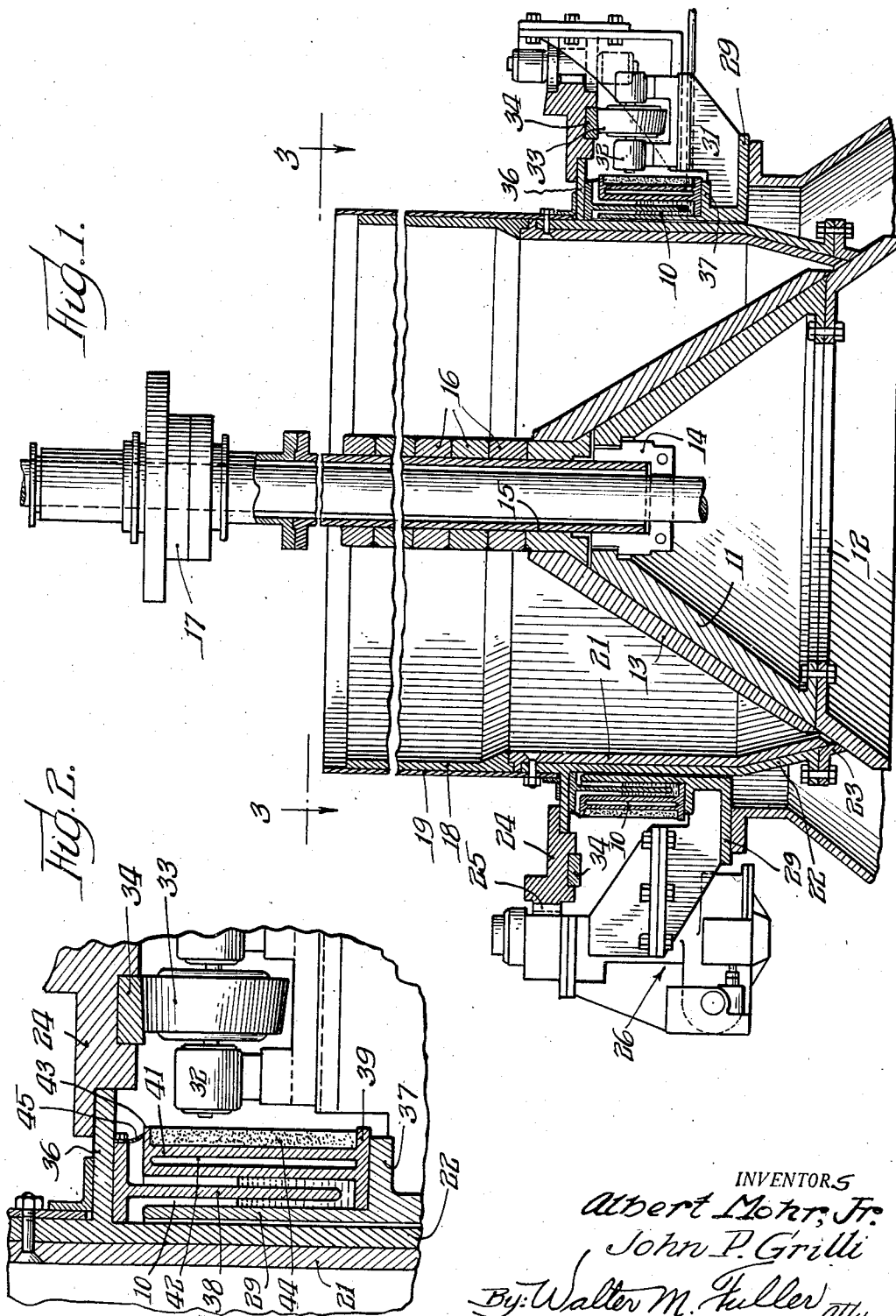


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FOR CHARGING IRON BLAST FURNACES
Filed Nov. 28, 1945

