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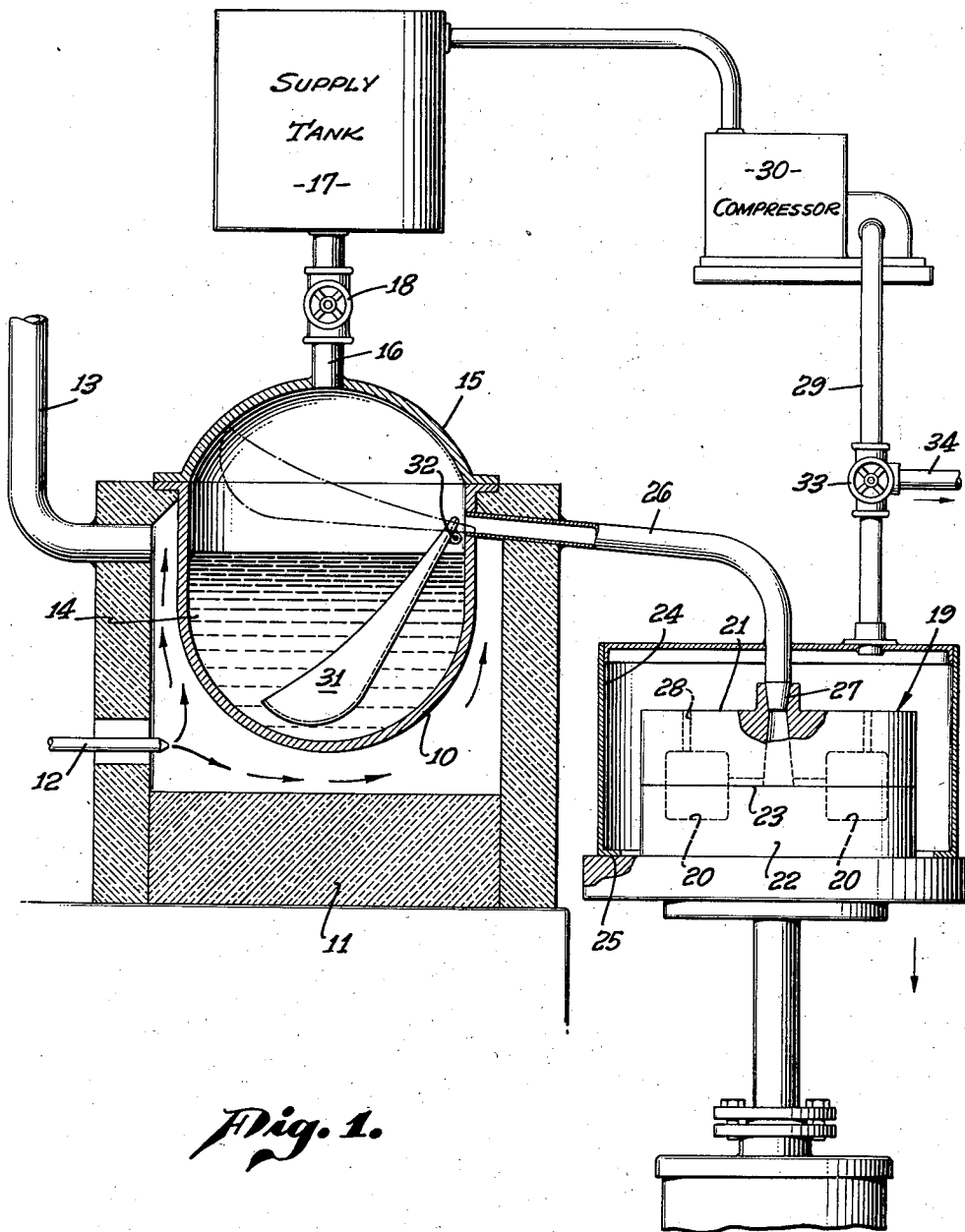
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APPARATUS FOR PREVENTING OXIDATION IN CASTING METALS

