United States Patent [19]

Balevski et al.

[11] **3,884,291**

[45] **May 20, 1975**

[54] **APPARATUS FOR PRODUCTION OF CASTINGS FROM ALLOYS OF METALS AND GASES**

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[22] Filed: **Oct. 2, 1969**

[21] Appl. No.: **863,308**

[30] **Foreign Application Priority Data**

Oct. 10, 1968 Bulgaria 10793

[52] **U.S. Cl.** **164/312;** 164/337

[51] **Int. Cl.** **B22d 25/06;** B22d 17/10

[58] **Field of Search** 164/312, 314, 315, 120, 164/266, 303, 305, 259, 337; 249/105

[56] **References Cited**

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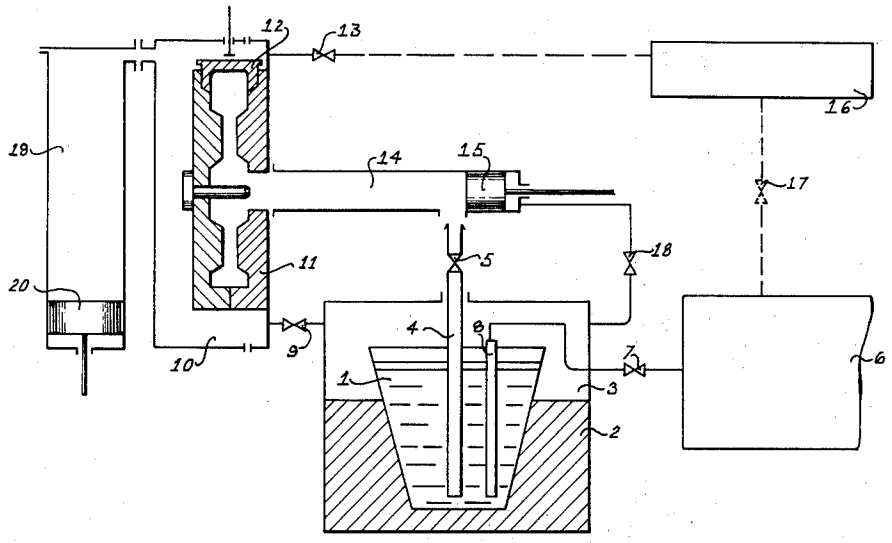
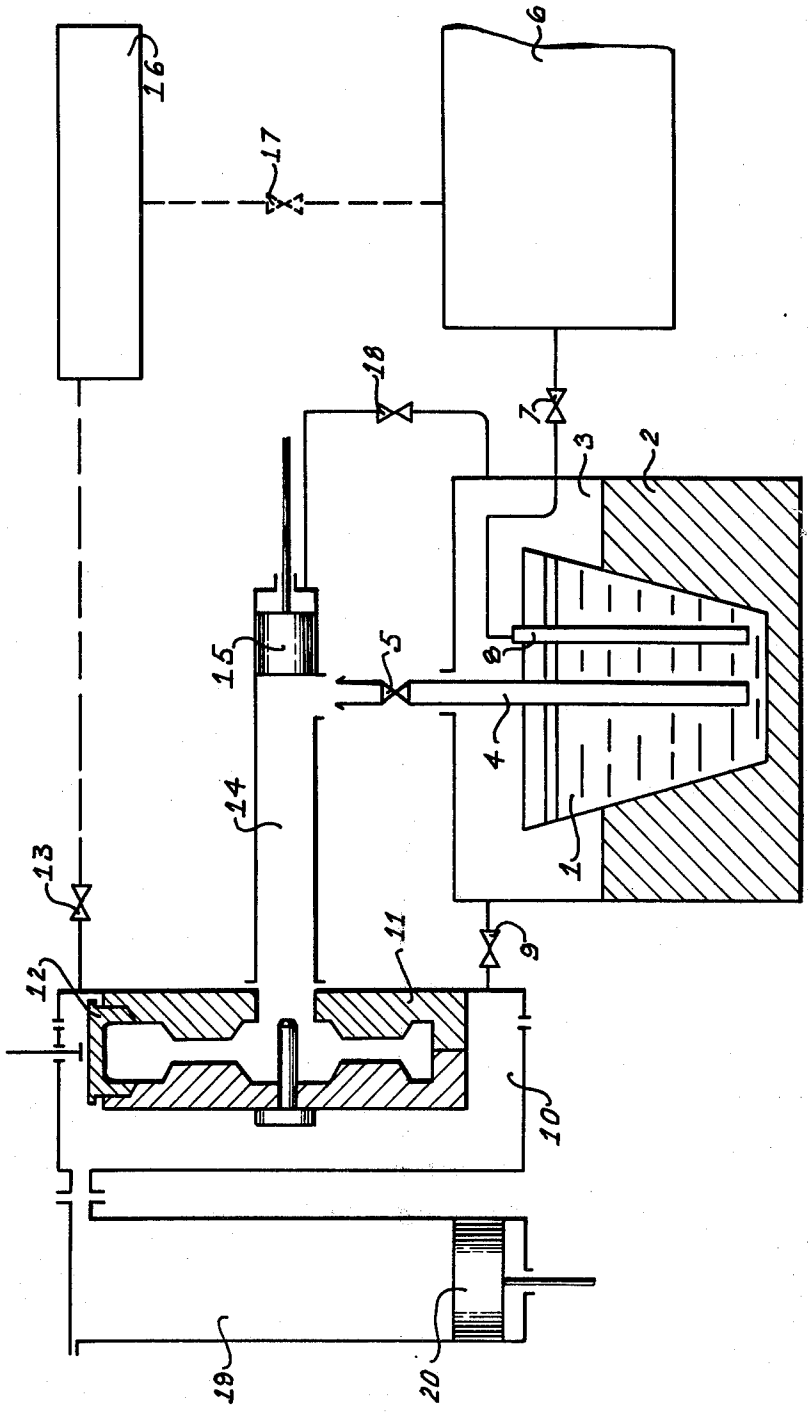
[57] **ABSTRACT**