2,429,481

2 Sheets-Sheet 1



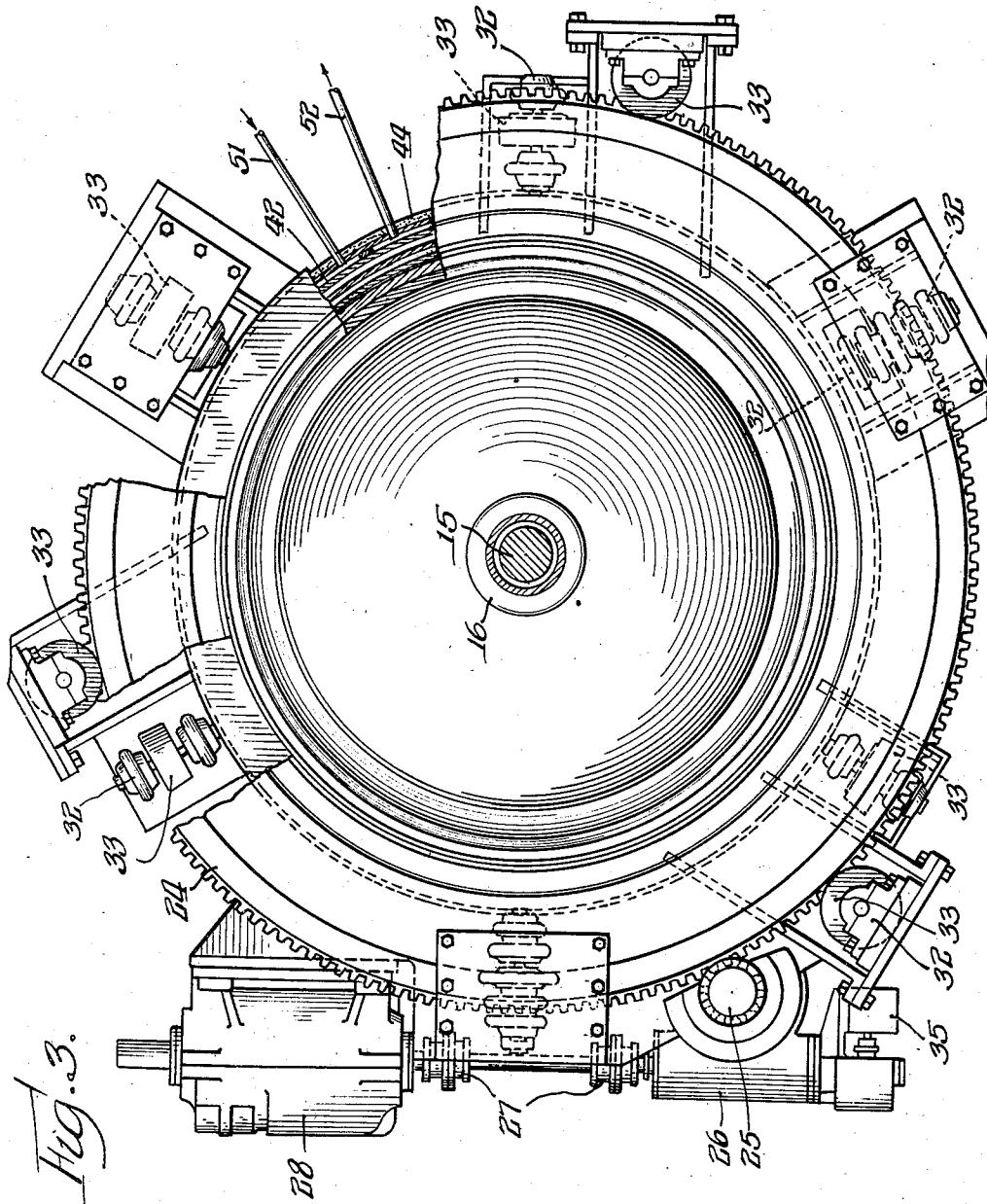
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UNITED STATES PATENT OFFICE

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SEALING MEANS FOR REVOLVING DISTRIBUTOR FOR CHARGING IRON-BLAST FURNACES

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For many years revolving distributors have been used in the charging of iron blast-furnaces to tend to even out the irregular amounts of materials deposited in the furnace, due to the nonuniform placing of the charging materials on the small bell of the furnace.

In a double-skip charged furnace the materials are always high on the side of the skip which has dumped and the slope of the materials in the small-bell hopper is a function of the angle of repose of the materials and, to correct this condition at least partially, the following course has been pursued for some time in the art.

The first charge, which generally consists of one skip of ore, one skip of ore, one skip of stone, one skip of coke, one skip of coke, one skip of coke, and one skip of coke, is dumped on the lower large bell without any rotation of the small upper bell and its hopper and is then dumped into the furnace by opening the large bell on which it rests.

In the second charge, the skip load of material is dumped into the small-bell hopper and then such small bell, its hopper, and the charge therein is revolved sixty degrees whereupon the bell is opened delivering the charge onto the lower large bell.