Filed May 8, 1943

2 Sheets-Sheet 1



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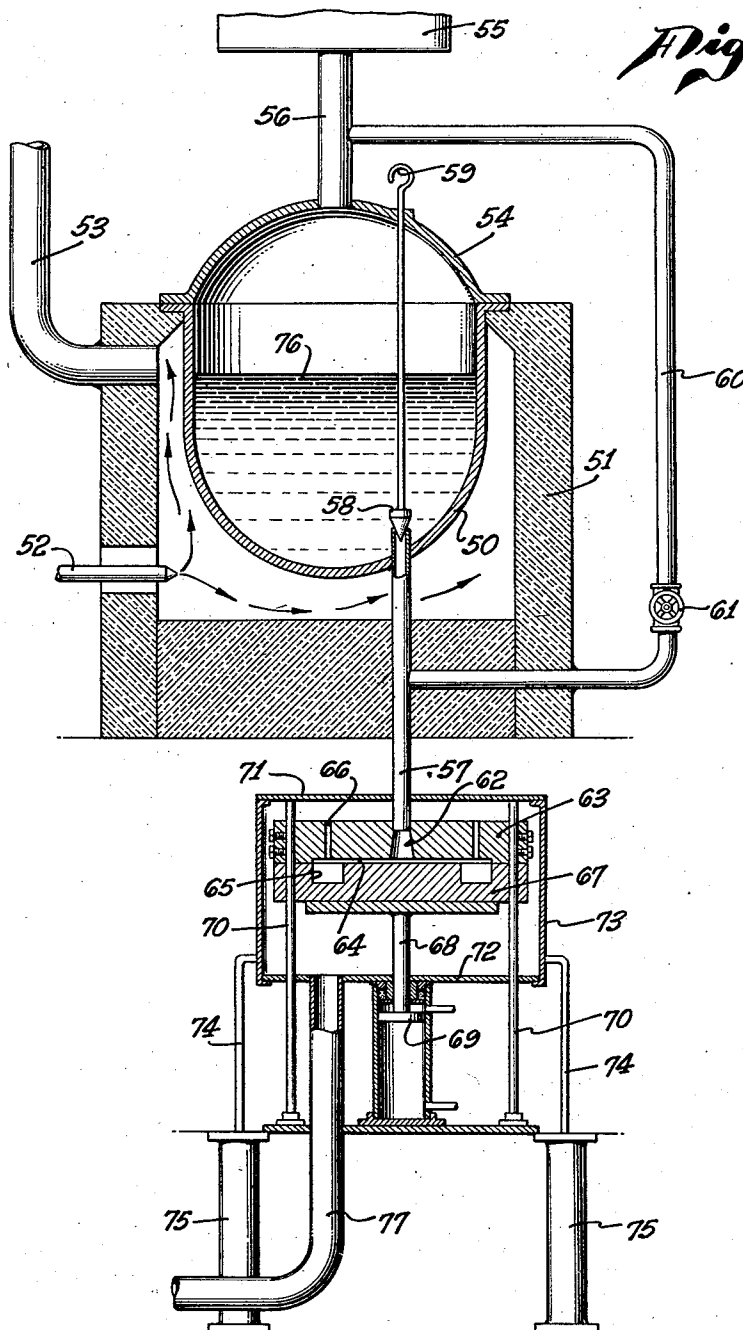
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APPARATUS FOR PREVENTING OXIDATION IN CASTING METALS

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2 Sheets-Sheet 2



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APPARATUS FOR PREVENTING OXIDATION
IN CASTING METALS

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10 Claims. (Cl. 22—57)

This invention relates to apparatus for casting metals and relates particularly to the casting of metals which, when molten, are apt to be injuriously affected upon exposure to the atmosphere.

Many metals, such as for example, magnesium and its alloys, are apt to be injuriously affected by oxidation when exposed in a molten condition to the atmosphere. Other metals of this character are aluminum and some of its alloys. Still other metals when exposed to the atmosphere when in molten condition may be injuriously affected by the nitrogen present forming objectionable nitrides.

An object of the present invention is to provide apparatus for casting metals which may be injuriously affected when exposed in a molten condition to the atmosphere wherein the metal while in molten condition is adequately protected by a gas which is inert with the metal and wherein the metal is poured from the crucible into the mold cavity in the presence of such a gas whereby metal is adequately protected at all times from exposure to the air.