A reservoir for molten metal is disposed in a first, hermetically closed chamber, in which an atmosphere under pressure is created by the gas to be dissolved in the metal. A compression casting cylinder is provided, such cylinder being connected with the mould, which is disposed in a second chamber. By means of a system of pipes and valve the second chamber may selectively be connected to the first chamber and to a source of gas under pressure.

3 Claims, 1 Drawing Figure





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APPARATUS FOR PRODUCTION OF CASTINGS FROM ALLOYS OF METALS AND GASES

The invention relates to an apparatus for the production of shaped castings from metals or metal alloys which contain in solid state a dissolved or chemically bound appropriately chosen gas in such quantity as to exert an advantageous influence on the physical, chemical or other properties of the material obtained.

An apparatus is known permitting the production of castings from such alloys, in which the reservoir for molten metal and the mould are disposed in separate, hermetically closed chambers, which are under the action of the pressure of an atmosphere composed of the gas to be dissolved and some other gas, which is inert to the metal. These gases are employed in such a proportion, that the partial pressure of the gas to be dissolved in the chamber with the mould is higher than that in the chamber with the reservoir for molten metal. Thus, it is possible for the gas, which is dissolved in the melt at a low partial pressure to remain in the solidifying or already solidified casting because of the high partial pressure of the same gas in the atmosphere in which the mould is placed. The application of this method is limited by the circumstance that there exist combinations of gases and metals, in which the decrease in solubility when changing over from fluid into solid state is extremely large. If the maximum partial pressure in the chamber with the mould, where the solidification of the metal takes place, is exerted by an atmosphere composed only by the gas to be dissolved, in order that no more gas should be dissolved than could be retained in the solidified casting, an atmosphere should exist in the chamber with the melt, in which the said gas is present in a very small concentration. This circumstance greatly limits the possibility for obtaining alloys that are considerably saturated with gas.

An improvement of this method is known, whereby, after filling the mould with molten metal, the connection between the chamber with the mould and the chamber with the reservoir for molten metal is cut off by means of a barrier along the path of the metal through the delivery pipe; then it is possible additionally to increase the pressure in the reservoir for molten metal. This improvement eliminates the said disadvantage only to a certain degree, since it is extremely difficult from a design point of view efficiently to seal the barrier of the delivery ripe at great pressure differences; furthermore, the synchronization of of the operation of the said barrier and the inlet of the gas with high pressure, on the one hand, and the process of solidification of the melt in the mould on the other, creates problems that are difficult to solve, since it such synchronization depends on the shape and size of each individual casting.

It is the object of the present invention to overcome the limitations of the existing methods for obtaining such alloys of metals and gases. The invention is particularly applicable to the case in which the solubility of the gas when the melt changes over in solid state is reduced to such a degree that, when controlled by means of the difference in the partial pressures acting upon the melt and the solidifying mould, it is not possible to obtain sufficiently high gas content in the alloy.

