June 3, 1958 L. M. PIDGEON 2,837,328

APPARATUS FOR PRODUCING MAGNESIUM

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Fig. 1

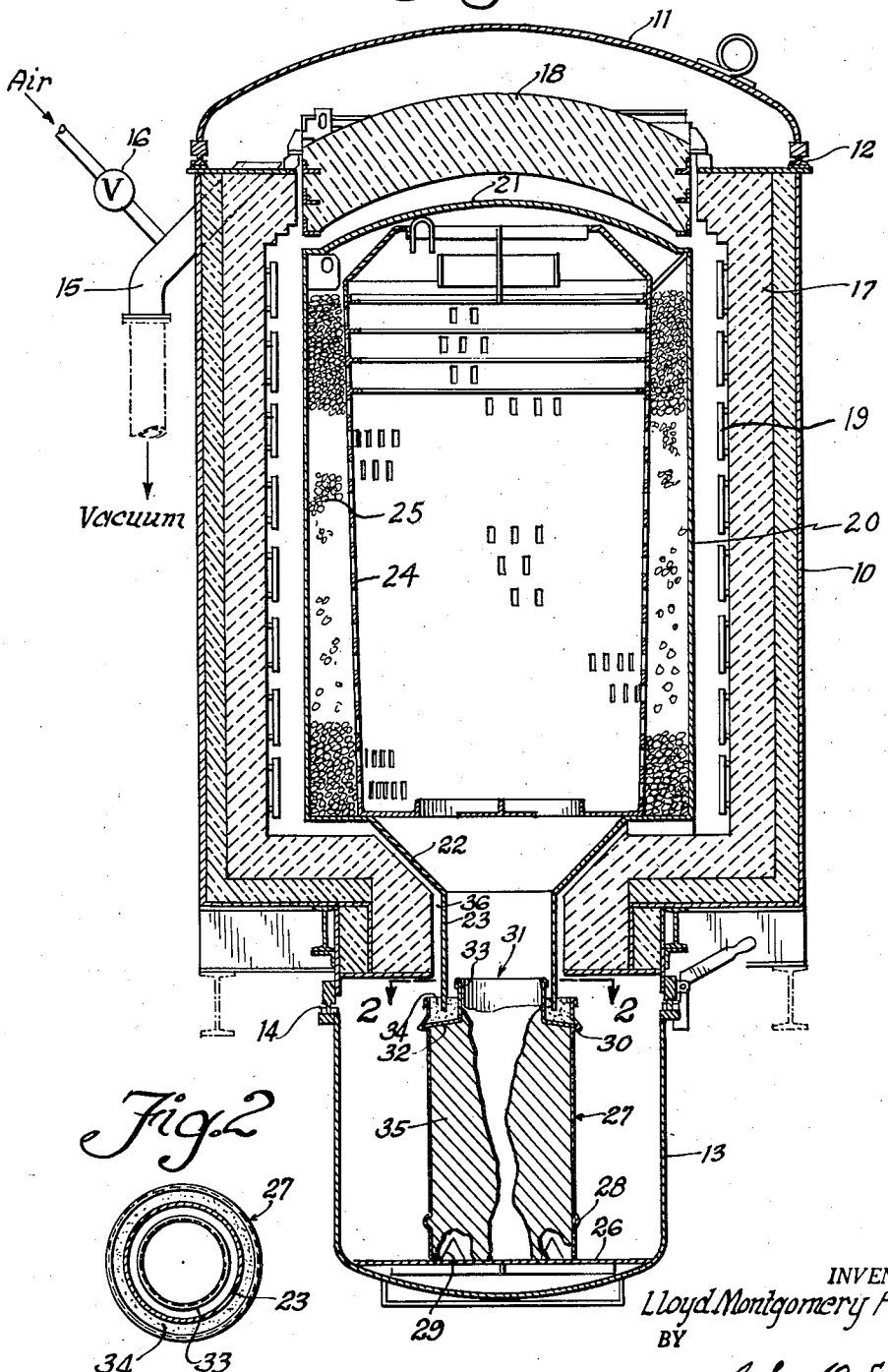

Fig. 2

INVENTOR.
Lloyd Montgomery Pidgeon
BY
John O. Evans, Jr.
Attorney

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Fig. 3

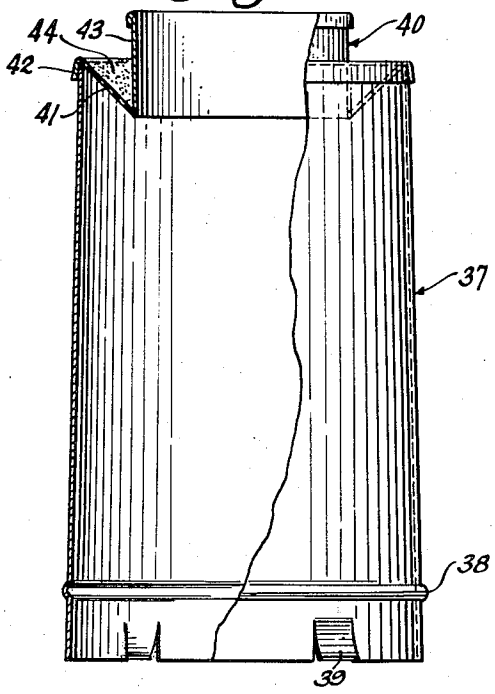
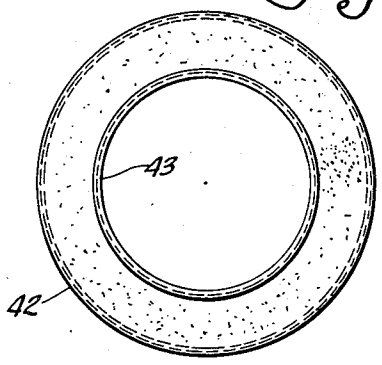


Fig. 4



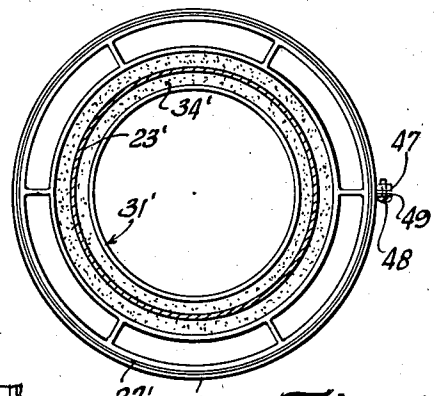
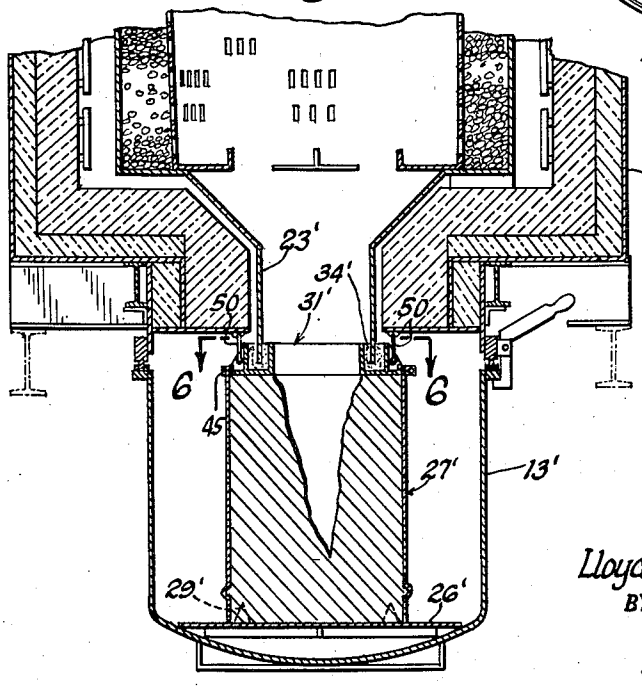


Fig. 6

Fig. 5



INVENTOR.
Lloyd Montgomery Pidgeon
BY
John O. Evans Jr.
Attorney

United States Patent Office

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APPARATUS FOR PRODUCING MAGNESIUM

Lloyd Montgomery Pidgeon, Toronto, Ontario, Canada, assignor to Chromium Mining & Smelting Corporation, Limited, Sault Ste. Marie, Ontario, Canada, a corporation of Canada

Application January 27, 1953, Serial No. 333,457

4 Claims. (Cl. 266—15)

This invention relates to apparatus for producing magnesium, and more particularly to a condenser sleeve wherein vapors of magnesium are condensed. The invention pertains particularly to a condensing sleeve having sealing means and adapted to be used in magnesium furnaces of the type disclosed in U. S. Patent No. 2,386,189, issued to Glen D. Bagley, October 9, 1945, for "Apparatus for Producing Magnesium."

