July 17, 1951 W. R. LING 2,561,062

PRESSURE CASTING APPARATUS

Filed Sept. 27, 1948 2 Sheets-Sheet 1

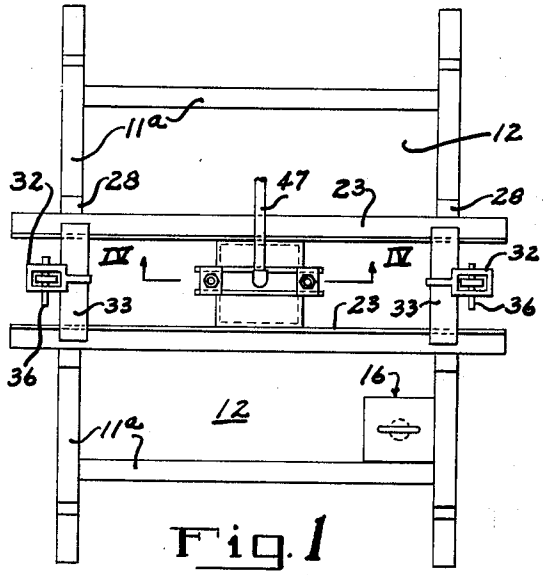


Fig. 1

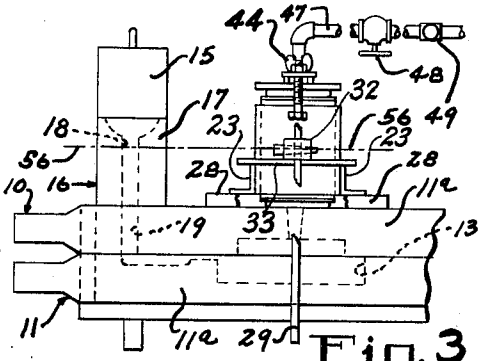


Fig. 3

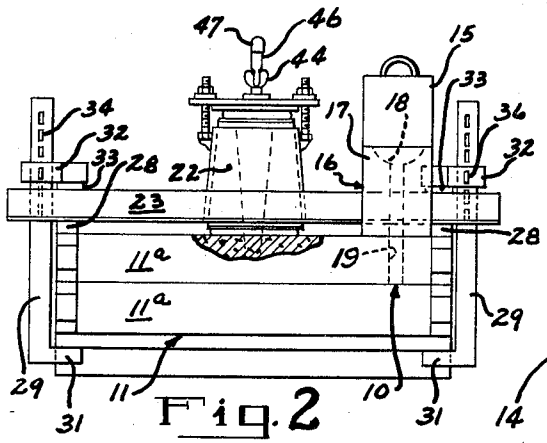


Fig. 2

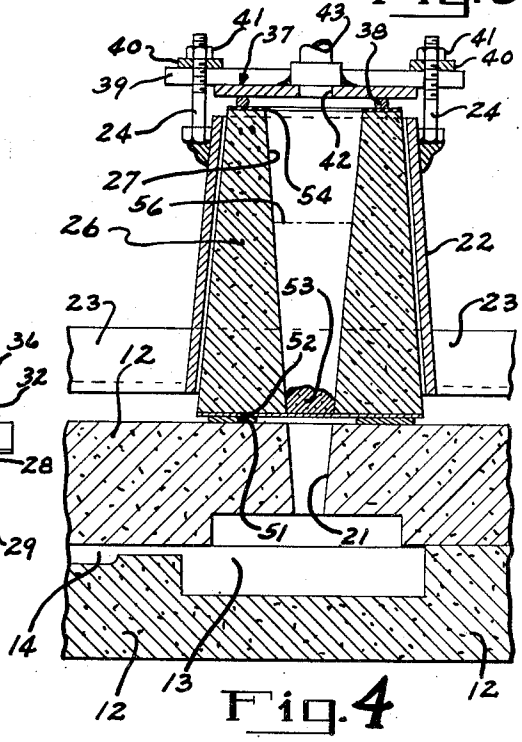


