for the outlet spout differ from those for the orifice, an orifice insert may be provided at the outlet end of the spout with a resilient refractory material gasket provided between the insert and outlet spout. Similarly the main portion of the control pin may be fabricated from one material with a tip of another material affixed to the lower

end thereof separated by a resilient refractory gasket material. A suitable mechanical means is provided for moving said pin tip into and out of contact with said orifice.

For purposes of more detailed discussion, this invention will be specifically described with reference to the embodiment shown in the accompanying drawings wherein:

FIGURE 1 is an end elevational view in cross section, with parts removed for purposes of clarity, of a molten metal trough and outlet illustrating the novel flanged outlet spout, orifice insert and pin tip insert of this invention, wherein a ported top section is employed on the outlet spout to permit use of a flexible loading device to effect a seal between the pouring spout and the trough,

FIGURE 2 is an end elevational view in cross section, with parts removed for purposes of clarity, of a molten metal trough and outlet illustrating the novel flanged outlet spout, orifice insert and pin tip insert of this invention wherein a cam type hold down device is employed to effect a seal between the pouring spout and the trough,

FIGURE 3 is a bottom view of the outlet and a portion of the receptacle or trough of FIGURE 2 further illustrating the cam type hold down device for effecting a seal between the pouring spout and the trough, and

FIGURE 4 is a detail view in cross section of the ring member and cam surfaces of FIGURES 2 and 3.

Referring now to the drawings, in which the same reference numerals have been applied to various corresponding parts, and more particularly to FIGURES 1 and 2, the present invention relates to an apparatus for transferring molten metal from one receptacle to another including an outlet spout 1 provided with a flange 2 located near the inlet end of the spout 1. The lower surface of flange 2 mates with a surface 3 provided inside a receptacle such as a transfer or distribution trough 4. Trough 4 generally comprises a metal shell 5 along the bottom and sides of which is generally provided insulation 6 of suitable material, e.g. magnesia. This insulation 6 is placed in contact with the bottom and sides of the shell 5 except in the area near the outlet spout 1. Generally the trough 4 is also lined with a suitable refractory material 7. This refractory material 7 may be a rammed lining of castable refractory material. Such material may comprise a grog of suitable refractory particles, such as particles comprising 95% Al_2O_3 , 4% CaO , 0.7% SiO_2 balance impurities bonded by calcium aluminate cement. In the alternative, the lining may be of prefired refractory brick or tile fabricated from materials such as high heat duty fireclay and 90% alumina material. An example of the latter comprises 7.5% SiO_2 , 91.0% Al_2O_3 , 0.5% TiO_2 , 0.4% Fe_2O_3 , 0.1 CaO , 0.2% MgO , 0.3% $\text{Na}_2\text{O}+\text{K}_2\text{O}$.

The refractory lining 7 may be supported by a spacer 9 of insulating refractory material such as a mixture of asbestos and diatomaceous earth with a calcium hydroxide type binder. Such a material is readily available under the trade name "Marinite." An opening or outlet 11 is provided in the trough 4 which has a diameter larger than the diameter of the outlet spout 1 but smaller than the diameter of the outlet spout flange 2 thus providing a clearance between outlet 11 and outlet spout 1. Thus the outlet spout may be easily inserted and removed from opening or outlet 11. In order to properly seal the connection between outlet spout 1 and trough 4, a gasket 12 of suitable resilient refractory material is provided between the lower surface of flange 2 and the mating surface 3 within trough 4.

It has been found that aluminum-silicate fiber materials are suitable resilient refractory materials for gasket 12. By the term "aluminum-silicate fiber materials" is meant materials obtained by melting and fiberizing mixtures of alumina and silicon with or without modifying agents such as borax, glass, zirconium and soda ash. One example of an available material of this type suitable for this application comprises 51.2% Al_2O_3 , 47.5% SiO_2 ,

0.6% B_2O_3 , 0.6% Na_2O , balance MgO , CaO , Fe_2O_3 , and impurities in minor amounts.

