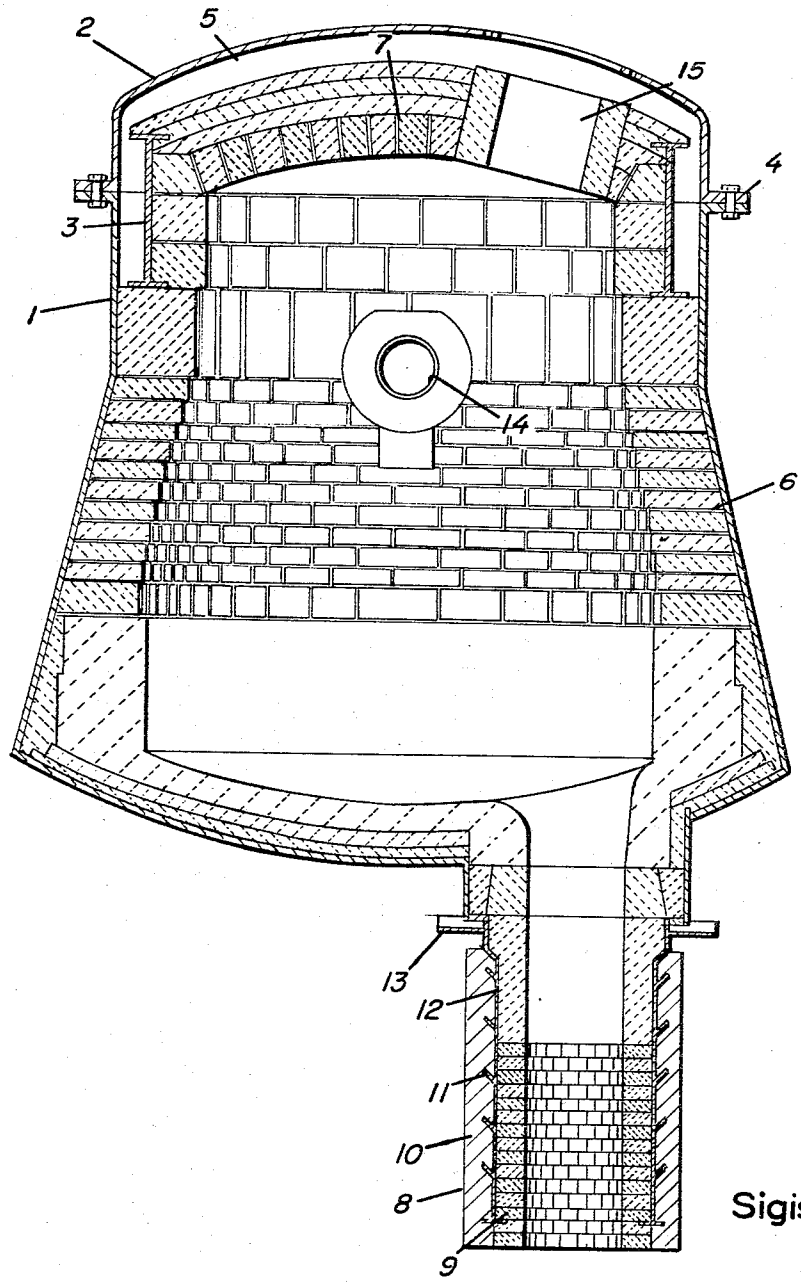
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LINING FOR INSTALLATIONS FOR THE DEGASIFICATION OF METALS

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Sigismund Kienow

INVENTOR.

BY

Wenderoth, Lind & Ponack

ATTORNEYS

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LINING FOR INSTALLATIONS FOR THE DEGASIFICATION OF METALS

Sigismund Kienow, Wiesbaden, Germany, assignor to Didier-Werke A.G., Wiesbaden, Germany

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This application is a continuation-in-part of my application Ser. No. 111,149 filed May 19, 1961, entitled Lining for Installations for the Degasification of Metals, now abandoned.

The present invention relates to a lining particularly designed for the vacuum or degasification chamber in installations for the degasification of metals, particularly steel.

It is an object of the invention to provide a lining capable of withstanding a considerably increased number of charges, particularly in periodically operated installations.

