S. E. HITT.

PNEUMATIC APPARATUS FOR DISCHARGING FURNACES.

APPLICATION FILED SEPT. 16, 1907.

916,314. Patented Mar. 23, 1909.

FIG. 1.

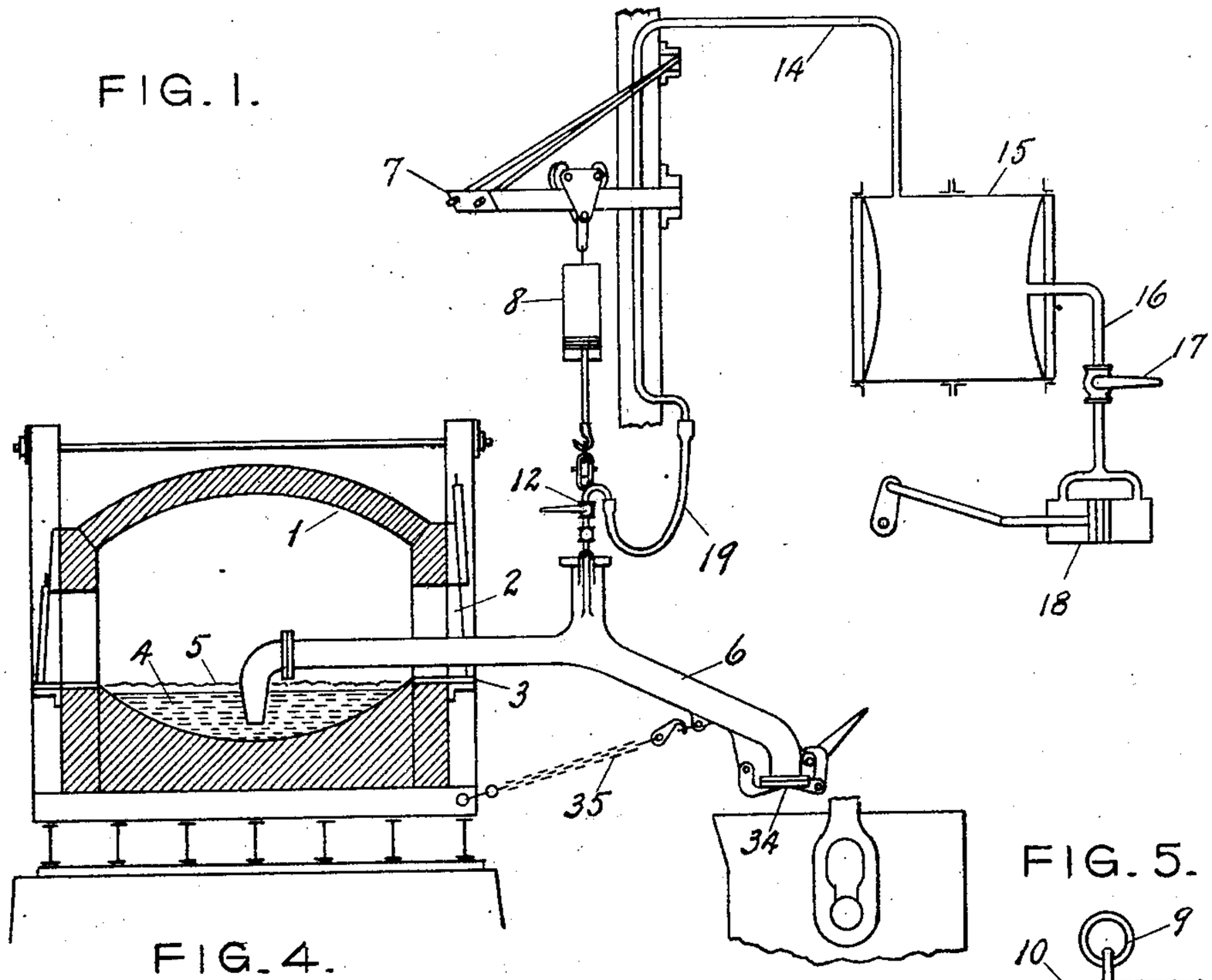
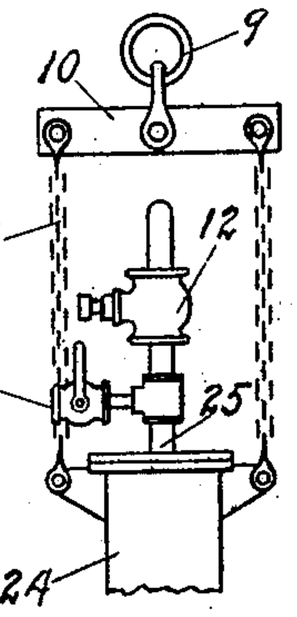


FIG. 4.

FIG. 5.