In order to maintain flange 2 of outlet spout 1 in contact with gasket 12 to thereby seal the connection a suitable hold down means should generally be provided. In some instances the weight of the outlet spout itself may be sufficient to provide proper sealing action. However, this is generally not the case.

With reference more particularly to FIGURE 1, an embodiment of this invention wherein a top section 13 having elongated ports 54 to permit passage of molten metal is provided on outlet spout 1, which top section extends to the upper portion of trough 4. Suitable weights (not shown) may be provided on top section 13 in order to maintain flange 2 in sealing connection with gasket 12. However, it is preferred to provide a flexible loading device 14 which exerts pressure downwardly on top section 13. Flexible loading device 14 may comprise a flexible member 15 hinged at one end of one side of trough 4 by means of a hinge 16. A fastening means 17 may be provided for fastening the opposite end of member 15 to the side of the trough opposite hinge 16. Fastening means 17 may comprise a member 18 pivotally attached to the side of receptacle 4 by hinge means 19. The end of member 18 opposite the hinge means 19 is provided with an eccentric roller 20 rotatably attached at this opposite end and provided with a suitable lever 21. In order to hold the end of member 15, fastening means 17 is moved pivotally around the end of flexible member 15 with the roller 20 positioned to provide easy clearance between roller 20 and the end of flexible member 15. The lever 21 is then moved in a clockwise direction whereby the surface of eccentric roller 20 applies pressure to flexible member 15 due to the eccentricity of roller 20. When fastened down, flexible member 15 exerts a downward force on top section 13 through a suitable spacer member 23, positioned between top section 13 and flexible member 15. When it is desired to remove outlet spout 1 the lever 21 is merely moved counterclockwise thus loosening contact between roller 20 and flexible member 15 permitting member 18 to be moved counterclockwise away from the end of member 15. Member 15 may then be raised and outlet spout 1 removed.

A second means for holding the flange 2 of outlet spout 1 in contact with gasket 12 is illustrated in FIGURES 2, 3 and 4. This means comprises a pair of shoulders 24 on outlet spout 1 positioned at a distance below the bottom of shell 5 of receptacle 4. A ring member 25 having cam surfaces 26 projecting from the bottom thereof adapted to surround outlet spout 1 is rotatably affixed to the bottom of shell 5 by means of a retaining ring 27 and bolts 28 adapted to engage the threads of threaded openings 29 in the bottom of shell 5. The inside diameter of the portions of ring member 25 having cam surfaces 26 is slightly greater than the outside diameter of outlet spout 1 but less than the outside diameter of shoulders 24. Ring member 25 is provided with openings 57 between cam surfaces 26 which are sufficiently large to permit passage of shoulders 24. Cam surfaces 26 have a configuration as shown in FIGURE 4 whereby rotation of ring member 25 in a clockwise direction causes cam surfaces 26 to engage shoulders 24 forcing outlet spout 1 downwardly. Ring member 25 is provided with a handle 58 affixed thereto by means of a bolt 59 to facilitate rotation of ring member 25 and to provide a mechanical advantage whereby flange 2 may be forced into tight contact with gasket 12 by forcing outlet spout 1 downward through engagement of cam surfaces 26 with shoulders 24. When it is desired to remove the outlet spout 1, ring member 25 may be rotated counterclockwise to the position where openings 57 register with shoulders 24 in which position spout 1 may be easily removed. When it is desired to maintain outlet spout 1 in position, ring member 25 is rotated in a clockwise direction as far as possible where-

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by flange 2 is maintained in tight contact with gasket 12.

In accordance with this invention the lower end of outlet spout 1 may be provided with a refractory orifice insert 30 having an orifice 38 defined therein, as illustrated in FIGURES 1 and 2. This insert is maintained in position by means of a sleeve member 31 having an internal shoulder 32 matching a shoulder 33 on insert 30. The refractory insert 30 is placed inside sleeve member 31 in the position as shown in the drawings and sleeve member 31 is then placed on the end of outlet spout 1. The end of outlet spout 1 is provided with a suitable recess 34 to allow for the upper portion of sleeve member 31. Sleeve member 31 may be affixed to outlet spout 1 by suitable means such as welding with a weld 35 as shown in FIGURE 1, or by threaded means as shown in FIGURE 2. These threaded means comprise an internal thread 36 on sleeve member 31 and an external thread 37 on the end of outlet spout 1.