Fig. 4

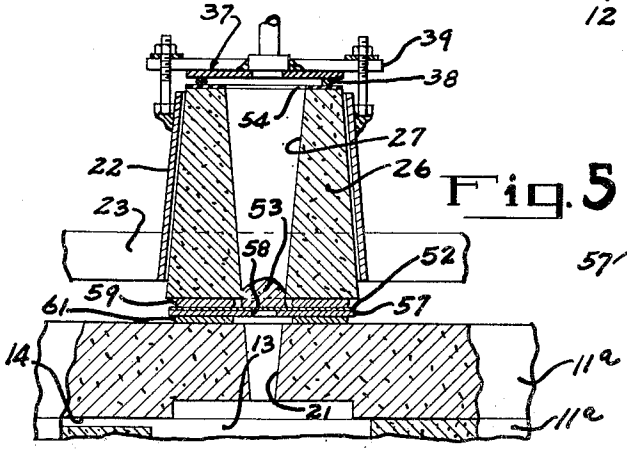


Fig. 5

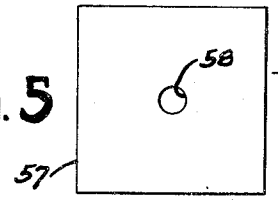


Fig. 6

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PRESSURE CASTING APPARATUS

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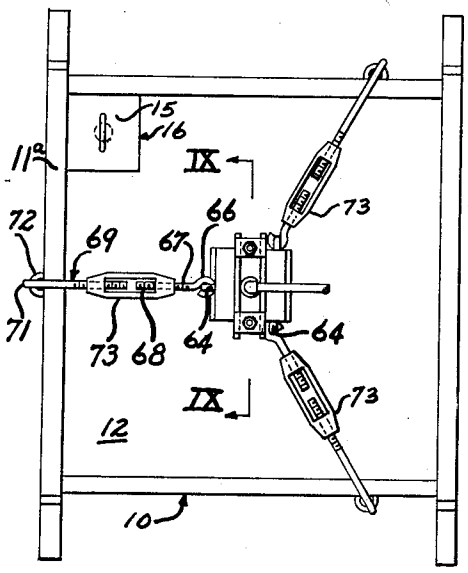