According to the present invention, this problem is solved by delivering the melt, which is saturated with gas by a known method, in a pressure cylinder, from which it is forced by means of piston pressure in the

mould, where an atmosphere of the gas to be dissolved with an appropriately selected pressure has been produced in advance. While the melt enters the mould, the gas therein is pressurized to such a degree that can be determined in advance by means of an appropriate selection of the size of a feeder head of the moulds, or by means of the action of a second gas piston, thereby reducing or increasing as desired the final compressed volume of the gas to be dissolved in the chamber where the mould is disposed. In this manner, the apparatus makes it possible to carry out the solidification process of the melt in the mould at a pressure of the gas to be dissolved which is considerably higher than the pressure at which the melt is saturated. The gas does not separate during the solidification period, but remains in the solid solution.

A more detailed explanation of the invention is given in connection with the enclosed drawing of the apparatus, illustrating its principle, set-up, and function.

A reservoir for molten metal **1** is disposed, together with a heating device **2**, in a hermetically closed and heat-insulated chamber **3**. The melt may be drawn into the casting system through the delivery pipe **4** and a known stopper device **5**. The gas reservoir **6** contains the gas to be dissolved which is delivered to the melt through the cock **7**, respectively - to the bottom of the reservoir for the melt **1**. A chamber **3** containing the reservoir for the melt **1** is connected through the cock **9** with the chamber **10**, wherein the mold **11** is disposed. The mould is provided in its upper end with a feeder head **12** intended to collect the gas contained in the mould, when the said mould is filled with molten metal. The molten metal is forced into the mould through a cylinder **14** by means of a pressure exerted by a piston **15** on the said molten metal. The gas contained in the chamber of the mould may be directed by means of a cock **13** in a circulation-regenerative system **16**, from where it can again be returned to the gas reservoir **6** through a pipe system and a cock **17**. A compression cylinder **19** with a piston **20** may be attached to the chamber with the mould.

The apparatus according to the present invention operates in the following way:

After the molten metal in the reservoir **1** has been saturated by known means with the gas to be dissolved, which enters from reservoir **6** through the cock **7** and the pipe **8**, the pressure in chamber **3** is increased in comparison with the pressure in the mould **11**, while a specified portion of metal is directed into the pressure cylinder **14**. A portion of molten metal is forced by means of the piston **15** into the mould **11**, such metal overcoming the gas pressure which acts in its cavity and has been created beforehand by the entrance through the cock **9** of an atmosphere of the gas to be dissolved, said gas entering from the reservoir **6**. The gas contained in the mould is forced into the cavity of the feeder head **12** thus creating above the the melt a gaseous atmosphere with a pressure equal to that exerted by the compression piston **20**. The gas dissolved in the melt in this way cannot separate during the solidification of the melt; after the solidification is completed, the feeder head, as well as the mould are opened, and the casting may be taken out after the gas, in chamber **10** has been drawn through the cock **13** into the regeneration system **16**.

The compression cylinder **19** with the compression piston **20**, disposed outside the chamber with the

mould **10** and connected with the said chamber **10,** an additional increase of the pressure of the gas to be dissolved in chamber **10,** respectively in the mould **11.** It also permits the control of this pressure in accordance with the mould filling process and the solidification of the melt, depending on the proportion between the volumes of chamber **10** mould **11** and feeder head **12.** The compression cylinder **19** may, at a specific proportion of the volumes, replace the action of the feeder head **12**; in other cases the additional increase in pressure by means of said cylinder may be found to be unnecessary.

What is claimed is:

1. Apparatus for the production of alloys of metals and gases, comprising a first, hermetically closed chamber, a reservoir for molten metal disposed in said first chamber, means for creating in said first chamber an atmosphere under pressure of the gas to be dissolved in the metal, a second chamber, a mould to be charged with molten metal from said reservoir disposed in the second chamber, means for injecting the molten metal into the mould, and conduit means for selectively connecting the second chamber to the first chamber and to the means for creating gas under pressure.

2. An apparatus for production of castings according to claim **1,** wherein a cavity is provided in the upper part of the mould, said cavity protruding outside the contours of the metal part to be cast and resembling a feeder head in shape, said cavity being sealed against the mould in such a way that the whole quantity or a part of the gas contained in the mould is compressed in said cavity when the mould is filled with molten metal.

3. An apparatus for production of castings according to claim **2,** comprising a gas compression device including a cylinder with a piston communicating with the interior of the second chamber.

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