In order to seal the joint between the refractory orifice insert 30 and the end of outlet spout 1, a gasket 42 of resilient refractory fiber material as described above, is provided between the orifice insert and the end of spout 1. It is also desirable in many instances to provide gaskets 60 and 61 between the sides of insert 30 and sleeve member 31.

The inlet of the orifice 38 defined within insert 30 has a conical configuration with a bevel preferably at an angle of 38° to the vertical to produce equal flow-lift characteristics. Releasing, controlling and stopping of metal flow through the orifice 38 is effected by means of refractory pin tip 39 which may engage the edge 41 of orifice 38. This pin tip has a spherical segment seating surface 40 whereby a line of contact may be made between this surface and the inlet edge 41 of orifice 38. When the curvature of the seating surface 40 is spherical, a line of contact seal in a form of a true circle is obtained regardless of small differences in angularity between the center line of pin tip 39 and the center line of orifice 38. If seating surface 40 had any curvature other than spherical, perfect straight line valving action would be essential requiring an expensive valving mechanism of great precision.

The phrase "line of contact seating" as used herein may be defined with reference to either FIGURE 1 or FIGURE 2. From these drawings it can be seen that the spherical segment seating surface 40 of pin tip 39 contacts the inlet edge 41 of orifice 38 at two points in the plane shown in FIGURES 1 and 2. By rotating this plane 180° about the center line of orifice 38, the locus of the points of contact would generate a circular line. This circular line is "the line of contact" as the expression is used herein.

Line of contact seating has many advantages over the plane of contact seating employed in the prior art, i.e. contact over a zone of appreciable breadth rather than a line. For example, fouling of the seating surface on the pin tip or orifice is minimized. Particles or obstructions must lodge along the line of contact to prevent mating or closure of the valve. Positive seating action is obtained and the seating area on the valve plug and orifice insert are self cleaning in nature. All of the force applied to the valve plug during the seating operation is concentrated at the line of contact between the valve plug and the orifice insert. Since this contact area is very small (e.g. a line several thousandths of an inch wide), the load per unit area is extremely high and this generally dislodges or removes any obstruction of a non-metallic nature which has fouled the seating surface.

The material of the orifice insert 30 and the pin tip 39 should be characterized by resistance to attack by molten aluminum, high degree of hardness, resistance to abrasion and thermal shock and non-wetting characteristics towards molten aluminum. Examples of refractory materials that are suitable for orifice insert 30 and pin tip 39 are refractory borides, carbide and nitrides such as zirconium boride, zirconium carbide, titanium boride, 75

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titanium carbide, silicon carbide, silicon nitride bonded silicon carbide, silicon nitride and aluminum nitride.

Suitable means are provided for moving pin tip 39 into and out of orifice 38 and for maintaining pin tip 39 in contact with orifice 38. One such means is shown in FIGURE 1 for application where a top section 13 and a flexible loading device 14 is employed for maintaining flange 2 in contact with gasket 12. A similar device is shown in FIGURE 2 where the cam type hold down means is employed. With either means a control rod 43, which may be of a non-refractory material such as cast iron is, employed on which pin tip 39 is mounted by means of a sleeve 44. In a preferred embodiment the upper portion 46 of pin tip 39 takes the form of a conical segment the width of the tip increasing toward the upper end. Sleeve 44 has an internal conical surface 45 which is complementary to the surface of upper portion 46 on refractory pin tip 39. Thus when the pin tip 39 is in position within sleeve 44 the pin tip cannot move downward. Since the refractory material of which pin tip 39 is fabricated may be brittle, a suitable resilient refractory material 47 is compressed between the end of pin tip 39 and the end of control rod 43 to avoid undue physical stress being imparted to pin tip 39 by control rod 43. By compressing the resilient refractory material 47 between the end of pin tip 39 and control rod 43 the resilience of refractory material 47 forces pin tip 39 into sleeve 44 to provide a firm joint. It has been found that aluminum-silicate fiber materials as described above are suitable for the resilient refractory material 47.

