July 30, 1940. C. D. GALLOWAY 2,209,882

PRESSURE-CASTING APPARATUS

Filed Dec. 3, 1938

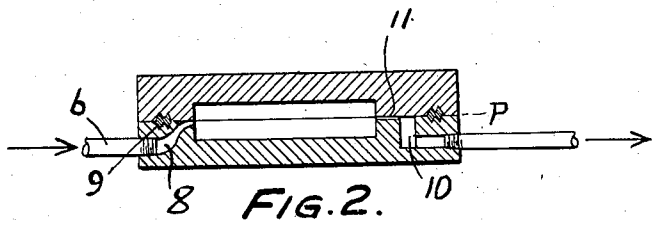

FIG. 2.

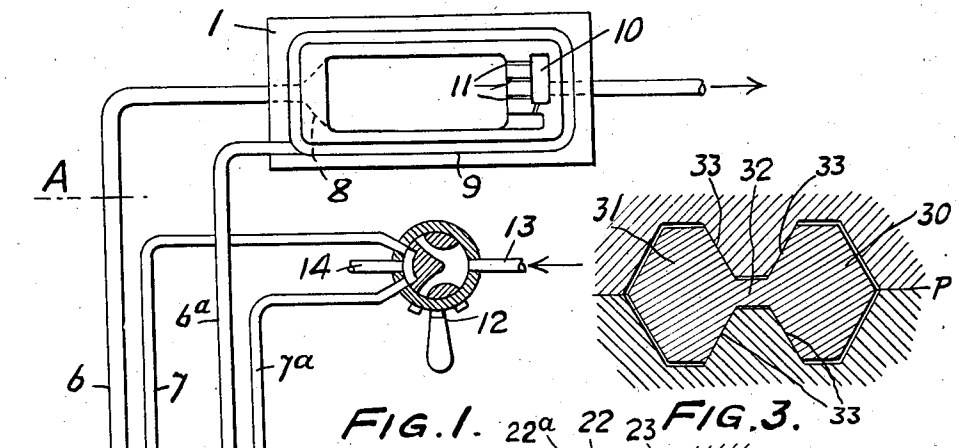

FIG. 1. FIG. 3.

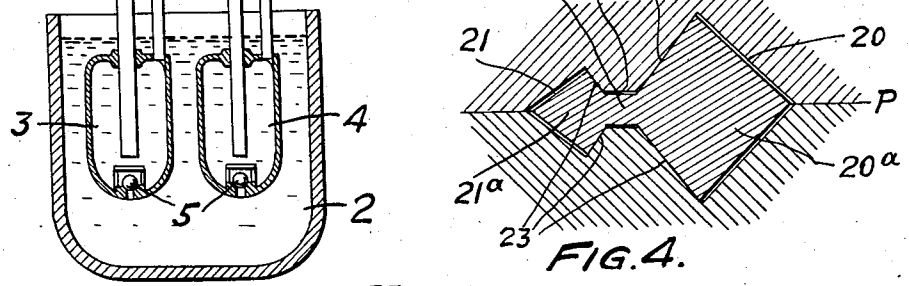

FIG. 4.

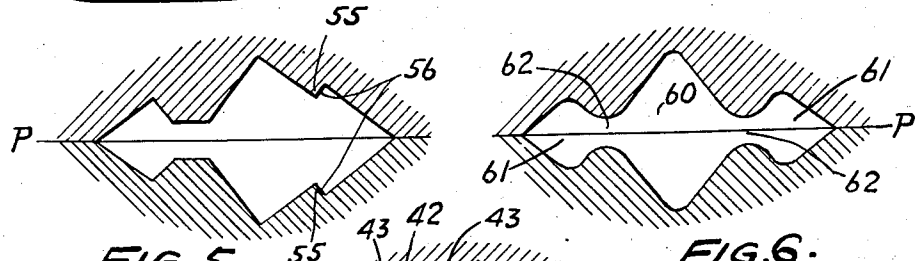

FIG. 5. FIG. 6.

