Oct. 12, 1965 A. SICKBERT 3,211,545

PROCESS AND APPARATUS FOR VACUUM DEGASSING OF METAL

Filed April 17, 1963 2 Sheets-Sheet 1

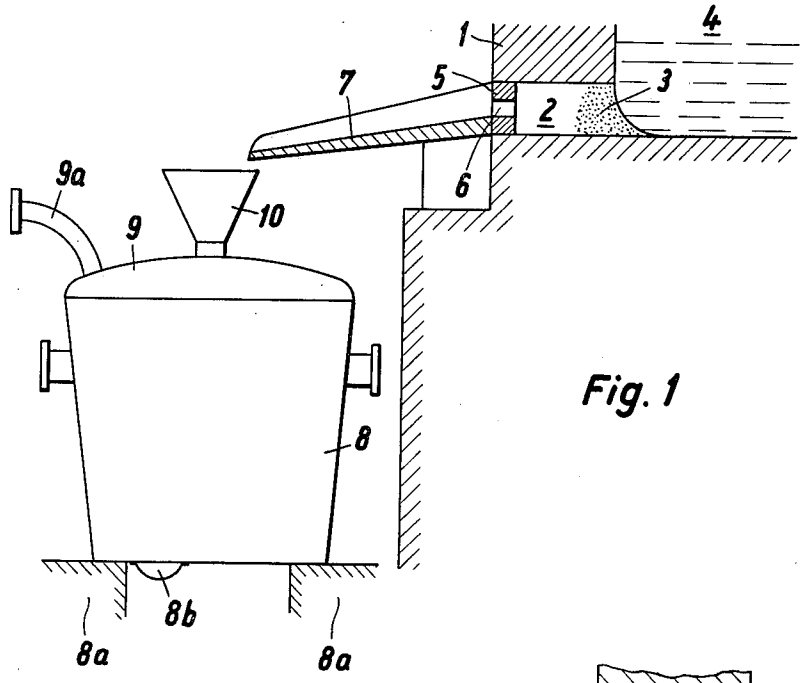

Fig. 1

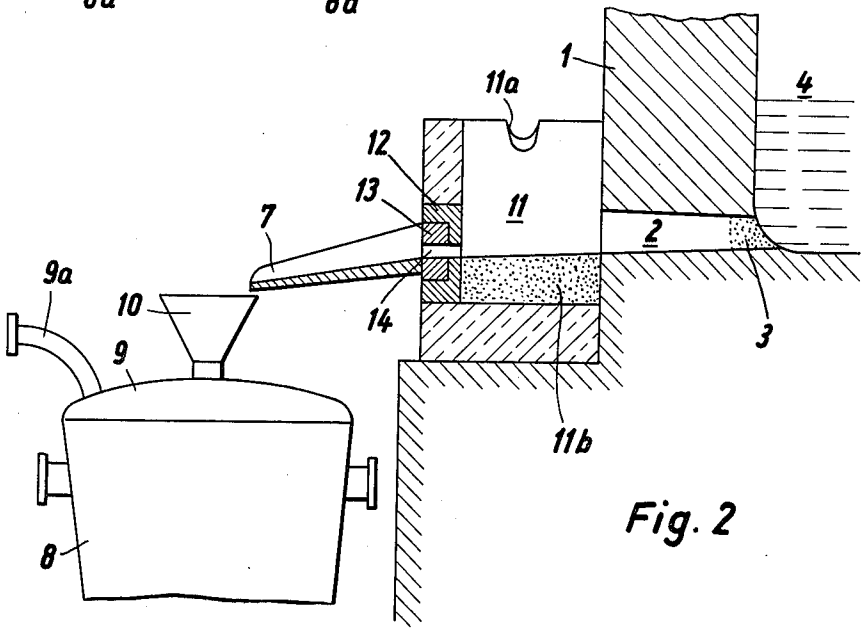

Fig. 2

Inventor:
ADOLF SICKBERT
By: Burgess, Dinklage & Sprung
ATTORNEYS

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PROCESS AND APPARATUS FOR VACUUM DEGASSING OF METAL

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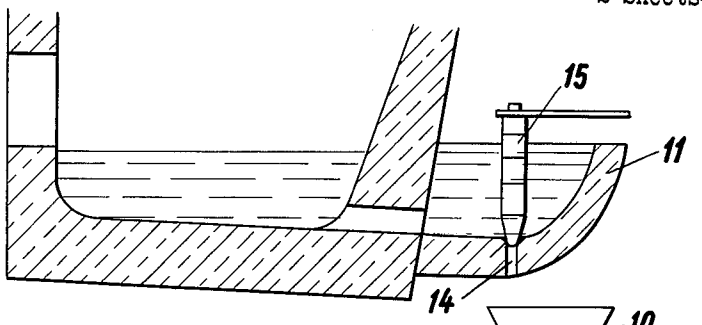