Still another object of the invention is to provide a relatively simple apparatus for casting metals that may be injuriously affected upon exposure to the atmosphere while in a molten condition so that wherein there is a crucible containing a supply of the molten metal, a conduit leading therefrom to the mold cavity, with provision made for supplying a gas that is inert to the metal to the top of the crucible cause it to flow therefrom through the conduit and through the mold cavity or cavities whereby the air that may be in the mold cavity and in the conduit is replaced by the inert gas and the gas which may have become heated from the molten metal may serve to preheat the conduit and the mold cavity to prevent unnecessary chilling.

With the foregoing and other objects in view, which will be made manifest in the following detailed description and specifically pointed out in the appended claims, reference is had to the accompanying drawings for an illustrative embodiment of the invention, wherein:

Figure 1 is a section view illustrating one form of apparatus that may be suitably employed to carry out the present invention; and

Fig. 2 is a similar view illustrating an alternative form of apparatus that may be employed.

Referring to the accompanying drawings wherein similar reference characters designate similar parts throughout, 10 designates a crucible that may be supported on a suitable hearth 11

that may be heated by any suitable source of heat, such as an oil burner 12. A stack 13 leads from the hearth and carries off the products of combustion that is utilized to heat the crucible 10. This crucible is intended to receive and have melted therein a substance 14 which may be magnesium or its alloys, aluminum or its alloys, or any other substance that is apt to be injuriously affected when exposed to air.

The crucible 10 is equipped with a cover 15 to which leads a pipe or conduit 16 from a tank or reservoir 17 that contains a gas that is inert to the metal when the metal is in a molten state or which is otherwise suitable so that it will not injuriously affect it. The conduit 16 may be controlled by a valve 18.

19 indicates a mold or chill in which there are one or more mold cavities 20. The mold is shown as having a cope 21 and a drag 22 separable upon a parting line 23. This mold is enclosed within a suitable cover or enclosure 24 which may or may not be separable at 25. A conduit 26 leads from the crucible to the gate 27 that supplies the mold cavities 20. The mold cavities are provided with vents indicated at 28 and these vents may be conventional risers. A conduit 29 leads from the enclosure 24 back to the tank or reservoir 17 and in this conduit there may be a compressor 30.

Any type of casting apparatus may be employed in lieu of the mold 19. The only essential characteristics of the casting apparatus are that some means be provided for venting the mold cavities and if the gas utilized in tank 17 is either a noxious gas or one which is expensive so that it is desired to retain or preserve it or reuse it where possible, then the mold should be enclosed in an enclosure 24 and the conduit 29 and compressor 30 be employed to preserve and return the gas to the tank 17 for reuse.

A centrifugal casting apparatus may be employed in lieu of the mold 19 in which case the gate of the casting apparatus should be arranged coincident with the axis of rotation and have the conduit 26 lead thereto. Conduit 26 leads from the side of the crucible 10 above the normal level of molten metal therein and adjacent the entrance to the conduit there is a pivoted dipper 31 mounted on a rock shaft 32 that extends transversely through the crucible so as to be operable from the exterior thereof.

The operation and advantages of the above-described construction are as follows. The metal that is to be cast is placed in the crucible 10 and brought up to a molten condition suitable for casting. During this operation valve 18 may be

opened to allow the inert gas in the tank or reservoir 17 to flow therefrom into the crucible through pipe 16. This expels and replaces the air that will be initially in the crucible and causes the air to flow outwardly therefrom through the conduit 26 into gate 27, outwardly through runners that may lead from the gate to the mold cavities, through the mold cavities, and out of the vent or vents 28. This air that is initially expelled may be released from the system by means of a three-way valve 32 that may be incorporated in conduit 29. When the air has been thus expelled the valve 33 may be turned so as to close the outlet 34 and gas from the tank or reservoir 17 will then follow the same path through the crucible, conduit 26, and through the mold. This gas, which is present in the crucible and which is inert to the molten metal or which will at least not injuriously affect it, serves to protect the metal as it is brought up to a casting heat. It may also be heated by the crucible and serve to warm the conduit 26 and the mold so that there will be no unnecessary chilling at the time of casting. When the metal is ready for casting, rock shaft 32 is rotated to swing the dipper 31 into the elevated position illustrated in dotted lines in Fig. 1. The dipper elevates a supply of the molten metal and allows it to flow downwardly through conduit 26 and into the gate 27. The gas which may be in conduit 26 in the gate 27 and in the mold cavities may be freely expelled ahead of the molten metal through the vents or risers 28.