In the third charge the angle of hopper rotation is 120 degrees, in the fourth 180 degrees, in the fifth 240 degrees, in the sixth 300 degrees, and the next charge is at zero degrees, that is, at the original starting point.

When the complete charge has been delivered onto the large underlying bell it is dumped into the furnace.

In the case described, an angle of sixty degrees was indicated, but any other angle of intermittent rotation could be chosen.

It will be understood in the case mentioned that by using the discontinuously-revolved charge-receiving distributor the points of dispersion of the materials will be six instead of two, and, therefore, the materials will lay in the furnace much more uniformly.

On a large iron blast-furnace these distributors, which must operate in a location which is very dirty, hot and gassy, are about one hundred and fifty feet above the ground and the amount of supervision which they require is ordinarily relatively small.

The construction of such equipment is crude and no substantial advance has been made in this type of appliance for several years, blast-furnace operators having considered it necessary to almost completely replace the distributor every year.

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The principal cause of this destruction of the mechanism is the leakage of hot, dirty gas incorporating abrasive dust through the packing-glands of the stationary spider-ring and the revolving distributor-bell and hopper.

In the present-day constructions soft packing is placed in a packing-gland, or a heavy grease labyrinth type gland is used, such styles of glands being crude and practically useless for this type of service in that these small-bell hoppers are six feet to seven feet in diameter and in a very short time they warp and become out-of-round, which makes it impossible to have a tight seal and at once the hot dirty gas begins to destroy the gland.

In some cases hoppers of a diameter of six feet have become out-of-round a half-inch after only two weeks of operation.

This hot, abrasive gas escaping through this leaky gland deposits its solid materials in all the moving and wearing parts of the distributor and in a short period of time the wear and cutting action of this abrasive material, which is a mixture of fine coke, iron ore and stone, will have destroyed all of the satisfactory operative properties of the distributor mechanism.

After much work and experimentation with flexible glands, we have discovered that seemingly the only type of seal that is substantially frictionless and also gas-tight is a molten-metallic seal.

We have tried mercury, but due to its great capacity to unite with impurities and become fouled, we were not successful in employing this as a metallic seal.

The molten metallic alloy which we have found that gives us the best service in this application has been a low melting point alloy which melts at approximately 158° Fahr. and has the following analysis: lead 26.7%, tin 13.3%, cadmium 10.0% and bismuth 50.0%, the reason for the success of this type of alloy being that it will not become fouled due to the impurities in the gases and will not tend to form any chemical union or amalgams with the containing parts of the seal.

In order that those trained and skilled in this art may have a complete understanding of the beneficial structural and functional characteristics of a construction incorporating our new invention, a present preferred embodiment of the same has been illustrated in the accompanying drawings forming a part of this specification and to which reference should be had in connection with the following detailed description, like reference numerals having been employed for the

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same mechanical parts in the several views of these drawings.

In such drawings:

Figure 1 is a vertical section through the distributor including its small bell and hopper;

Figure 2 is a fragmentary, enlarged section showing the novel and improved seal employed; and

Figure 3 is a horizontal section on line 3—3 of Figure 1.

Referring to these drawings, 11 is the upper, small-bell referred to above which has mounted thereon, so as to be replaceable or removable, a frustum-cone manganese-steel seat-member 12 forming a flaring extension of the conical surface of the bell itself.

Such bell, externally protected with a replaceable manganese-steel wearing-cover 13, is equipped with a supporting head 14 having a square section so that it and the bell will turn together, the head being mounted on the lower end of an upright, split-pipe 15 which supports the head 14 and its companion bell 11, such pipe or hollow, small-bell rod 15 being encased in a series of removable, manganese-steel wearing-rings 16, 16.

A ball-bearing, not shown, housed within the part 17, sustains the weight of the small-bell 11, 12, 13 and its supporting hollow-rod 15 and the rings 16 allowing them to rotate about the axis of the part 15.

Manganese-steel wearing-plates 18 line the upper receiving-hopper 19, and 21 are similar wearing-plates for the small-bell hopper 22, 23 being a removable or demountable manganese-steel ring-seat at the bottom of hopper 22.

A ring-gear 24 surrounding and fastened to the small-bell hopper 21 is rotated by means of a pinion 25 driven by a worm-gear reducer 26 through shafting and flexible couplings 27 and electric-motor 28.