Fig. 7

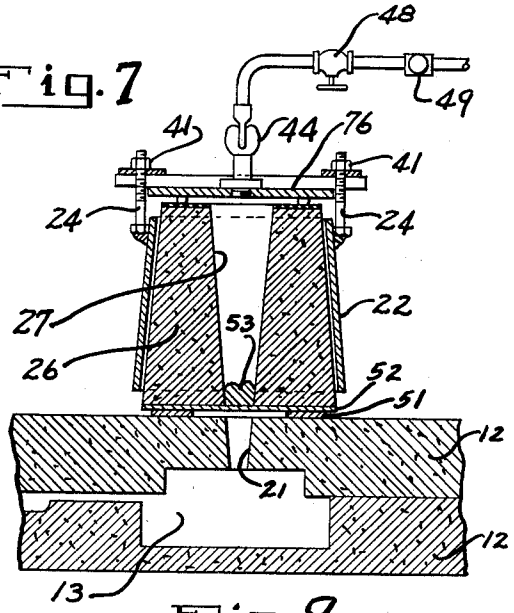


Fig. 9

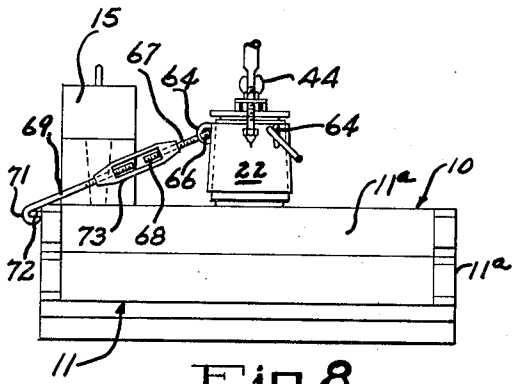


Fig. 8

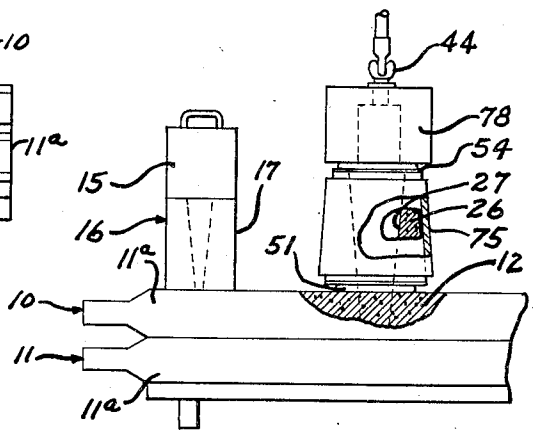


Fig. 10

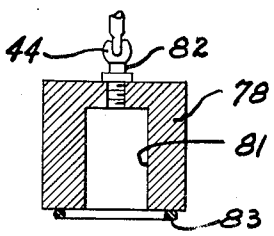


Fig. 11

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PRESSURE CASTING APPARATUS

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6 Claims. (Cl. 22—72)

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My present invention relates to apparatus for applying pressure to castings immediately after the same are poured, whereby the necessary feeding of the molten metal to the solidifying casting is facilitated, resulting in a finished casting free of faults, and one in which the grain structure of the metal is more dense than the castings poured under atmospheric pressure.

In the art to which my invention relates, it has heretofore been proposed to pour metal into a mold and subsequently to apply pressure to the molten metal at the pouring gate. However, the apparatus heretofore proposed for accomplishing this has not been sufficiently satisfactory for this method to come into general foundry practice. For instance, it has heretofore been considered necessary to use very high pressures, thus necessitating the use of heavy, strong apparatus, generally comprising steel or plaster molds. Further, insofar as I am aware, it has not been proposed heretofore to pour the metal through a pouring gate, then seal the gate in the manner taught herein, and then to put the metal in the riser under pressure while in association with means to maintain the metal in molten condition, thereby furnishing a supply of molten metal for feeding the casting during solidification. More particularly, none of the prior art apparatus has embodied means for placing on top of the metal in the riser a material for aiding in maintaining the metal in molten condition to permit the same to feed into the main body of the casting as the same solidifies, together with suitable means to seal the riser at the point of contact with the sand of the mold.

In seeking to overcome the deficiencies of prior apparatus, I have found that for large and medium castings made in molds of sand or the like, it is necessary to provide means for holding the riser securely to the mold so that the riser will not separate therefrom when the metal is poured and pressure is applied. On the other hand, the risers must be so secured as not to endanger the mold by caving in the same, and the hold-down mechanism must be capable of being quickly applied to and removed from the flask, and must be simple and economical of manufacture.

Accordingly, an object of my invention is to provide apparatus of the character designated in which the riser for the mold is in the form of a hollow refractory liner and a metallic holder or shell removably surrounding the same, together with quick connecting clamps for holding the shell and hence the liner in position on the mold.

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A further object is to provide a removable cap for sealing the upper open end of the liner which is connected to the shell by bolts, thereby permitting the liner to be pressed into contact with the sand of the mold with a positive yet controllable degree of pressure, whereby the danger of breaking the sand and spoiling the mold is eliminated.

My invention further contemplates the provision of apparatus of the character designated which in slightly modified forms is especially adapted for pouring large, medium, and small castings, and which in all modifications may readily be attached to and detached from existing, standard flasks carrying molds of sand or the like.

A still further object is to provide apparatus embodying the above enumerated features in which the pouring gate is sealed after the metal is poured by placing thereover a weight, whereby when air under pressure is admitted to the riser, the pressure is effective to cause the confined body of molten metal to flow into all parts of the mold, eliminating faults in the casting, and improving the grain structure of the metal.