Pin tip 39 is maintained on the end of control rod 43 by welding the upper end of sleeve 44 to control rod 43 by welds 48. The end of control rod 43 opposite the end provided with pin tip 39 is provided with external threads 62 adapted to engage the internal threads 63 or 63' of a horizontal member 49 or 49'. The end of control rod 43 is provided with a suitable handle 51. With the hold down device of FIGURE 1, horizontal member 49 merely rests on top of flexible member 15. Four upward projections 50 are provided on flexible member 15 on either side and at each end of horizontal member 49 to prevent horizontal member 49 from rotating when control rod 43 is rotated. Suitable conventional means could be provided to fasten horizontal member 49 to flexible member 15, however it has been found that this is not necessary. In general the weight of the control rod, pin tip, handle and horizontal member assembly is sufficient to maintain orifice 38 closed.

With the embodiment of FIGURE 2, horizontal member 49' is generally somewhat longer than horizontal member 49 and may be provided with spacer members 52 affixed to horizontal member 49' by suitable means such as welding whereby horizontal member 49' may rest on the upper surfaces 53 of trough 4. Four suitable projections 56 may be provided on the upper surfaces 53 to prevent turning of horizontal member 49' as control rod 43 is turned.

A specific example of the invention involving apparatus as shown in FIGURE 1 and applied to an aluminum melting and holding furnace pertains to the casting of four 11" x 44" aluminum alloy ingots having a length on the order of 80 inches. Approximately 20,000 pounds of 7075 aluminum alloy were charged and melted in an oil fired open hearth furnace. The molten metal was stirred for about 5 minutes and sampled by spectrographic analysis. Upon receipt of the analysis, the alloy composition was corrected to the exact 7075 alloy composition desired by adding the necessary alloying constituents. The composition of the melt was approximately as follows: silicon 0.17%, iron 0.25%, copper 1.53%, manganese 0.03%, magnesium 2.49%, chromium 0.20%, zinc 5.53%, titanium 0.03%, balance aluminum. The molten metal was fluxed by a suitable method and means. The temperature of the metal was on the order of 1325° F. The molten metal was level poured from the furnace into a transfer trough containing one outlet and down into the

casting mold. The outlet spout 1 was of the design shown in FIGURE 1 with an outside diameter of $2\frac{3}{4}$ inches and an inside diameter of 2 inches. The orifice 38 had a configuration as shown in FIGURE 1 with a diameter of $\frac{1}{8}$ inch and a length of $\frac{3}{8}$ inch. The inlet of orifice 38 had a conical configuration with the sides at an angle of 38° to the vertical. The pin tip 39 was a hemispherical pin tip as shown. Outlet spout 1 and control rod 43 were fabricated from cast iron. The pin tip 39 and orifice insert 30 were fabricated from silicon nitride bonded silicon carbide. Resilient refractory fiber material gaskets 12, 42 and 47 provided between flange 2 and mating surface 3, orifice insert 30 and the end of outlet spout 1, and the end of pin tip 39 and control rod 43 were fabricated from a melted and fiberized material comprising 51.2% Al_2O_3 , 47.5% SiO_2 , 0.6% B_2O_3 , 0.6% Na_2O , balance MgO , CaO , Fe_2O_3 and impurities. The four aluminum alloy ingots were cast successively in the casting apparatus.

During casting there was no sign of any leaking around the joint between the flange 2 on outlet spout 1 and the mating surface 3 in the trough 4. Upon completion of the casting, the outlet spout was removed with ease and facility by simply disengaging flexible member 15.

The molten metal flow was easily controlled through the use of this apparatus. Although these were large ingots requiring a substantial amount of molten metal passing therethrough, there was no signs of erosion or wear on the orifice or pin tip. A good control and good valving action was maintained throughout the cast. The aluminum alloy ingots had excellent metallurgical quality and were satisfactory for the production of high quality products for rolling, forging or extrusion operations.

