

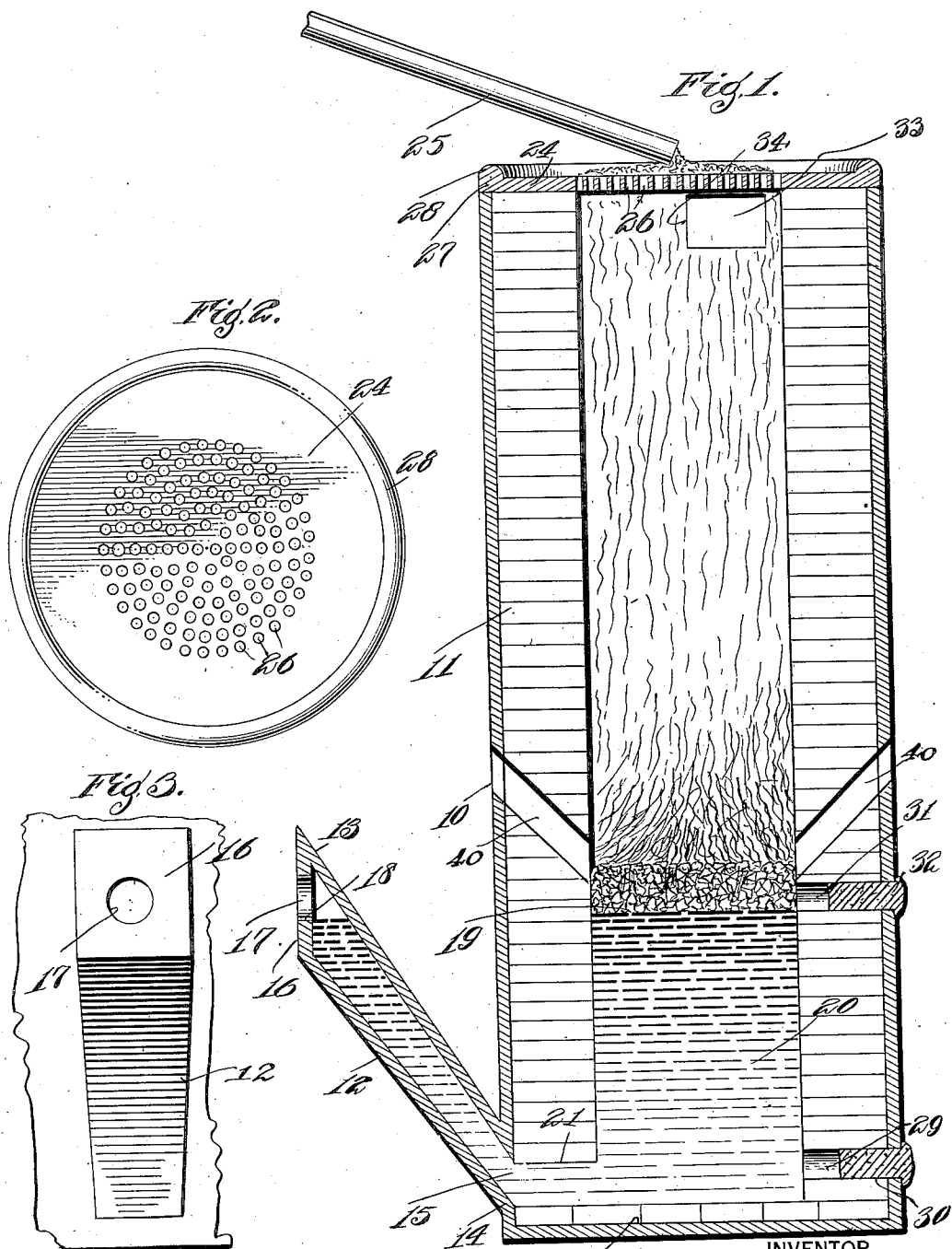
April 8, 1930.

L. JONES

1,753,891

APPARATUS FOR THE REDUCTION OF IMPURITIES CONTAMINATING MOLTEN METAL

Filed July 19, 1928



Witnesses
F. M. Taylor
Harry C. Seidel

INVENTOR
Llewellyn Jones
 BY *Mumford & Co.*
 ATTORNEY

UNITED STATES PATENT OFFICE

LLEWELLYN JONES, OF MUNCIE, INDIANA

APPARATUS FOR THE REDUCTION OF IMPURITIES CONTAMINATING MOLTEN METAL

Application filed July 19, 1928. Serial No. 293,963.