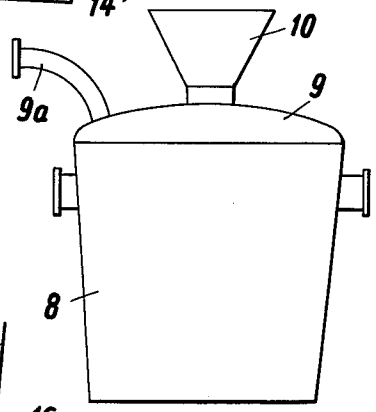
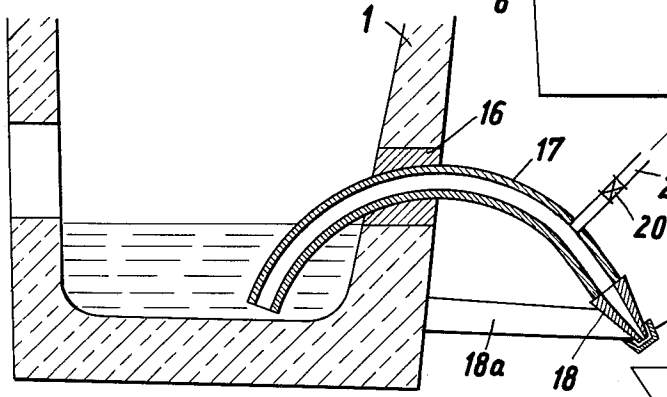


Fig. 3



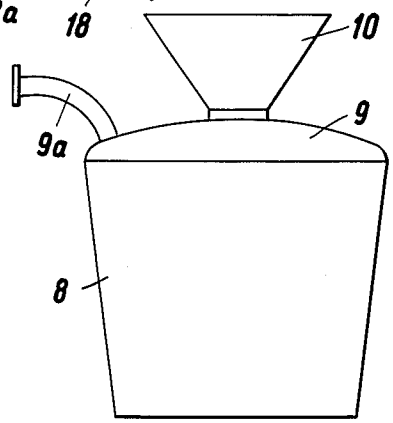


Fig. 4

Inventor:
ADOLF SICKBERT
BY: Burgess, Dinklage & Spring
ATTORNEYS

United States Patent Office 3,211,545
Patented Oct. 12, 1965

3,211,545

PROCESS AND APPARATUS FOR VACUUM DEGASSING OF METAL

Adolf Sickbert, Wattenscheid-Eppendorf, Germany, assignor to Heppenstall Company, Pittsburgh, Pa.

Filed Apr. 17, 1963, Ser. No. 273,713
Claims priority, application Germany, Apr. 19, 1962, B 66,914
3 Claims. (Cl. 75—49)

In tap degassing of metal, particularly steel, molten metal is transferred from a vessel such as a furnace to a tap degassing chamber maintained at a vacuum. As the metal enters the tap degassing chamber, it breaks into a spray due to the influence of the vacuum thereon, and thereupon the degassing occurs. As practiced heretofore, the molten metal is transferred from the furnace to a small so-called pouring funnel which is a small container positioned atop the tap degassing ladle and in communication therewith, so that molten metal can flow from the pouring funnel into the vacuum degassing chamber. The molten metal in the pouring funnel is exposed to atmospheric pressure and it maintains a seal to secure the vacuum in the tap degassing chamber. The pouring funnels are of small size in order to reduce heat losses. To control the flow of metal into the tap degassing chamber, a valve means or so-called stopper rod is provided, and the control is effected by adjusting the position of the stopper rod to control the size of the discharge opening of the pouring funnel.

This manner of operation has certain disadvantages, and, in particular, difficulty is encountered in the control of flow rate with the stopper described above. The stopper is exposed to extensive wear and does not provide suitable control.

It is a principal object of the invention to provide improved procedures and improved means for controlling the transfer of molten metal to the degassing step.

The manner in which this and other objects are attained will be apparent from the following description taken in reference to the accompanying drawings.

In the drawings:

FIG. 1 is a schematic representation of apparatus according to the invention, showing in cross-section a furnace, transfer means, pouring funnel and tap degassing chamber;

FIG. 2 is a schematic representation of an arrangement according to the invention of form alternative to that shown in FIG. 1;

FIG. 3 shows still another alternative arrangement; and

FIG. 4 shows a fourth alternative arrangement.

In the various views of the drawings, like reference characters indicate corresponding parts.

According to the invention, tap degassing can be performed by maintaining a relatively large body of metal in a container such as a furnace, transferring the molten metal from the furnace or the like to a pouring funnel mounted atop a tap degassing chamber, and allowing the metal to flow from the pouring funnel into the tap degassing chamber for degassing of the metal, and during such operation, controlling the rate of flow of molten metal into the pouring funnel and allowing the molten metal to flow freely from the pouring funnel into the tap degassing chamber. By such operation, flow of molten metal to the tap degassing chamber is controlled without the use of a stopper rod or other valve means for controlling rate of flow from the pouring funnel into the tap degassing chamber.

Various means and procedures for controlling flow according to the invention are indicated in the drawings.

