H. H. CAMPBELL.

RECEIVER FOR MOLTEN METAL.

APPLICATION FILED FEB. 2, 1905.

907,680. Patented Dec. 22, 1908.

Fig. 1.

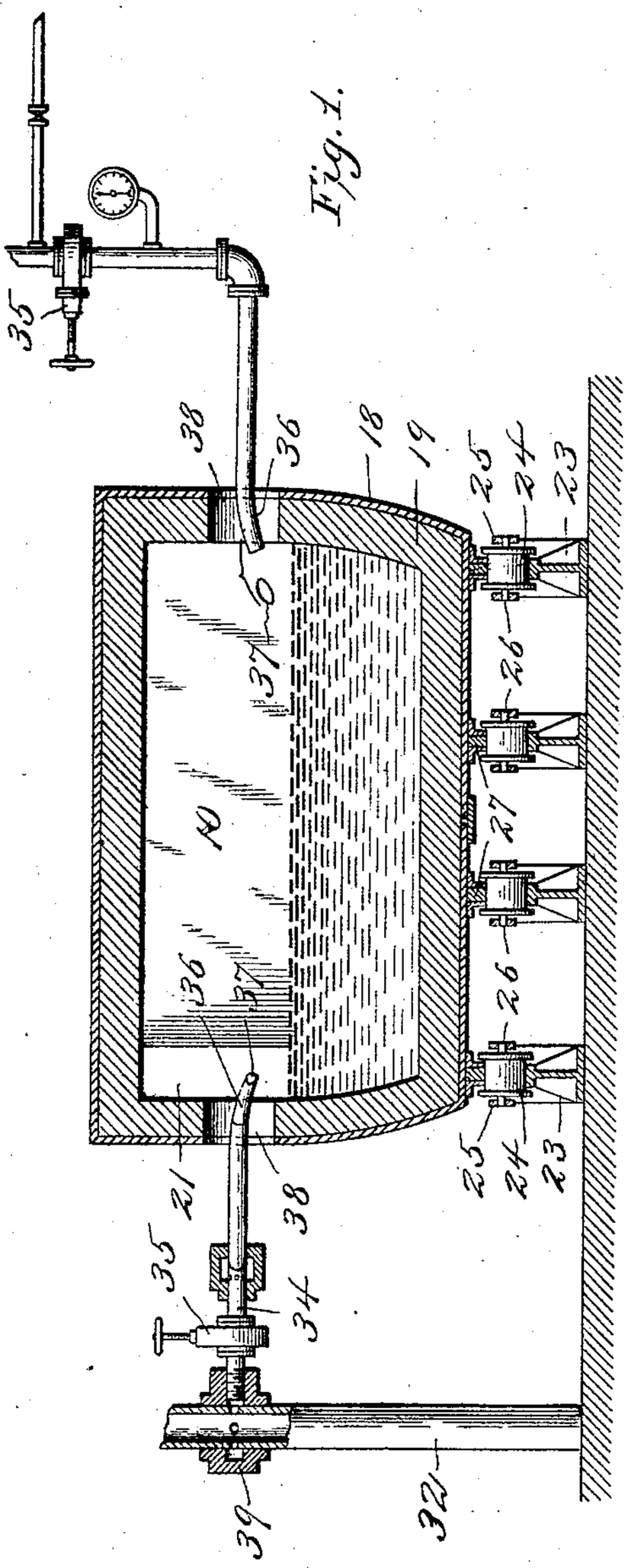
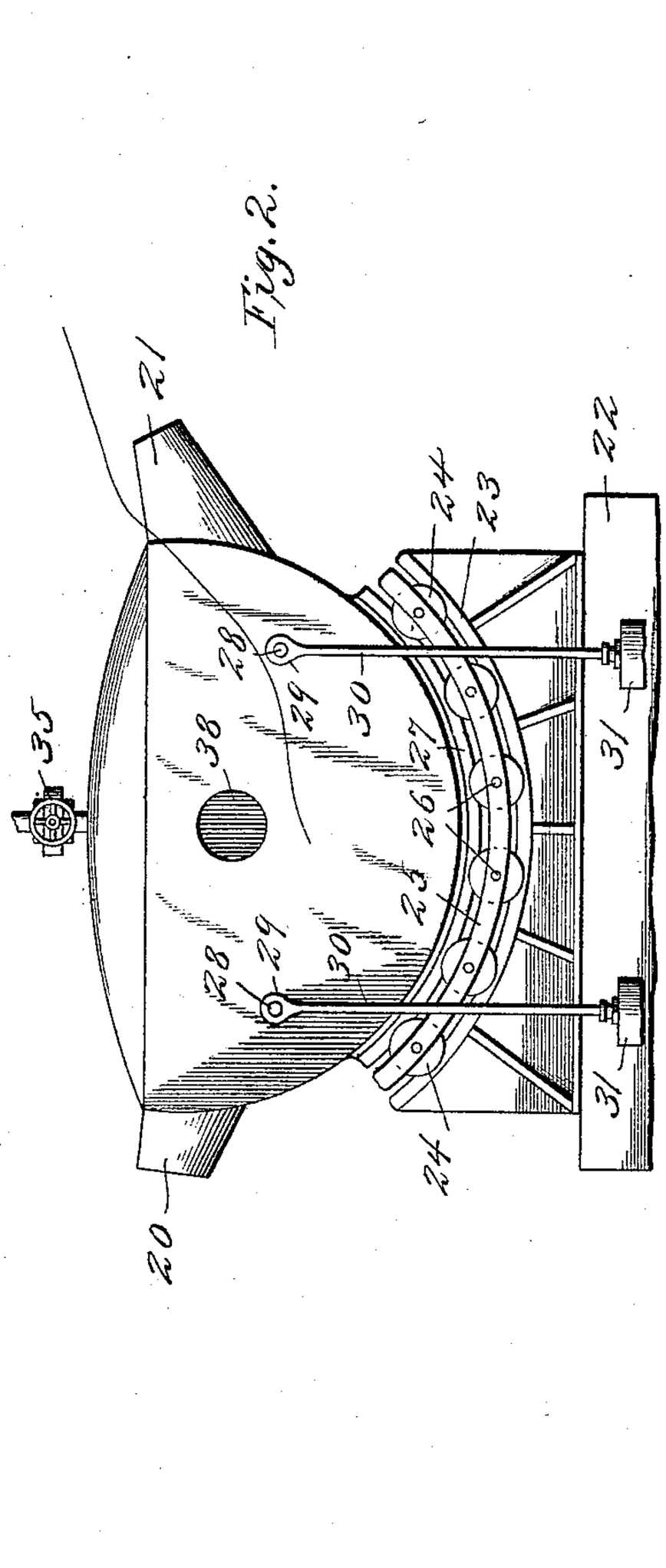