Apparatus illustrating the features of my invention is shown in the accompanying drawing forming a part of this application in which:

Fig. 1 is a plan view of one form of my improved apparatus in place on a flask;

Fig. 2 is a side elevational view partly broken away and in section;

Fig. 3 is a fragmental end view of the apparatus shown in Fig. 1;

Fig. 4 is a detail sectional view drawn to an enlarged scale and taken generally along line IV—IV of Fig. 1;

Fig. 5 is a view similar to Fig. 4 and showing my improved riser associated with a pipe eliminating wafer of refractory material;

Fig. 6 is a plan view of the wafer shown in Fig. 5;

Fig. 7 is a plan view of a modified form of my invention;

Fig. 8 is an end elevational view of the apparatus shown in Fig. 7;

Fig. 9 is a detail sectional view drawn to an enlarged scale and taken along line IX—IX of Fig. 7;

Fig. 10 is an end elevational view, partly broken away and in section and illustrating yet another modified form of my invention; and,

Fig. 11 is a detail sectional view showing the weight applied to the riser of the device shown in Fig. 10.

Referring now to the drawings for a better understanding of my invention and more particularly to Figs. 1 to 4 inclusive, I show my invention in association with a well known form of flask having superposed cope and drag sections 10 and 11. The cope and drag sections comprise rectangular frames 11*a* into which is packed a bed of sand 12. As understood, the sand 12 is packed about a pattern which is drawn before the cope and drag sections are mated, thus to provide an opening 13 for receiving the molten metal and of a shape to conform to the casting desired. A sprue hole 14 connects the opening 13 with a pouring gate 16 comprising a refractory member 17 having an opening 18 therein in communication with a vertical end 19 of the sprue hole 14. The pouring gate may be placed on any convenient part of the flask and connected to the opening 13 by sprue holes of various sizes and lengths, the size, length and configuration of which will be readily apparent to those skilled in the art.

As likewise is well understood, the space 13 into which the molten metal is to be poured is vented at one or more places by a second opening 21. My improved riser, presently to be described, is disposed to be placed and held over the opening 21, whereby when metal is poured into the pouring gate 16 the same rises thereinto.

Referring more particularly to Fig. 4, my improved riser comprises a frusto-pyramidal shell 22, made of welded plates or the like, and with its base disposed downwardly. Welded to opposite sides of the shell 22 are angles 23 of a length to span the flask. Welded to the sides of the shell 22 adjacent the top are bolts 24. Slidably fitting within the shell 22 is a frusto-pyramidal refractory lining 26 having a through opening 27 therein. The liner 26 is disposed to fit with slight clearance in the shell 22 when the same is in pouring position on the mold for a reason later to appear.

The angles 23 and shell 22 carried thereby are placed on top of the flask, and preferably rest on spacer blocks 28 resting on the frame 11*a* of the flask, thereby to hold the bottom of the shell and the angles out of contact with the top of the sand 12. The angles are secured to the flask by means of L-shaped clamps 29 having a foot portion 31 disposed to engage beneath the flask, and a sliding member 32 adapted to fit over a plate 33 spanning the top of the angles. The leg of the clamp may be provided with a number of openings 34 into which are driven tapered pins 36, passing through the sliding members 32, thereby to hold the angles and shell 22 clamped positively to the flask. The upper end of the shell 22 is provided with a cap 37 in the form of a plate having a bead 38 on its underside. Welded on top of the cap 37 are spaced parallel bars 39, the overhanging ends of which are adapted to straddle the bolts 24. The cap is held in place by the provision of washers 40 and nuts 41.

The plate 37 has an opening 42 therein in which is tapped or welded a conduit 43. The conduit 43 carries one portion 44 of a quick connecting coupling. The other mating end 46 of the quick connecting coupling is carried on the end of a conduit 47, leading through a manually operated valve 48 and a pressure regulating valve 49 to a source of air under pressure, not shown.