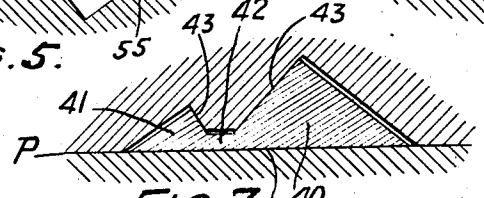

FIG. 7.

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PRESSURE-CASTING APPARATUS

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Application December 3, 1938, Serial No. 243,710

10 Claims. (Cl. 22—73)

In pressure-casting apparatus in which a vacuum is applied to the mold cavity just prior to forcing the molten metal into the cavity by super-atmospheric pressure, it is important that the mold cavity shall be hermetically sealed against the entrance of air when the vacuum is applied, and where the mold is in two or more parts which are brought together to close the mold cavity prior to the casting operation, it has been found necessary to provide a gasket between the two confronting parts of the mold to effect an air-tight seal. Gaskets made of asbestos fabric or similar material resistant to heat in the form of a cord lying in confronting grooves in the opposite faces of the mold have been found unsatisfactory as they quickly become deformed and fail to make an air-tight seal. To overcome this difficulty, applicant provides confronting grooves in the opposite faces of the two parts of the mold to form a channel surrounding the mold cavity at the parting line, into which channel molten metal is forced and solidified. For the initial tests, this channel had a circular or similar cross-section but the shrinkage of the metal on cooling developed sufficient space between the surfaces of the gasket and the walls of the channel to permit leakage of air into the mold cavity when vacuum was applied. The improvement was then devised whereby advantage is taken of the shrinkage of the metal on cooling to increase the pressure between the surfaces of the gasket and the walls of the channel to perfect the seal. In general, this improvement consists in providing a channel whose cross-section has the form of two areas connected by a comparatively narrow neck; or, in other words, the periphery of the cross-section has one or more re-entrant angles or equivalent re-entrant portions whether angular or more or less cuved. Preferably one of the two areas as well as the neck should be comparatively small so that the corresponding portion of the metal in the gasket will solidify first and will then be drawn, by the subsequent shrinkage of the larger area, into close contact with the surface of the channel in the mold where the seal is to be effected.

In the accompanying drawing:

Fig. 1 is a diagram, with parts in cross-section, showing the general arrangement of the mold and the reservoir containing the molten metal from which the mold is filled.

Fig. 2 is a sectional view taken through the two-part mold.

Figs. 3, 4, 5 and 6 are cross-sections, on an enlarged scale, through alternative designs of the channel and gasket therein, the latter being exaggerated to illustrate the principle involved.

Fig. 7 is a cross-section, on an enlarged scale, showing the channel and gasket formed on one side only of the parting-line of the mold.

In Figs. 1 and 2, 1 represents one-half of the mold, the other half (not shown in Fig. 1) being substantially identical except that the ducts for admitting the molten metal and for applying the vacuum need not be duplicated in the second half. 2 is a reservoir of molten metal in which the vessels 3 and 4 are submerged, the vessel 3 being designed to supply molten metal to the mold cavity; and the vessel 4, which is identical with the vessel 3, being designed to supply molten metal to the gasket channel surrounding the mold cavity. The design of the vessel 3 only will therefore be described. At the bottom of the vessel is a ball check valve 5 designed to permit the molten metal to enter the vessel from the reservoir 2 but to prevent it from being forced back. The vessel is hermetically sealed except for the dip stand pipe 6 and the air supply pipe 7. The dip stand pipe 6 extends to a point near the bottom of the vessel 3 and is connected at its upper end to the mold cavity through the duct or sprue 8. The vertical length of dip stand pipe 6 is such that, when atmospheric pressure is applied to the surface of the metal in the vessel 3 and vacuum is applied to the mold cavity, the differential pressure will not be sufficient to force the molten metal into the mold but will raise it only to some intermediate point as A in the stand pipe 6.