This casting apparatus was employed subsequently for the casting of approximately 150 ingots of various alloys and throughout these casting operations there were no signs of leakage, no damage to linings or the spout even though the same spout was employed for all ingots and removed many times. Further, there were no signs of erosion of the orifice or pin tip, and good flow control was maintained at all times.

As used herein, the term "aluminum" is meant to cover high purity aluminum, commercial purity aluminum and aluminum alloys.

It is to be understood that various changes and modifications may be made in the foregoing apparatus and substitution of equivalent mechanisms effected without departing from the spirit and scope of the appended claims.

What is claimed is:

1. An apparatus for transfer of molten metal from one receptacle to another comprising a receptacle provided with an outlet, an outlet spout provided with a flange located near the inlet end of said spout, the lower surface of said flange mating with a surface inside said receptacle which surrounds the outlet of said receptacle, a resilient gasket provided between the lower surface of said flange and said mating surface inside said receptacle, means for maintaining said flange in contact with said gasket, and a clearance being provided between said outlet and said spout whereby said spout is easily removable from said receptacle.

2. An apparatus for transfer of molten metal from one receptacle to another comprising a receptacle provided with an outlet, an outlet spout provided with a flange located near the inlet end of said spout, the lower surface of said flange mating with a surface inside said receptacle which surrounds the outlet of said receptacle, a resilient refractory gasket provided between the lower surface of said flange and said mating surface, means for maintaining said flange in contact with said gasket including a ported top section of said spout and means for exerting a downward pressure on said ported top section whereby said flange is maintained in contact with said gasket.

3. The apparatus of claim 2 wherein said ported top

section of said spout extends to the upper portion of said receptacle and said means for exerting pressure on said ported top section is a resilient means including a flexible horizontal member one end of which is pivotally attached at one side of said receptacle, the other end of said member being adapted to be affixed to the opposite side of said receptacle and simultaneously therewith contact and exert pressure on the upper portion of said top section.

4. The apparatus of claim 3 wherein the end of said flexible horizontal member opposite the end which is pivotally attached at the side of said receptacle is adapted to be affixed to the opposite side of said receptacle by means comprising a member pivotally attached at said opposite side of said receptacle adapted to move around the end of said flexible member, said pivotally attached members being provided with an eccentric roller at the end of said member opposite the end attached to said side of said receptacle, said eccentric roller being provided with a lever whereby through movement of said lever in a predetermined direction, the surface of said eccentric roller is caused to apply pressure to said end of said flexible member.

5. An apparatus for transfer of molten metal from one receptacle to another comprising a receptacle provided with an outlet, an outlet spout provided with a flange located near the inlet end of said spout, the lower surface of said flange mating with a surface inside said receptacle which surrounds the outlet of said receptacle, a resilient refractory gasket provided between the lower surface of said flange and said mating surface inside said receptacle, cam type means affixed to the bottom of said receptacle adapted to engage a surface surrounding and integral with said outlet spout for maintaining said flange in contact with said gasket, and a clearance being provided between said outlet and said spout whereby said spout is easily removable from said receptacle when said cam type means is not in engagement with said surface surrounding and integral with said outlet spout.

6. The apparatus of claim 5 wherein said cam type means comprises a ring member provided with cam surfaces projecting from the bottom thereof rotatably affixed to the bottom of said receptacle surrounding said outlet spout, said cam surfaces being adapted to engage shoulder surfaces on opposite sides of said outlet spout, the inside diameter of the portion of said ring member having said cam surfaces being slightly greater than the outside diameter of said outlet spout but less than the outside diameter of said shoulders, said ring member being provided with openings between said cam surfaces adapted to permit passage of said shoulders, said cam surfaces having a configuration such that rotation of said ring member in one direction causes said cam surfaces to engage said shoulders forcing said outlet spout downwardly while rotation in the opposite direction loosens said engagement and permits registration of said opening between said cam surfaces with said shoulders whereby said shoulders may pass through said openings.