From the description so far given, the method of assembling my improved apparatus for use may now be explained. With the cope and drag sections of the flask in superposed relation, and after the sprue holes and openings 21 are provided, the pouring gate 16 is put in place. A ring of suitable sealing material 51 is placed around the opening 21 and over this ring is placed a sheet of paper or other combustible material 52. On top of the paper 52 I place the lower end of the refractory lining 26, and in the opening 27 thereof I place a small amount 53 of any of the well known pipe eliminating materials, such as powdered coke, lime, aluminum oxide and the like. I next place the shell 22 over the liner 26 and secure the angles 23 to the flask with the spacers 28 in place. The tapered pins 36 are now driven into a selected one of the openings 34, thus clamping the shell to the flask in spaced relation thereto, and incidentally clamping the cope and drag sections together. The assembly is completed by placing a rubber gasket 54 on top of the liner 26, putting the cap in place and running in on the bolts 41. The molten metal is now poured through the pouring gate and fills the casting space 13. The metal rises by gravity up into the riser to the level that the same occupies in the pouring gate, burning through the paper 52 and floating the compound 53 on its surface. It will be noted that the paper 52 supports the material 53 above the casting space 13 until the molten metal burns through the paper, thus preventing the material 53 from falling into the casting space before the metal has risen to a level above the casting space. The pouring is stopped after the metal in the pouring gate and riser reach approximately the line 56. I now confine the metal against flowing out of the pouring gate by chilling the surface of the metal therein with water, or by placing a small amount of sand or the like on top of the metal in the pouring gate and placing thereover a weight 15. Immediately thereafter the quick connecting coupling is connected and air is admitted to the riser by opening the valve 48. The molten metal is thus put under pressure, the same being confined by the chilled surface in the gate or the weight 15. While the pressure applied to the riser may vary somewhat, I have found that about 3 to 5 pounds per square inch gauge is sufficient for most castings.

Referring now particularly to Figs. 5 and 6, I show my improved apparatus assembled with a wafer 57 of refractory material interposed between the top of the mold and the refractory liner 26. As is understood by those skilled in the art, the wafer 57 has an opening 58 therein which is of less area than the opening 21 and the opening 27 in the lining. It has been found that such an arrangement further aids in maintaining the metal molten for a longer period of time.

In order to effectively seal the apparatus just described I may employ rings 59 and 61 of the sealing material at top and bottom of the wafer and I may interpose the sheet of paper or the like 52 to support a quantity 53 of the pipe eliminating material.

Referring more particularly to Figs. 7, 8 and 9, I show a modified form of hold down mechanism for securing my improved riser to the flask. The shell 22 is provided with three or more eyes 64, welded equi-angularly thereabout. Disposed to fit in each of the eyes 64 is the hook end 66 of a rod 67, threaded on its outer end as at 68. A similar rod 69 has a hook end 71 secured in

a staple or the like 72 in the frame 11a of the flask and the two rods are connected by a turn buckle 73.

The angles 23 are omitted from the shell 22 in this embodiment and the pressure of the liner 26 against the sand is regulated by the turn buckles 73. A cap 76, similar to cap 37, carries the quick connector coupling member 44, and the device is assembled for pouring substantially as above described. The turn buckles 73 and threaded rods 68 and 69 provide simple and easily operated means for securing the angles and shell to the flask, and the hooks 71 are disengageable from the staples 72. Likewise, this modification has the further advantage of providing clearance for gagger rods and the like projecting above the level of the mold.

The form of my invention shown in Figs. 7, 8 and 9 is especially adapted for making castings of medium size. It will be understood that the pouring gate is sealed by means of chilling or by the weight 15 after the metal is poured and that pressure is admitted to the riser by means of the valve 48.

In Figs. 10 and 11 I show a form of my invention especially adapted for pouring the smaller type of casting and in which the entire shell and refractory liner for the same is supported directly from the sand bed 12 of the mold. As shown, the liner 26 is placed in a shell 75, similar to the shell 22. The liner is sealed at the bottom by a ring 51 of the sealing material similar to the rings 59 and 61. I seal the top of the liner 26 by means of a weight 78 resting on a rubber gasket 54. In this modification, the shell is of a size to fit closely about the liner whereby the lower end of the shell is held out of contact with mold.