In the embodiment shown in FIG. 1, rate of flow to the pouring funnel is controlled by controlling rate of flow from the furnace. Thus, a furnace **1**, which can be a stationary Siemens-Martin furnace, contains a large body **4** of molten metal. In the rear wall of the furnace, there is an outlet opening **2** provided with a plug **3** which can be knocked out or burned out when it is desired to drain metal from the furnace. The outlet opening **2** communicates with a pouring spot **7** and the pouring spot **7** is positioned to transfer molten metal to the pouring funnel **10** mounted atop the tap degassing chamber which, as here shown, is formed by a ladle **8** having a vacuum tight cover **9**. Connection **9***a* to the tap degassing chamber is for drawing a vacuum on the chamber. The ladle is provided with a discharge means **8***b* and rests on supports **8***a*. Positioned in the furnace outlet opening **2** is an insert **5** of refractory material, this insert has an opening **6** of suitable size so that metal flows from the furnace at a suitable rate for introduction into the tap degassing chamber, and, hence, control of the flow from the pouring funnel **10** to the tap degassing chamber is not required.

In the embodiment shown in FIG. 2, the arrangement of equipment is generally similar to that shown in FIG. 1, except that a reservoir is interposed between the furnace **1** and the pouring funnel **10**. This reservoir **11** is positioned to receive molten metal from the outlet opening **2** of the furnace and is provided with an outlet **12** having an insert **13**, the insert being proportioned to provide an opening **14** of a size suitable to limit flow to the value desired for the tap degassing operation. The reservoir **11** is provided with a slide let-off spout **11***a* and with suitable bottom fill **11***b* to provide a desired lower level for the reservoir.

The embodiment shown in FIG. 3 is similar to the embodiment shown in FIG. 2, except that in this embodiment, the reservoir outlet opening **14** is outfitted with a valve means or stopper **15** for controlling the size of the outlet opening **14** and thereby controlling the rate of flow of molten metal from the reservoir **11** to the pouring funnel **10**. The position of the stopper **15** relative to the opening **14** can be controlled by any suitable means, such as means as are known for controlling the position of stoppers used in combination with pouring funnels in the tap degassing of metals. If desired, a tap spout such as tap spout **7** in FIG. 2, can be positioned to receive molten metal from the discharge opening **14** of reservoir **11** in FIG. 3, and to conduct the metal to a port hole positioned at a convenient location.

Still another means for controlling flow according to the invention is indicated in FIG. 4. Here a siphon is used for transfer of molten metal from the furnace **1** to the pouring funnel **10**. The outlet opening of the furnace is positioned above the upper level for molten metal in the furnace and there is positioned in this opening a refractory insert **16**. Extending through the insert **16** is a siphon tube of refractory material. Within the furnace **1**, the siphon tube extends to about the bottom of the furnace, while without the furnace **1** the siphon tube extends to a level just below the lower level for molten metal in the furnace. A bracket **18***a* is provided for supporting the siphon outside the furnace. Further, the siphon is provided with a nozzle means **18** which can be of suitable size to provide the desired rate of flow of metal to the pouring funnel **10** and hence to the tap degassing chamber **8**. The siphon is outfitted with a starting line **20** having valve **20***a*. The starting line **20** communicates with a suitable vacuum pump and upon opening the valve **20***a* vacuum for initiating the siphoning action can be obtained. The discharge nozzle **18** can be provided with a closure sealing its outlet opening and formed of a material such as plastic or paper which, upon

being struck by the molten metal will burn and thus open the siphon for flow therethrough of the molten metal.

The procedure and means provided by the invention are particularly applicable to non-tilting furnaces such as stationary Siemens-Martin furnaces.

While the invention has been described with respect to particular embodiments thereof, it is pointed out that these embodiments are merely representative and do not set forth the limits of the invention.

What is claimed is:

1. The method of tap degassing metal available initially as a molten body thereof in a furnace which comprises:

(a) transferring molten metal from said furnace as a continuous stream to a reservoir and simultaneously, continuously transferring molten metal from the reservoir to a pouring funnel mounted atop a tap degassing chamber and exposed to atmospheric pressure,

(b) the reservoir having an outlet opening for transfer of molten metal to the pouring funnel, said outlet opening controlling rate of flow to the pouring funnel, and

(c) the step of allowing the molten metal to flow freely from the pouring funnel into the tap degassing chamber.

2. Apparatus for tap degassing of metal which comprises:

(a) a steel making furnace for holding a relatively large body of molten metal, said furnace having an outlet opening therein for discharge of molten metal therefrom;

(b) a tap degassing chamber for degassing of molten metal;

(c) a pouring funnel mounted atop said tap degassing chamber for the feeding of molten metal by free flow from the pouring funnel into the tap degassing chamber, the pouring funnel inlet side being communicated with the atmosphere;

(d) conduit means for transferring molten metal from said furnace outlet to said funnel; and

(e) a reservoir interposed in said conduit means for receiving molten metal from said furnace, said reservoir having an outlet opening for discharge of molten metal to the pouring funnel, the reservoir outlet opening having an opening size suitable to control the rate of flow of molten metal to the pouring funnel.

3. Apparatus according to claim **2**, and including valve means for controlling the opening size of the reservoir discharge outlet, whereby flow to the pouring funnel can be regulated.

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DAVID L. RECK, *Primary Examiner.*

BENJAMIN HENKIN, *Examiner.*