7. An apparatus for transfer of molten metal from one receptacle to another comprising a receptacle provided with an outlet, an outlet spout provided with a flange located near the inlet end of said spout, the lower surface of said flange mating with a surface inside said receptacle which surrounds the outlet of said receptacle, a resilient gasket provided between the lower surface of said flange and said mating surface inside said receptacle, means for maintaining said flange in contact with said gasket, said outlet spout having a refractory orifice insert provided at the outlet end thereof, and a control pin for controlling the flow of molten metal through said orifice having a refractory tip affixed to the lower end thereof.

8. An apparatus for transfer of molten metal from one receptacle to another comprising a receptacle provided with an outlet, an outlet spout provided with a flange located near the inlet end of said spout the lower surface of said flange mating with a surface inside said receptacle

which surrounds the outlet of said receptacle, a resilient refractory gasket provided between the lower surface of said flange and said mating surface inside said receptacle, means for maintaining said flange in contact with said gasket, said outlet spout having a refractory orifice insert at the outlet end thereof with resilient refractory material provided between said insert and said outlet spout and a control pin for controlling the flow of molten metal through said orifice having a refractory tip affixed to the lower end thereof with resilient refractory material provided between the upper end of said refractory pin tip and the lower end of the control rod, the inlet of the orifice of said refractory insert having a conical configuration whereby better flow control is obtained through use of the pin tip and wherein said refractory pin tip takes the form of a spherical segment whereby line of contact seating is obtained between said tip and the inlet edge of said orifice.

9. The apparatus of claim 8 including means for releasing, controlling and stopping the flow of molten metal through said orifice by moving said pin tip into and out of contact with said orifice.

10. The apparatus of claim 8 including means for releasing, controlling and stopping the flow of molten metal through said orifice by moving said pin tip into and out of contact with said orifice comprising a horizontal member adapted to be positioned over said receptacle, said member having internal threads matching external threads on said control rod, said control rod being provided with a handle on the end opposite the pin tip.

11. An apparatus for transfer of molten metal from one receptacle to another comprising a receptacle provided with an outlet, an outlet spout provided with a flange located near the inlet end of said spout, the lower surface of said flange mating with a surface inside said receptacle which surrounds the outlet of said receptacle, a resilient refractory gasket provided between the lower surface of said flange and said mating surface inside said receptacle, means for maintaining said flange in contact with said gasket, said outlet spout having a

refractory orifice insert provided at the outlet end thereof, said orifice insert being adapted to fit within a sleeve member which sleeve member is affixed to the lower end of said outlet spout, a resilient refractory gasket positioned between said insert and said sleeve and outlet spout, a control pin for controlling the flow of molten metal through said orifice having a refractory tip affixed to the lower end thereof by means of a cylindrical sleeve, a resilient refractory gasket provided between the upper end of said refractory pin tip and the lower end of the control rod, the upper portion of said pin tip taking the form of a conical segment, the width of said tip increasing towards said upper end, the lower portion of said sleeve having an internal conical surface complementary to the surface of the upper portion of said refractory tip, said refractory tip fitting within said sleeve and said sleeve being affixed to said control rod, the lower end of said refractory tip taking the form of a spherical segment whereby line of contact seating is obtained between said tip and the inlet edge of said orifice, the inlet of the orifice of said refractory insert having a conical configuration whereby better flow control is obtained when employed in combination with said pin tip.

12. The apparatus of claim 9 including means for moving said pin tip into and out of contact with said orifice comprising a threaded member adapted to be positioned over said receptacle, said member having internal threads matching external threads on said control rod and said control rod being provided with a handle.

References Cited in the file of this patent

UNITED STATES PATENTS

537,568	Fisher	Apr. 16, 1895
2,018,586	Wetherill et al.	Oct. 22, 1935
2,787,537	Wilhelm	Apr. 2, 1957
2,840,871	Gaffney	July 1, 1958
2,846,740	Edstrand	Aug. 12, 1958

FOREIGN PATENTS

549,212	Great Britain	Nov. 11, 1942
250,120	Switzerland	May 18, 1948