The weight 78 has an opening 81 therein forming a compression chamber communicating with the central opening 27 of the liner 26. The air conduit 82 is threaded into the weight at the top to communicate with the chamber 81, and carries the portion 44 of the quick connector coupling. The weight 15 is employed to seal the pouring gate in the manner already explained, and the weight 78 may be provided with a bead 83 to cooperate with the gasket 54 in sealing the top of the refractory lining.

From the foregoing it will be seen that I have provided an improved apparatus for pouring molten metal into a mold in which the metal is subjected to pressure while in a molten condition. In actual operation I have found that my apparatus results in castings which are free of faults and in which the metal is considerably improved as to strength and quality. In the modification shown in Figs. 1 to 6 inclusive wherein the opening 27 in the refractory lining 26 may of necessity be rather large, thereby to provide a sufficient reservoir for feeding the casting, I eliminate the possibility of spoiling the mold by supporting the shell 22 from the mold frame and secure a controllable sealing pressure through the medium of the nuts 41 on the bolts 24. In actual operation I have found that my apparatus is satisfactory in every way and that the same is both simple and economical of manufacture.

While I have shown my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications, without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In apparatus for making pressure castings in a divided mold having pouring and vent openings wherein when in pouring relation the parts of the mold are superposed together with a refractory riser having a through opening therein, said riser being disposed to rest on the mold with its opening in communication with the vent opening thereof, the combination of a metallic shell slidably fitting about the riser and of less height than the riser, members carried by the shell and extending across the mold, clamps for simultaneously securing said members to the mold and clamping the parts of the mold together, a removable cap for closing the top of the riser opening, fastening means on the upper end of the shell for drawing the cap onto the upper end of the riser and simultaneously moving the same downwardly to seal the lower end of the riser against the surface of the mold, means to seal the pouring opening after metal is poured therethrough, and means to admit air under pressure through the cap onto the surface of the metal in the riser.

2. In apparatus for making pressure castings in a mold having pouring and vent openings and a refractory member having an opening therein mounted on the mold with said opening in communication with the vent opening, the combination of a sheet of combustible material interposed between the lower end of the refractory member and the mold, a quantity of heat retaining material within the refractory member and on top of the sheet of material, a cap for sealing the upper end of the opening in the refractory member, means to seal the pouring opening after the metal is poured, the metal being disposed to burn through said sheet and rise into the refractory member floating said heat retaining material, and means to admit air under pressure through the cap into the surface of the metal in said refractory member.

3. In apparatus for making pressure castings in a mold having a pouring gate and a vent opening and a refractory member having an opening therein mounted on the mold, the combination of a metallic shell slidably fitting about the refractory member, means to secure the shell to the mold with the lower end of the shell out of contact therewith and with the opening of the refractory member in communication with the vent opening of the mold, a cap for the upper end of the opening of the refractory member, bolts carried by the shell, and passing slidably upwardly through said cap, nuts for the bolts for drawing the cap into sealing relation with the upper end of the refractory member, means to seal the pouring gate after the metal is poured, and means to admit air under pressure through the cap into the surface of the metal in said refractory member.

4. In apparatus for making castings in a mold having a riser opening and a pouring gate, a riser and support therefor comprising an outer metallic shell and a centrally open refractory liner slidably fitting within said outer shell and disposed to rest on the mold with the opening thereof in communication with the riser opening of the mold and with its upper end projecting through the upper end of the outer shell, members rigidly secured to the outer shell ex-

tending across and secured to the edges of the mold and holding the lower end of the shell out of contact with the mold, upwardly extending bolts on the upper end of the outer shell, a removable cap on the projecting upper end of the liner having holes in the edge thereof through which said bolts loosely pass, nuts on said bolts disposed to draw the cap into sealing contact with the upper end of the liner, means to seal the pouring gate after the metal is poured and means to admit air under pressure through the cap into the refractory member.

5. Apparatus as defined in claim 4 in which the central opening of the liner is smaller in transverse sectional area at the lower end of the liner than at the upper end thereof.

6. Apparatus as defined in claim 4 in which the liner and outer shell are frusto-pyramidal, and in which the central opening of the liner is larger in transverse sectional area at the upper end of the liner than at the lower end thereof.

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