During this casting operation it will be appreciated that the metal is maintained at all times out of contact with the air so that it will not be oxidized or otherwise injuriously affected. When the metal has solidified in the mold the enclosure 24 may be opened or removed, the mold opened and the casting or castings recovered. If the inert gas is not noxious or expensive the return afforded by conduit 29 and compressor 30 may be dispensed with and the gas allowed to freely escape through the vents or risers 28. If the gas is expensive or noxious it may be conducted off through conduit 29, compressed by compressor 30 and returned to tank 17 for reuse. The inert gas employed will vary with various metals and compositions. It is preferable, however, that the gas be relatively heavy, such as for example, carbon dioxide. Other gases such as carbon monoxide, nitrogen, or sulphur dioxide may be employed.

In Fig. 2 an alternative form of construction is disclosed wherein the crucible is indicated at 50 mounted on a hearth 51 and heated such as by an oil burner 52. 53 indicates the stack leading from the hearth and 54 the cover for the crucible. The tank for the inert gas is indicated at 55 and a pipe 56 leads therefrom to the crucible. In this instance the outlet from the crucible is provided by the conduit 57 which communicates with the interior of the crucible at a point slightly above the bottom thereof. This outlet from the crucible formed by the conduit 57 is controlled by means of a valve 58 operable by handle 59 from the exterior of the crucible.

A branch conduit 60 leads from the pipe 56 through a valve 61 to conduit 57. Conduit 57 leads to the gate 62 in the cope 63. This gate is connected by runners 64 to the mold cavities 65 which are vented as at 66.

To illustrate the application of the invention to another type of casting apparatus differing from that illustrated in Fig. 1, the drag 67 of the

mold shown is supported on a vertical shaft 68 of a hydraulically or pneumatically operable piston 69. It is slidable on standards 70. The mold is disposed within a receptacle or enclosure having a top 71 supported on the standards and a bottom 72 that is likewise supported on the standards. The side walls which may or may not be cylindrical and which are indicated at 73 may be raised and lowered by means of piston rods 74 of pistons disposed in hydraulic or pneumatic cylinders 75.

In this form of construction the molten metal 76 is protected from injurious effects of the atmosphere by the inert gas that is supplied from the tank or reservoir 55. When the metal is brought up to casting heat valve 61 may be opened to allow some of the inert gas to flow through the bottom of conduit 57 and out through the mold cavities and through the vents, thus replacing the air that is initially present in conduit 57 and in the mold cavities. When the air has been thus replaced by the inert gas the valve 58 may be opened and the required amount of metal allowed to flow through conduit 57 into the gate 62 to fill the mold cavities. When the metal in the cavities has solidified the wall 73 may be lowered and the drag 67 likewise lowered to open the mold and to permit the casting to be removed. Thereafter the parts are returned to their initial position for a subsequent operation.

Gas that is expelled from the mold may be retained and conducted off through a pipe 77 and compressed and returned to the reservoir or tank 55.

It will be appreciated that either type of crucible may be employed with either type of casting apparatus and that the mold or casting machine need not conform to either of the casting machines illustrated. In the form illustrated in Fig. 2, the outlet from the crucible is preferably arranged above the bottom of the crucible so that impurities that may be present in the metal and which tend to settle may collect in the bottom of the crucible and will not flow with the molten metal to the mold cavities.

From the above-described constructions it will be appreciated that I have devised a method and apparatus wherein metals that may be injuriously affected by exposure to the atmosphere are adequately protected both while in the crucible itself and during the casting operation.

Various changes may be made in the details of construction without departing from the spirit or scope of the invention as defined by the appended claims.

I claim:

1. In combination, a mold having a mold cavity, a gate and a vent arranged so that flow from the gate is through at least a portion of the mold cavity to the vent, a crucible, a conduit closed against ingress of air leading from the crucible to the gate, means for introducing a gas inert to the material to be cast into the conduit to pass therethrough through the gate, mold cavity, and vent to wash air therefrom, and means for flowing the material to be cast from the crucible through said conduit and gate into the mold cavity.

2. In combination, a mold having a mold cavity, a gate and a vent arranged so that flow from the gate is through at least a portion of the mold cavity to the vent, a crucible, a conduit closed against ingress of air leading from the crucible to the gate, means for introducing a gas inert to the material to be cast into the conduit to

pass therethrough, through the gate, mold cavity, and vent to wash air therefrom, means for flowing the material to be cast from the crucible through said conduit and gate into the mold cavity, and means for recovering the gas expelled from the vent and subsequently returning it to the conduit.