The revolving degasification process which is used lately for the vacuum steel degasification consists in that an evacuated degasification vessel with two tubes which extend substantially vertically towards the bottom is immersed from the top into the fluid melt which is to be degasified and the melt is brought into circulation by means of a conveying gas.

This process has proved to be advantageous for larger quantities of melting masses for charges of 40 tons and above. The degasification process requires a relatively minor time of duration of about 10 to 15 minutes. The quality and the gas content of the melt are considerably improved. For the degasification the melt is cut off into a casting ladle, whereby the temperature is chosen a little bit higher than the pouring. This surplus temperature has to be sufficient in order to accomplish the vacuum treatment according to the revolving process. It is therefore easier to treat larger charges with a higher heat content than smaller charges with a correspondingly lower heat content. For these smaller charges the temperature has to be chosen accordingly high enough, which is not of advantage for all kinds of steel.

These disadvantages are avoided in a simple way in that for the container for the melt a melting furnace is used which is heated in the known way, but which is not provided with a jacket sealing the same towards the atmosphere.

As a container for the melt any desired heated ladle of a melting furnace can be used. For the heating, a simple heating by means of a gas burner is used, for instance, but preferably an induction furnace ladle. This kind of heating has the special advantage that it promotes the agitating effect and the intermixing of the degasification process.

Vacuum vessels in installations of the above type for the degasification of metals, especially for steel, for instance such as are described in Luxembourg Patent 34,978, in German Design Patent 1,820,854 and in German patent application DAS 1,098,971 consist, as shown in the attached drawing, of the steel jacket **1** and the steel cover **2** which is bolted onto the jacket **1** by the flanges **4**. The abutment ring **3** is made of steel. The fireproof insulating masonry is shown at **6** and the magnesite masonry **7** consists of magnesite bricks of low iron content. Between the insulating masonry **6** or the abutment ring **3** and the cover **2** or jacket **1** is a cavity **5**.

A connecting member **8** is attached to the bottom of the vessel which consists of the steel tube **12** having holding pins **11**. The inside of the steel tube is either fully or partially lined with corundum bricks **9** which are produced by fusing corundum with aluminum oxyhydroxide as a binding agent. There is also the possibility of lining the upper portion of the tube **12** with magnesite bricks of low iron content. The outer lining of the steel tube **12** consists of a high aluminiferous ramming mass **10** which is retained by the holding pins **11**.

The connecting member is mounted upon the steel jacket **1** by the flange **13**. A closable opening **14** is provided in the side masonry **6** through which a graphite bar (not illustrated) may be introduced into the vessel. In the masonry ceiling **7** and in cover **2** an opening **15** is provided at which the vacuum duct (not illustrated) of the vacuum unit (also not illustrated) is connected. This vacuum duct is mounted upon cover **2** in a manner which is also not illustrated.

If such periodically operating vacuum vessels, as is customary in Europe, are supplied with iron oxide-rich magnesite bricks of the following composition:

	Percent
MgO	85–92
Fe_2O_3	6–8
SiO_2	1–3
Al_2O_3	0–1
CaO	1–3

they would not withstand more than 50 to 70 charges. Periodically operated installations are for instance such, as are described in the above Luxembourg Patent 34,978. The reason for the premature failure is that the Fe_2O_3 contained in the brick is during degasification reduced to FeO, and finally to metallic Fe. In reverse order, Fe is oxidized up to Fe_2O_3 when air is present in the degasification vessel. The changes occurring in volume cause grinding of the bricks, and exfoliation.

It has been found that the durability of the lining can be considerably increased, when instead of magnesite bricks which are nowadays commercially sold, use is made of those which have a Fe_2O_3 content of not above 2 percent and preferably those practically free from iron oxide.

A vacuum vessel which was lined with magnesite bricks having a Fe_2O_3 content of below 2% did not show any corrosion after 192 charges on the side walls. The bottoms were only slightly corroded. The device could have continued operation without any repairs for a considerable number of further charges.

The other ingredients of the magnesite CaO, Al_2O_3 and SiO_2 influence the durability only to a minor extent. But, by diminishing these constituents a considerable improvement of the durability can be obtained. A lining from magnesite bricks with constituents of Fe_2O_3 below 2 percent, SiO_2 below 2 percent, Al_2O_3 below 2 percent, CaO below 1 percent and MgO of 95 percent resisted, for instance, 351 charges. At such time, a complete renewal of the bottom was necessary. The other parts of the lining could have been further used, but, they were also replaced.