This invention relates to an apparatus for the reduction of impurities in molten metals and is an improvement on the process and apparatus described and claimed in my Patent
5 #1,472,006 dated October 23, 1923.

In carrying out the inventive idea dependence is placed in a converter for the reduction of certain impurities by the forcing of air upwardly through a charge of molten metal or
10 by resorting to a low pressure over the surface of the metal in side blowing converters. In this case, which is similar to the furnace melt, the metal ebullates rising from the bottom to the surface in order to secure contact.

15 It is an object of the present invention to provide an apparatus for the reduction of essential elements in order to improve the qualities of metal, by the use of a slag to cause the elimination of oxides, gases and metalloids
20 from the molten metal obtained from a cupola or furnace, the molten metal being filtered through molten slag, the slag being removed from the level of the molten metal while at the same time replenishing with fresh slag,
25 or introducing any factor as a reagent or scavenger to the slag, or air may be forced in contact with the metal to hasten reduction of the carbon.

A further object of the invention is the provision of an apparatus in the form of an open vessel partially filled with a filtering material, such as molten slag, the open end being
30 partially closed with a perforated disk, formed of fire resistant material of a highly refractory clay, this being provided with a
35 plurality of perforations, the bottom of the vessel having an outlet in communication with the bottom of the vessel for discharging the molten metal at a point approximately
40 adjacent the level of the molten metal, the discharge end being of a greater diameter than the inlet end, with the discharge end provided with a passage normally plugged,
45 for removing lean slag which is exhausted and which may be drained from the surface of the molten metal.

This invention will be best understood from a consideration of the following detailed description, in connection with the accompanying drawings; nevertheless, it is to

be understood that the invention is not confined to the disclosure, being susceptible of such changes and modifications as shall define no material departure from the salient features of the invention as expressed in the
55 appended claim.

In the drawings:—

Figure 1 is a section of a vessel in which the reduction of elements such as oxides, gases, and metalloids in the molten metal is
60 carried out.

Figure 2 is a plan view of a perforated disk normally disposed in line with the open end of the vessel,

Figure 3 is a view in elevation of the outer
65 end of the discharge spout.

Referring more particularly to the drawings, 10 designates an outer metal shell of a vessel which is interiorly lined with a refractory material 11. The vessel is open at
70 the top and the bottom is provided with a discharge spout 12, which is formed of metal from plate stock and may be cast integrally with the shell 10 or connected thereto in any
75 approved manner.

The spout tapers from the outer upper end 13 to the lower inner end 14 so that the port 15 is of less diameter than the upper end of the spout. The spout is provided with a partition 16 at the outer end thereof which has a
80 discharge opening 17 disposed in substantially the same horizontal plane as the level 19 of the molten metal 20 in the vessel. The port 15 is at the outer end of a discharge passage 21 formed through the
85 interior lining 11. The discharge opening is located sufficiently above the bottom 22 of the vessel that a certain quantity of the molten metal 20 will be entrapped in the
90 lower end of the vessel.

The vessel is provided with a predetermined thickness of molten slag, which can be prepared in a separate furnace or cupola, if volume is desired, but a small charge may be developed by melting glass in a separate vessel. The slag is adapted to float upon the top
95 of the molten metal 20 when sufficient liquid metal has been poured into the vessel to provide a level as indicated at 19.

While the vessel is normally open at the
100

top, I provide a perforated disk 24 made of a high refractory material which will stand the intense heat of the molten metal when poured from a spout 25. The member 24 consists of a disk having a plurality of perforations 26 of such cross sectional area as will be suitable for the purpose. The portions of the disk, as shown at 27, adjacent the periphery rest upon the upper end of the refractory lining 11 and a flange 28 at the periphery and rising above the outer surface of said disk will aid in preventing the molten metal from splashing over the sides of the perforated disk. The disk also acts to break the fall of the incoming stream of molten metal.

An opening 29 is formed at the lower end of the retort through the refractory lining 11 and also in the outer casing 10 to provide a passage for the removal of the molten metal from the vessel whenever it may be desired. A plug 30 composed of clay is adapted to normally maintain the passage closed to prevent the loss of metal during the carrying out of the process.