In accordance with the invention, a device for condensing metallic vapors, such as those produced in a furnace having a throat pipe, includes an elongated sleeve member, an endless trough portion adjacent one end of said sleeve member adapted to receive the end of the throat pipe of the furnace producing metallic vapors, the sleeve providing an opening within the eye of the trough portion for establishing communication between the interior of the sleeve member and the furnace throat, the trough portion being adapted to contain sand to provide a seal between the sleeve member and the throat pipe. The trough portion may be formed integrally with the sleeve portion or it may be a separate member that is removably attached to the sleeve member.

An object of the invention is to provide apparatus for producing magnesium including a vapor condensing sleeve that provides an effective seal between the sleeve and the throat portion of a furnace with which the condensing sleeve is associated. Such sealing means substantially prevents the escape of metallic vapors from the condensing sleeve to other portions of the furnace where the vapors condense and build up encrustations that damage the furnace. Such sealing means moreover effects improvement in metal recovery.

Other objects of the invention are to provide a sleeve for condensing vapors of magnesium and the like that is simple to manufacture and that is readily connected to and removed from the furnace in operation.

In the drawings, showing several forms of the invention:

Fig. 1 is a vertical axial sectional view of a magnesium furnace having a condensing sleeve associated therewith;

Fig. 2 is a horizontal sectional view taken along the line 2—2 of Fig. 1.

Fig. 3 is an elevational view, partly in section, showing another form of condenser sleeve;

Fig. 4 is a plan view of the condenser sleeve shown in Fig. 3;

Fig. 5 is a partial vertical axial sectional view of a furnace similar to that shown in Fig. 1 and incorporating still another form of condensing sleeve and sealing arrangement; and

Fig. 6 is an enlarged sectional view taken along the line 6—6 of Fig. 5.

Referring to the drawings, particularly Figs. 1 and 2 thereof, the furnace shown is one for producing magnesium wherein calcined dolomite is reacted with a silicon containing material at elevated temperature and in high vacuum to produce vapors of magnesium that pass from the reaction zone of the furnace to a condensing

zone wherein the magnesium is condensed and recovered in solid form. The furnace has an outer cylindrical steel shell 10 provided with a removable steel cover 11 that fits the shell 10 along a vacuum seal 12. A condenser shell 13 is removably fitted to the bottom of the shell 10, and is provided with a vacuum seal 14 at the joint. A vacuum line 15 communicates with the interior of the vacuum furnace and is connected exteriorly to a conventional vacuum pump (not shown). The vacuum line is provided with a vacuum relief valve 16 opening to the atmosphere.

The vacuum furnace shell 10 has a high temperature resistant insulating lining 17 provided with a removable top insulating plug 18 that is made of high temperature resistant ceramic material.

A plurality of electric resistance heating elements 19 are mounted on the interior surface of the furnace liner 17 and the usual electrical connections (not shown) supply power to the elements for heating.

Inside the furnace is positioned a generally cylindrical charge can 20 having a removable cover 21 at the top. The bottom of the can opens into an inverted truncated conical portion 22 connected to a cylindrical throat member 23 that leads into the condenser shell 13. Inside the charge can is an apertured downward tapering charge can gate 24 that is removable from the charge can in an upward direction. Included between the can 20 and the gate 24 is the charge 25 consisting of pellets of finely ground and intimately mixed calcined dolomite and ferrosilicon reducing agent. The can and gate structure holds the charge in position to be heated by the heating elements 19.