Chemically bound magnesite bricks, also such as those with the constituents of foreign oxides which were below the above mentioned values, did not prove suitable for the lining of vacuum vessels in installations for the degasification of metals, especially steel. The bricks, generally, have to be sintered advantageously at temperatures of 1600° C. and higher. With bricks which were sintered at 1650° C. and which had the composition of 95% MgO, 0.5% Fe_2O_3, 2% SiO_2, 2% Al_2O_3, 0.5% CaO 321 charges could be accomplished.

The porosity of the bricks shall advantageously be at most 20% by volume. Bricks which were sintered at 1650° C. and having said composition and a porosity of 18% by volume resulted in 356 charges, bricks with the same composition, but with a porosity of 22% by volume resulted in only 323 charges.

The described bricks are especially advantageous for the lining of the bottom and the side walls of degasification chambers. Said bricks are manufactured, for example, as follows:

Sinter calcined at a temperature of 1800° consisting of sea-water magnesia or impervious natural magnesite or fusion magnesia is crushed and sieved so that a fraction of 0–4 mm. and fine flour of 0–0.5 mm. result. The fractions are mixed in a pan grinder in such ratio that the mass after the grinding contains 28 to 30% of flour below 0.09 mm. As binding agent there are added 2% of sulphite solution. It is important that no other binding agent such as silicate, alumina, etc., are added which would reduce the chemical purity and thus result in an increased attack by the usually alkali-rich slag, and further in a decrease of the volume consistency of the bricks during operation.

The mass is pressed under a pressure of 1000 kg./cm.^{2} in a hydraulic press to shaped bricks, or rammed with the compressed-air gun and is subsequently calcined in the tunnel kiln at a temperature of 1620° C.

The ceiling or arched roof of the vessel should be advantageously lined with magnesite bricks which have a high resistance towards temperature changes, for instance such as those consisting of coarse magnesite granules and fine magnesite granules, lacking medium granules, as for instance those consisting of above 70% magnesite sinter having a granule size of 1 to 4 mm. and 30% magnesite sinter having a granule size below 0.2 mm. It is not necessary, thereby, that these bricks are also provided with a minor portion of foreign oxides, especially Fe_2O_3 and CaO, such as the ones which are used for the bottom and the side walls. Also, the porosity can be higher and the sintering temperature can be lower. Chemically bound bricks are not suitable for the ceiling e.g. arched roof. But, advantageously, the bricks for the ceiling or arched roof shall have the same chemical composition and same low porosity as the bricks for the bottom and the side walls and shall be sintered equally high.

The ports or sockets which are arranged below the vacuum vessel, may also be lined with magnesite bricks as suggested according to the present invention for the bottom and the side walls. In this portion of the vessel there is a strong change in temperature and further an intensive attack by the passing steel flow and slag. A magnesite brick does not withstand such attacks. Of special advantage for the lining of the ports are corundum

bricks with as minor a constituent of foreign oxides as possible, such bricks are, for instance, manufactured as follows: Electrically fused corundum of the granulation of 2–4 mm. and 0–0.2 mm. as mixed with 5% artificial aluminum meta hydroxide or aluminum oxyhydrogel as dross in an Eirich mixer and subsequently pressed in a hydraulic press with the pressure of 500–600 kg./cm.^{2} or rammed in iron molds with compressed-air guns. The calcination is done in a chamber kiln at 1450°–1480° C. Synthetic aluminum meta hydroxide forms a thixotropic mass with water with which considerable amounts of corundum etc. can be bound.

It is thought that the invention and its advantages will be understood from the foregoing description and it is apparent that various changes may be made in the construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing its material advantages, the form and the article hereinbefore described being merely a preferred embodiment of the invention.

I claim:

A vacuum receptacle for installations for the degassing of metals, especially iron, comprising a kettle and a connecting piece, said kettle being lined with baked magnesite bricks which contain at least 95% MgO and not more than 2% Fe_2O_3, 2% SiO_2, 2% Al_2O_3 and 1% CaO, and said connecting piece being lined with corundum bricks consisting only of corundum.

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CHARLIE T. MOON, *Primary Examiner.*

TOBIAS E. LEVOW, *Examiner.*

J. E. POER, *Assistant Examiner.*