Fig. 2.



Witnesses.

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UNITED STATES PATENT OFFICE.

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RECEIVER FOR MOLTEN METAL.

No. 907,680. Specification of Letters Patent. Patented Dec. 22, 1908.

Original application filed November 22, 1904, Serial No. 233,857. Divided and this application filed February 2, 1905. Serial No. 243,869.

To all whom it may concern:

Be it known that I, HARRY HUSE CAMPBELL, a citizen of the United States, residing at Steelton, in the county of Dauphin and State of Pennsylvania, have invented certain new and useful Improvements in Receivers for Molten Metal; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to apparatus for use in the treatment of iron, being a division of my application for patent Serial No. 233,857, filed November 22, 1904, and comprises a receiver or container for the molten iron and means to direct a blast of air, preferably but not necessarily a blast of cold air onto the surface of the molten metal therein to keep the receiver clean or free from accretions adhering to its lining, as well as to keep the metal in a molten state until ready for charging into a converter or open hearth furnace, with details of construction hereinafter to be particularly described and claimed.

Referring to the drawings in which like parts are similarly designated—Figure 1 is a section through the receiver or container. Fig. 2 is a side elevation of the same.

In the manufacture of steel in a Bessemer plant, molten iron is charged into vessels called converters to be decarburized, desiliconized, etc., by the action of a blast of cold air. The molten iron is sometimes derived from pig-iron that has been melted in cupolas conveniently placed near the converters and is sometimes brought in a molten state direct from the blast furnaces in transfer ladles.

Inasmuch as the iron has to be tapped from a blast furnace at such times and in such quantity as may be necessary for the proper economic operation of the blast furnace and is generally transported to the steel plant as soon as practicable to avoid loss of heat, the molten pig-iron is liable to reach the steel plant or is ready for use, at times when it is impracticable to charge it into converters. I have found it expedient to provide one or more receivers into which the transfer ladles can promptly empty their contents of molten metal, so as to return promptly to the blast furnace. These receivers are, therefore, adapted to hold the molten iron in considerable quantity until it can be used in the converters, while fresh charges from the blast furnace are liable to be received before the molten iron in the receivers can be used. Hence it follows that the receivers must be used without opportunity for cleaning or repair for as long periods of time as the steel plant continues in operation.

As the molten pig-iron flows out from the blast furnace into the transfer ladles, it is frequently accompained by more or less "kish," a plumbago like substance that often forms in blast furnaces, and other substances more or less silicious. In transferring the molten iron into the receivers, these substances pass in with it, remain at or near the surface of the molten metal and accumulate, often becoming attached to the walls of the receiver and at all times promoting the formation of slag, metal skulls and other accretions on the walls of the receiver. The removal of such accretions by mechanical means, as by bars, chisels, etc., is very difficult and often liable to result in injury to the refractory linings of the receivers that keep the molten metal from contact with the metallic structure thereof, so that it has not been practicable to effect the removal of the accretions referred to, to any adequate extent while the receiver is in use. When the receiver is out of use and cold, the cleaning of the accretions of slag and skulls is also quite difficult, tedious and expensive and generally necessitates considerable repairing of the refractory lining to which the accretions have adhered. Thus it will be understood that any effectual means of preventing the accretion of kish, slag or skulls on the walls of the receiver, without mechanically removing them and thereby enabling the continuous and prolonged use of the receivers, is of very considerable importance in the production of steel where receivers are employed.