Within the condenser shell 13 positioned upon a horizontal plate member 26 is a metallic vapor condenser sleeve 27. The sleeve is formed of light gauge steel and has a circumferential strengthening rib 28 near the bottom. Triangular apertures 29 are formed in the bottom of the sleeve to facilitate withdrawal of gases during the initial degassing stage of the reduction cycle. The sleeve has a second circumferential rib 30 formed near the top of the sleeve. Received in the interior depression of the rib 30 is a top member 31 having a flange portion 32, the periphery of which rests in the depression of the rib 30, and a vertically extending neck 33. It will be seen that the sleeve 27 and top member 31 cooperate to provide a circumferential trough open at the top into which the throat 23 of the furnace depends. The trough is filled with sand 34, calcined dolomite, or the like, and provides a vapor-tight joint between the sleeve 27 and the furnace throat 23. Magnesium vapors produced in the furnace are directed through the throat 23 into the sleeve 27, wherein they are condensed to form a crown 35 of magnesium. Magnesium vapors are prevented from escaping around the throat 23 and condensing about the vacum seal 14 or finding their way through the space 36 between the charge can throat and the furnace liner 17 to condense in this space or to diffuse to and attack the heating elements 19.

Referring to Figs. 3 and 4 of the drawings, a modified form of condensing sleeve is shown which includes a sleeve member 37 that is slightly tapered toward the top. The sleeve has a strengthening rib 38 formed therein near the bottom and is provided with tongues 39 that may be bent outwardly or inwardly from the body of the sleeve to provide gas vents at the bottom. A top member 40 has an inverted frustoconical flange portion 41 having a rim 42 turned over the upper edge of the sleeve. An upstanding cylindrical neck portion 43 is welded or otherwise suitably affixed to the inner rim of the flange 41. Flange 41 and neck 43 cooperate to provide a trough that is filled with sand 44 or other suitable sealing material.

It will be seen that top member 40 is constructed and arranged to receive the throat portion of a vacuum magnesium furnace and to seal the condenser sleeve to the furnace throat.

It will also be seen that the tapering configuration of the sleeve 37 permits the sleeve to be readliy stripped from a crown of solidified magnesium that has condensed therein.

Referring to Figs. 5 and 6, another form of condenser sleeve construction is shown. The furnace shown in Fig. 5 is similar to that shown in Fig. 1 and described hereinbefore. The furnace has an outer steel vacuum shell 10', a removable condenser shell 13' and a throat portion 23' extending down into the condenser section. A condenser sleeve 27' is positioned in the condenser shell 13' on a bedplate 26'. The bottom of the sleeve may have vents 29'. The top member 31' is preferably formed of a metal casting that is removably attached to the top edge of the sleeve. The top member provides a sealing trough filled with sand 34' that is adapted to receive in sealing relation the depending throat 23' of the furnace. The top casting 31' is received in the upper end of the sleeve 27' and the sleeve is secured to the casting by means of a flexible metal band 45 that is tensioned around the assembly and secured by means of a nut 47 and bolt 48 passing through holes in ears 49 of the securing band.

As seen in Fig. 5, the top casting 31' is suspended from the furnace by means of hangers 50.

In operation when the furnace reduction cycle has been completed, the condenser shell 13' is removed from the furnace and the weight of the filled condenser shell 27' is usually sufficient to cause a separation of the sleeve 27' from the top piece 31' which remains suspended from the furnace. In reassembling the condenser it is a simple matter first to secure to the top piece 31 a fresh sleeve 27' and thereafter to reassemble the condenser shell 13'.

From the foregoing description it will be seen that the present invention provides apparatus for producing magnesium wherein the condenser sleeves are easily assembled and disassembled. When a condenser sleeve is positioned in the furnace the sand seal cooperating with the furnace throat effectively directs the vapors of magnesium into the condenser sleeve without loss of vapors to other parts of the furnace.

It will be apparent that many modifications of condenser devices in accordance with the invention may be made in the light of the foregoing description without departing from the spirit of the invention.

I claim:

1. In combination with a condenser shell of the type that is suspended beneath the downwardly directed throat member of a vacuum furnace, an open-ended, cylindrical sleeve adapted to rest on one end in said condenser, an upwardly open trough disposed on the upper end of said sleeve, said trough having a diameter and its side walls having a height such that when the condenser with the sleeve is positioned beneath the furnace, the furnace throat will extend into the trough.

2. The combination of claim 1, wherein the lower end of the sleeve is notched to permit movement of air from the sleeve into the shell.

3. The combination of claim 1, wherein the furnace throat and the trough are circular.

4. The combination of claim 1, wherein the inside wall of the trough is substantially higher than the outside wall of the trough so that when in position it extends up into the throat of the furnace.

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