The vessel 4 is connected by a similar stand pipe 6a to the channel 9 which surrounds the mold cavity and into which the molten metal is forced to provide an air-tight gasket just prior to forcing the molten metal into the mold. The mold is provided with a vacuum chamber 10 connected to the mold cavity by vent ducts 11, these vent ducts being of such restricted section that, while they will permit the air to escape from the mold cavity when vacuum is applied, they will not permit the molten metal to pass into the vacuum chamber. The vessels 3 and 4 are connected by pipes 7 and 7a, respectively, to a valve 12 by means of which connection may be made either to a source of compressed air via the pipe 13 or to the atmosphere via the outlet 14.

In operation, the mold is closed, the vacuum chamber 10 being connected to the source of vacuum with the valve 12 turned to connect the pipes 7 and 7a to the atmosphere. This will

cause the metal in pipe 6 to rise to the level A. The valve 12 is then turned to admit compressed air to the pipe 7a which will force molten metal into the gasket channel 9 where it will be promptly congealed to form an air-tight seal around the mold cavity. The valve 12 is then turned to admit compressed air to the pipe 7 which will force the molten metal through stand pipe 6 into the mold cavity which has already been exhausted of air through the vents 11 and the vacuum chamber 10. The valve 12 is then turned to shut off the supply of compressed air and connect the pipes 7 and 7a to the atmosphere, and the mold is opened for removing the casting and the gasket, permitting the molten metal in the pipes 6 and 6a to drop to the level of the molten metal in the reservoir 2, thus restoring the original conditions.

In Fig. 3 a design of channel and gasket is shown, comprising in cross-section two similar areas 30 and 31 connected by the narrow neck 32, the shrinkage on cooling producing close contact at the points 33.

In Fig. 4 is shown the cross-section, to an enlarged scale, of a preferred design of channel and gasket. The cross-section of the channel comprises a comparatively large area 20 and a comparatively small area 21 connected by a comparatively narrow neck 22. The gasket, after solidifying, is represented in cross-section by the areas 20a and 21a connected by the neck 22a. The shrinkage of the metal of the gasket, on cooling, has drawn the surfaces of the gasket and the channel into close contact at the points 23. The parting-line between the two-halves of the mold is indicated at P.

In Fig. 5 is shown a slight modification of the design shown in Fig. 4 consisting in the additional re-entrant angles 55, producing additional points of contact pressure 56 due to shrinkage.

In Fig. 6 the cross-section of the gasket channel is shown as comprising the comparatively large area 60 with two relatively small areas 61, one on either side, connected to the area 60 by the narrow neck 62.

In Fig. 7 the gasket channel is formed by a single groove on one side only of the parting-line P of the mold, and comprises in cross-section the comparatively large area 40 and the comparatively small area 41 connected by the narrow neck 42. The contact pressure resulting from shrinkage is produced at the points 43 to effect the seal.

The expression "re-entrant angles" used in the claims is intended to include such re-entrant portions of the periphery of the cross-section of the gasket channel as are defined by curved lines (as in Fig. 6), as well as those defined by straight lines and sharp angles.

I do not intend to be limited save as the scope of the prior art and of the attached claims may require.

I claim:

1. In a two-part mold adapted for use in a pressure-casting machine having provision for applying vacuum to the mold cavity prior to filling the mold, a groove in at least one of the confronting faces of the mold surrounding the mold cavity and providing, when the mold is closed, a closed channel having a cross-section with at least one peripheral re-entrant angle and adapted for casting a metal gasket in which shrinkage of the congealed metal increases the sealing pressure between the surfaces of the gasket and the channel.