Passages 40 for the introduction of oxygen or air under pressure, are provided in the walls of the retort. The port slants through the lining 11 and also the casing at an acute angle to deflect air over the surface of the molten metal, when so desired for reducing essential elements.

A passage 31 is formed in the lining 11 and also in the casing 10 at a point which is substantially in the same horizontal plane as the level of the molten metal liquid 20, whereby the weak slag or contaminated slags may be drained off at this point. A plug 32 of clay is adapted to maintain the passage 31 normally closed.

An opening 34 is formed in the upper end of the wall 11 and the casing 10 to permit the exhausted gases to escape and also acting as an inlet for the replenishing of essential compounds for aiding in building up the slag or for bringing the compounds into contact with the metal by the aid of the slag. This port may be closed by a brick when desired.

In carrying out my process the vessel 10 of my apparatus should be conveniently located in line with the pouring spout of a cupola or vessel used in pouring molten metal, or in line with the run spout of a furnace. The passages 29 and 31 are plugged as shown, prior to the pouring of the metal into the vessel. As the molten metal strikes the disk member 29 it is broken into finely divided streams and disintegrated in this manner before it enters the vessel and passes on into the slag which rises to the top of the entrapped molten metal, (not shown).

As the molten metal reaches the level 19 a plug at the throat of the spout is forced back and the metal flows from the port 17. The pouring of the molten metal in its sprayed effect and disintegrated condition through

the slag causes the metal to pass out through the spout 12. Since the metal upon leaving the furnace or cupola has a temperature of approximately 2700° F. the metal heats the slag and maintains it at the same temperature.

The treatment of the metal by the molten slag has a decided use in trapping off the oxides, metalloids, and gases entrained in the metal due to the fact that the molten slag has an affinity for these elements and therefore the slag acts as a scavenger and a reagent in the fluxing of the metal. In this manner the slag is able to contain and retain elements essential to the quality of the metal. As the molten metal is in a sprayed and disintegrated condition it offers a wide range of attack by the reducing gaseous effects of the compounds or minerals used in connection with the slag, and since some of the compounds are highly volatile they can be retarded and retained by the blanket of slag. Other reducing agents may be resorted to to act upon the metal in this sprayed and disintegrated condition.

When necessary a battery of the vessels may be so connected that the molten metal passing through the first vessel will be discharged through the spout of the first vessel and into a second vessel to provide a continuous path whereby the molten metal may be acted upon by the chemical condition of the slag and its compounds.

It may be required to divide the volume of the molten metal leaving the spout of a cupola or furnace into a number of streams with each directed to a separate apparatus since the flow may be too great to handle as a single stream.

During the melting down process of the metal the volatilized mineral gases and other elements which contaminate the metal and which are entrapped in the molten metal are acted upon by the reagents and compounds in the molten slag or sinter which float upon the molten metal. It will be noted that the filtering process functions continuously as the metal percolates or passes through the slag and whereby the metal is washed by the slag and cleansed of impurities by reason of the strong affinity of the different slags for the gases. These impurities which contaminate the molten metal if not reduced will injure subsequent castings.

The weak and exhausted contaminated slag is revived but when spent is undesirable and is removed from time to time from the level 19 of the liquid 20 through the passage 31 after the plug has been removed.

Other materials such as re-agents or scavengers can be introduced through the opening 34 for the replenishing of the slag during its now possible to revive or build up slags by the present method and apparatus. By tapering the spout 12 it will be seen that a better

balance is had between the two columns of liquid, and the slag, and better access to the plug used in the throat of the pouring spout is provided for.

I claim:—

5 An apparatus for the reduction of the elements from molten metals, which has been run directly from a melting unit comprising an open vessel formed of a metal shell, a
10 refractory lining within the shell, said shell and lining being provided with an outlet passage adjacent the lower end thereof, a discharge spout connected with the passage and tapering from the outer free end thereof to-
15 wards the inner end where it is connected with the passage in the shell and lining, the outer free end of the spout being provided with a discharge port, the shell and lining having air inlet passages opening into the
20 vessels at points above but adjacent a horizontal plane passing through the discharge port of the spout.

LLEWELLYN JONES.

25

30

35

40

45

50

55

60

65