The receiver 10 comprises a metallic built-up casing or envelop 18 having a refractory

lining 19, provided with preferably, but not necessarily, a receiving spout 20, a discharging spout 21 and openings 38 in the sides in or about the axis of rotation of the receiver. On the bed 22 of the receiver is a set of circular or curved rails 23, on which are flanged rollers 24, held in their relative distances apart by plates 25, in which the axles 26 of the rollers 24 are journaled. On the bottom of the receiver are rails 27 that rest on the rollers.

On the side of the receiver, or on both sides, if necessary, are pins 28 with which engage eyes 29 of flexible piston rods 30, reciprocated from pneumatic or hydraulic cylinders 31 secured to the bed 22 of the receiver. The structure of these cylinders and pistons are those commonly used in connection with steel plants and therefore need no detailed description. By means of this device or devices, the receiver is tipped to pour part of its metal contents into the charging ladle through the pouring spout 21.

In proximity to the axis of rotation of the receiver and preferably between two such receivers, I place a blast pipe 32 to conduct a strong blast, preferably from the cold blast mains for supplying air to the Bessemer converters. Branches 34, from this blast pipe 32 are provided with valves 35 from which extend nozzles 36 having preferably, but not necessarily, a substantially elliptical discharge orifice 37. These nozzles extend freely through the openings 38 into the receiver and since they are in or about in the axis of rotation or tip of the receiver and considerably larger than the nozzles, they will not interfere with the pouring of metal from the receiver to the charging ladle.

The necks of valves 35 will be preferably arranged to swivel horizontally as shown at 39 and the nozzles 36 attached to the valves by rotatable connections 34, by which means the direction of the delivery of the blast can be controlled and delivered at any desired point of the surface of the molten metal. Any other method of conducting the blast, by which the direction of delivery of the blast into the receiver can be varied vertically or horizontally, may be used as may be found practicable and convenient.

Although I have shown the receiver provided with two blast nozzles 36, a single blast nozzle may be used. When two blast nozzles are used they are placed diametrically opposite as shown, and in or about in the axis of rotation of the receiver, one of them stationary and the other movable, or both may be made movable or stationary as the exigencies of the particular plant require or admit. When desired other nozzles can be inserted at various points of the periphery, as the particular plant using such receivers demand or admit, according to the size of the receiver, quantity and pressure of blast and the quantity of metal to be held in the receiver.

It will be observed that I have spoken of adjustable nozzles and although such as desirable, so that the blast can be directed in any portion of the receiver and adjusted for various levels of the molten contents, fixed nozzles can also be used, but when used, preferably like the adjustable nozzles, do not direct the blast radially into the receiver, but more or less tangentially to maintain as far as possible, a movement or rotation of the surface of the molten contents, so that the oxidation due to the air will reach all portions of the surface and effectually oxidize accumulations, lessen to a great extent their ability to adhere to the lining of the receiver and at the same time obtain a scouring action on the lining.

I have found that by using a strong air blast, preferably of the pressure used in Bessemer converters, introduced into the receiver above the surface of the metal and suitably directed, I am enabled to remove accumulations of kish, congealed metal or skulls, and other accretions incident to receivers, as above mentioned, by a process of combustion or decomposition effected by the oxygen of the air, burning out the carbon of the kish and melting the slag and other foreign substances, thus keeping the receiver clear of such obstructions for long periods of time and at the same time increasing the heat of the metal contained in the receiver. The application of my improvement to an open hearth steel plant is obvious if we have in lieu of the converters, open hearth furnaces of the usual form and provide an air compressor to furnish the air blast required.

Having thus described my invention, what I claim as new therein and desire to secure by Letters Patent, is:—

1. The combination with a lined open tilting receiver independent of the blast furnaces to contain at least one blast furnace run, said molten metal to be subsequently used in the manufacture of steel in other suitable apparatus; of means to direct a blast of air at any desired angle onto the surface of the molten metal to maintain a surface rotation in the receiver and oxidize the kish, thereby reducing the skulls to maintain the lining free from accretions, said means passing into the receiver at about its center of rotation and movable independently of the receiver.

2. The combination with a receiver for molten metal having openings in its sides at about its axis of rotation and means to tilt the receiver about said axis, of a cold air main, adjustable blast nozzles connected thereto and projecting through the openings into the receiver, and whose delivery ends are formed to direct a broad blast of air onto the surface of the metal in the receiver and

at an angle to maintain a circular movement of the surface of the molten contents, thereby consuming the "kish" and reducing the skulls and at the same time producing a scouring action on the lining, substantially as described.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

HARRY HUSE CAMPBELL.

Witnesses:
J. B. F. LAURIE,
GEO. W. PARSONS.