2. In a two-part mold adapted for use in a pressure-casting machine having provision for applying vacuum to the mold cavity prior to filling the mold, confronting grooves in the confronting faces of the mold surrounding the mold cavity and providing, when the mold is closed, a closed channel having a cross-section with a peripheral re-entrant angle on each side of the parting-line and adapted for casting a metal gasket in which shrinkage of the congealed metal increases the sealing pressure between the surfaces of the gasket and the channel.

3. In a two-part mold adapted for use in a pressure-casting machine having provision for applying a vacuum to the mold cavity prior to filling the mold, confronting grooves in the confronting faces of the mold surrounding the mold cavity and providing, when the mold is closed, a closed channel having a cross-section comprising two areas connected by a comparatively narrow neck, the parting-line passing through both areas and the neck and adapted for casting a metal gasket in which shrinkage of the congealed metal increases the sealing pressure between the surfaces of the gasket and the channel.

4. In a two-part mold adapted for use in a pressure-casting machine having provision for applying vacuum to the mold cavity prior to filling the mold, confronting grooves in the confronting faces of the mold surrounding the mold cavity and providing, when the mold is closed, a closed channel having a cross-section comprising a comparatively large area and a comparatively small area connected by a comparatively narrow neck, the parting-line passing through both areas and the neck and adapted for casting a metal gasket in which shrinkage of the congealed metal increases the sealing pressure between the surfaces of the gasket and the channel.

5. A multi-part mold for die casting having a mold cavity therein, a sprue for admitting molten metal to said mold cavity, means for applying vacuum to said mold cavity, said mold also having therein a second cavity, normally empty, surrounding said mold cavity and adapted to receive molten metal to form a gasket surrounding said mold cavity and sealing the parting line thereof during the casting operation, and said mold also having a second sprue therein for admitting molten metal to said second cavity.

6. A multi-part mold for die casting having a mold cavity therein, a sprue forming an inlet for molten metal to said mold cavity, means for applying vacuum to said mold cavity, said mold having a second cavity therein surrounding said mold cavity and adapted to receive molten metal therein to form a gasket surrounding said mold cavity during casting, said second cavity having in cross-section two relatively large areas connected by a portion of relatively small area.

7. A process of die casting comprising, casting a gasket of metal surrounding and spaced from the cavity of a multi-part mold to seal to the parting-line of said mold, applying a vacuum to the mold cavity of said mold to exhaust said mold cavity, and filling said mold cavity with molten metal to form a casting.

8. In the art of die casting, the improvement which consists in, supplying molten metal to a cavity in a multi-part mold surrounding the mold cavity therein and causing said metal to congeal to form a gasket sealing the parting-line of said mold cavity, evacuating gases from the mold cavity by the application of vacuum while said cavity is connected to a reservoir of molten

metal subjected to atmospheric pressure and while said cavity is located at a height above said metal greater than that to which the metal will be raised by the pressure differential between the atmosphere and the vacuum, and then introducing the metal into the mold cavity by additional pressure applied to the reservoir.

9. In the art of die casting, the improvement which consists in, introducing molten metal into a cavity in a multi-part mold, said cavity surrounding and being spaced from the mold cavity of said mold and causing said metal to congeal and thereby form a gasket sealing the parting-line of said mold cavity, evacuating gases from the mold cavity by the application of vacuum while said cavity is connected to a reservoir of molten metal subjected to atmospheric pressure and while said cavity is located at a height above said metal greater than that to which the metal will be raised by the pressure differential between the atmosphere and the vacuum, then introducing the metal into the mold cavity by additional pressure applied to the reservoir, and then restoring atmospheric pressure to said reservoir and to the mold cavity to return to the reservoir the surplus metal.

10. A process of sealing multi-part molds having a mold cavity therein for use in die casting by vacuum which comprises, filling molten metal into a cavity in said mold surrounding the mold cavity therein, and causing said metal to congeal and to press against surfaces of said cavity and to thereby seal the parting-line of said mold cavity as by a gasket.

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