A main, round spider-frame or encasing, circular member 29 supports the brackets 31 which carry the several bearing-assemblies 32 with their supporting and guiding rollers 33 of which there are six sets of supporting-rollers, three sets of vertical-guiding rollers and three sets of hold-down rollers, the supporting-rollers running on a hardened-steel race 34, a limit-switch 35 of common design being employed to control the amount of angular rotation.

The annular, molten-metal gas-seal, designated as a whole 10, comprising the subject-matter of the present invention, is shown perhaps most clearly in Figure 2 and is incorporated between the outstanding, circular, rotary flange 36 of, and integral with, the rotary hopper-wall 21, and a lower, exterior, stationary flange 37 on the circular member 29.

Secured to and depending from flange 36 is a circular blade 38 extending into, but not reaching the bottom of, an annular trough having as its inner, vertical wall the upstanding, thin, circular portion of member 29 and having as its outer wall a heating member having a base 39, constituting the bottom of the trough, upstanding from which is a hollow, cylindrical portion 41 whose circular chamber is characterized 42, the top of such element 41 having a horizontal, outstanding lip 43.

The exterior surface of heating element 41 between its base 39 and its lip 43 is covered with a suitable heat-insulating jacket 44 to prevent undue heat loss to the atmosphere, the circular space 42 containing the heating medium which

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may be either steam or electrical means or other appropriate heating medium.

The trough, U-shape in vertical cross-section, constituting the gas-seal is filled with the molten alloy referred to which is always maintained in melted condition by the heat supplied from the heater, this being at about 158° Fahr., the space between the top of the blade 38 and the upper surface of the lip 43 being closed by a sealing-strip 45 of any suitable character such as brake-lining.

Experience has shown that the molten seal is efficiently gas-tight and practically frictionless, the rate of rotation of the associated hopper being relatively slow, and the construction will not allow any furnace gases to escape, thereby preventing warping and cutting of the machinery by the hot, dirty, abrasive furnace-blast gas.

The mechanical operation of this improved revolving distributor is the same as the old type already described except that heat is necessarily furnished to maintain the metal in the gas-seal in molten condition at all times when the appliance is in operation and except for the elimination of the prior sealing difficulties heretofore encountered.

When steam is used as the heating medium, it may be supplied to the circular chamber 42 through an admission pipe 51 and delivered therefrom through a conduit 52, the chamber or compartment 42 between these two pipes being closed as illustrated in Figure 3.

Obviously, when an electric heater is employed suitable conducting means for the current will be supplied.

Those skilled in and acquainted with this art will readily understand that this invention is not necessarily limited and restricted to the precise and exact details of construction and mode of operation illustrated and described and that reasonable modifications may be resorted to without departure from the heart and essence of the invention, as defined by the appended claims, and without the loss or sacrifice of any of its material benefits and advantages.

We claim:

1. A gas-seal for a blast-furnace rotary distributor-hopper and its surrounding stationary member in which it revolves, including the combination of a stationary circular trough, sealing molten-metal occupying said trough, means to heat the metal in said trough to maintain it in molten condition, a circular wall on and revolvable with said hopper and depending into the molten-metal in said trough but terminating short of the bottom of the latter and out of contact with its side-walls, and means between said wall and the adjacent surface of said hopper closing the top of the space above the inner section of said trough, whereby escape of gas from between said hopper and stationary member is prevented by the molten-metal.

2. The gas-seal set forth in claim 1, in which said molten-metal is an alloy composed substantially approximately of lead 26.7%, tin 13.3%, cadmium 10.0% and bismuth 50.0%.

3. The gas-seal set forth in claim 1, including in addition a seal for the outer-portion of the space above said trough.

4. The gas-seal set forth in claim 1, in which the inner-wall of said trough is formed of at least a portion of said surrounding stationary member.

5. The gas-seal set forth in claim 1, in which said molten metal is an alloy composed substan-

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tially approximately of lead 26.7%, tin 13.3%, cadmium 10.0% and bismuth 50.0%, in which the outer-wall of said trough incorporates heating-means to maintain said alloy in the trough in molten condition, in which said outer-wall of the trough is externally covered with heat-insulating material and in which a seal closes the outer portion of the space above said trough.

6. The gas-seal set forth in claim 1, in which said heating means is in the outer wall of said trough.

7. The gas-seal set forth in claim 1, in which said heating means is in the outer wall of said trough and including also heat-insulation cover-

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ing the exterior surface of said outer wall of the trough.

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