3. In combination, a mold having a mold cavity, a gate and a vent arranged so that flow from the gate is through at least a portion of the mold cavity to the vent, a crucible closed against ingress of air, a conduit closed against ingress of air leading from the crucible to the gate, means for introducing a gas inert to the material to be cast into the conduit to pass therethrough, through the gate, the mold cavity, and vent to wash air therefrom, and means for flowing the material to be cast from the crucible through said conduit and gate into the mold cavity.

4. In combination, a mold having a mold cavity, a gate and a vent arranged so that flow from the gate is through at least a portion of the mold cavity to the vent, a crucible, a conduit closed against ingress of air leading from the crucible to the gate, means for introducing a gas inert to the material to be cast into the conduit to pass therethrough, through the gate, mold cavity, and vent to wash air therefrom, means for flowing the material to be cast from the crucible through said conduit and gate into the mold cavity, and means for recovering the gas expelled from the vent and subsequently returning it to the conduit.

5. In combination, a mold having a mold cavity, a gate, and a vent arranged so that flow from the gate is through at least a portion of the mold cavity to the vent, a crucible closed against ingress of air, a conduit closed against ingress of air leading from the crucible to the gate, means for introducing a gas inert to the material to be cast into the crucible so as to maintain the material therein in an inert atmosphere and to flow therefrom through the conduit, gate, mold cavity, and vent to expel air therefrom, and means for flowing material to be cast through the conduit and gate into the mold cavity.

6. In combination, a mold having a mold cavity, a gate, and a vent arranged so that flow from the gate is through at least a portion of the mold cavity to the vent, a crucible closed against ingress of air, a conduit closed against ingress of air leading from the crucible to the gate, means for introducing a gas inert to the material to be cast into the crucible so as to maintain the material therein in an inert atmosphere and to flow therefrom through the conduit, gate, mold cavity, and vent to expel air therefrom, means for flowing material to be cast through the conduit and gate into the mold cavity, and means for

recovering the gas expelled from the vent and subsequently returning it to the crucible.

7. In combination, a centrifugal mold having a gate, a mold cavity and a vent from the mold cavity arranged so that flow from the gate is through the mold cavity to the vent, a crucible, means for maintaining the material in the crucible to be cast under an inert atmosphere, a conduit closed against ingress of air leading from the crucible to the gate, means for introducing a gas inert to the material to be cast into the conduit to expel air therefrom through the gate, mold cavity, and vent, and means for flowing the material to be cast through the conduit and gate into the mold cavity.

8. In combination, a centrifugal mold having a gate, a mold cavity and a vent from the mold cavity arranged so that flow from the gate is through the mold cavity to the vent, a crucible, means for maintaining the material in the crucible to be cast under an inert atmosphere, a conduit closed against ingress of air leading from the crucible to the gate, means for introducing a gas inert to the material to be cast into the conduit to expel air therefrom through the gate, mold cavity and vent, means for flowing the material to be cast through the conduit and gate into the mold cavity, and means for recovering the gas expelled from the vent and subsequently returning it to the conduit.

9. In combination, a centrifugal mold having a gate, a mold cavity, and a vent from the mold cavity arranged so that flow is from the gate through the mold cavity to the vent, a crucible closed against ingress of air, a conduit closed against ingress of air leading from the crucible to the gate, means for introducing a gas inert to the material to be cast into the crucible to flow therefrom through the conduit, gate, and mold cavity to expel air therefrom, and means for flowing the material to be cast from the crucible through the conduit and gate into the mold cavity.

10. In combination, a centrifugal mold having a gate, a mold cavity, and a vent from the mold cavity arranged so that flow is from the gate through the mold cavity to the vent, a crucible closed against ingress of air, a conduit closed against ingress of air leading from the crucible to the gate, means for introducing a gas inert to the material to be cast into the crucible to flow therefrom through the conduit, gate, and mold cavity to expel air therefrom, means for flowing the material to be cast from the crucible through the conduit and gate into the mold cavity, and means for recovering the gas expelled through the vent and subsequently returning it to the crucible.

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