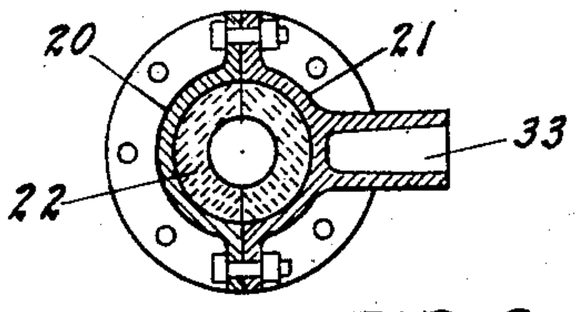
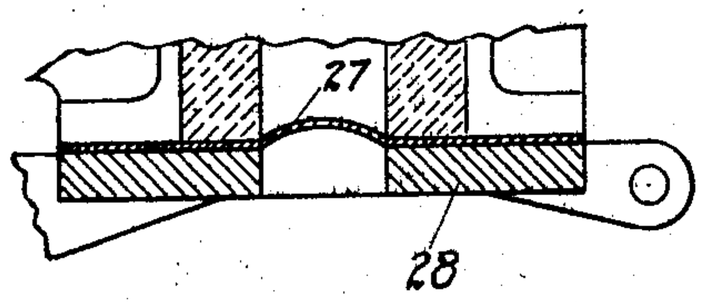


FIG. 2.

FIG. 3.



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PNEUMATIC APPARATUS FOR DISCHARGING FURNACES.

No. 916,314. Specification of Letters Patent. Patented March 23, 1909.

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To all whom it may concern:

Be it known that I, SAMUEL E. HITT, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Pneumatic Apparatus for Discharging Furnaces, of which the following is a specification.

The apparatus is applicable to what are known as open hearth, reverberatory, melting or smelting furnaces, to mixers, a heated receptacle for mixing molten metals, and to converters, in which molten metal is subjected to an oxidizing blast.

In the manufacture of open hearth steel my apparatus is particularly applicable to what is known as the continuous process, in which only about one quarter of the heat is tapped off at one time. In this process a highly basic ferruginous slag is formed, which floats on the surface of the bath and reacts upon the bath to eliminate the carbon, silicon, phosphorus, and other impurities. This slag is formed in some quantity and is generally poured off with the heat before its usefulness is gone; so it has been proposed to divert this slag in pouring and return it to the furnace until its reacting qualities are exhausted.

It is therefore the object of my invention to provide an apparatus for discharging such a furnace, *i. e.* with an open bath, without disturbing the slag floating upon the surface of the molten metal.

The rolling or tilting open hearth steel furnace is very effective in pouring, but is expensive both in first cost and in maintenance and for that reason is being largely replaced by stationary furnaces. In these stationary furnaces considerable annoyance and delay is caused by the present method of tapping. The spout must be well plugged with clay or other refractory material to withstand the pressure of the metal and is not easily removed. A delay of some minutes in tapping is frequently the cause of a material change in the composition of the metal. When, after considerable effort, the plug is removed, the metal flows freely, but the rate of flow is not subject to regulation with any degree of precision and the operation is crude.

It is therefore a further object of my invention to furnish a quick and efficient method of discharging a furnace and one by which the size of the stream can be regulated at any time during the discharge and by which the discharge can be instantly stopped.

In a general way, my invention consists in the use of a siphon to draw the molten metal up over the fore plate level and discharge it at a level lower than the surface of the molten metal or bath of the furnace, and means for starting the siphon.

In my invention the siphon is of refractory material, such as fire brick or burnt clay, or both, either with or without a casing, closed at the pouring end with a fusible plug or plate, is air tight and has a pipe connection for exhausting the air.

Another part of the apparatus required is some means for exhausting the siphon, such as a vacuum pump.

In its simplest form the apparatus would consist of a direct connection from the siphon to the vacuum pump, starting the pump when the vacuum is desired.

I consider the best construction for my apparatus is with a vacuum chamber between the siphon and the pump, or exhauster, with valves so arranged that the vacuum can be made ready in the chamber beforehand, ready for use when required. As the siphon is too heavy to be lifted by hand, some means of hoisting the same into position is also required. I also prefer the use of flexible pipe connections between the siphon and the vacuum chamber, so that everything can be made ready before the siphon is swung into place. These preferred constructions are shown in the drawings, in which:

Figure 1— is a cross section of an open hearth furnace, with the short leg of the siphon immersed in the bath, the lower leg extending over a ladle to be filled, the piping, vacuum chamber and pump being shown diagrammatically. Fig. 2— is an enlarged section of the siphon. Fig. 3— is a detail of the closed end of the siphon. Fig. 4— is a section on the line A—A of Fig. 2. Fig. 5— is a detail showing the suspension of the siphon.

Designation of numerals: 1 is a furnace with side door 2, fore plate 3 and bath 4, the flux or slag 5 floating on the surface of the bath. 6 is the siphon suspended from the crane 7 by the hoisting cylinder 8 and the fastenings 9, yoke 10 and chains 11. The siphon 6 is connected by the valve 12 and piping 14 with the vacuum chamber15 which is connected by piping 16 and valve 17 with the vacuum pump 18. Flexibility in the

piping 14 is effected by a length of flexible piping 19. I prefer to construct the siphon as shown in Fig. 2, with a casing in halves 20—21, that can be bolted or riveted together, as shown in Fig. 4. The two halves are first lined with fire brick 22 set with clay or with clay alone or other refractory material. The mouth-piece 23 is a hollow cylinder such as a length of tiling or elbow. The mouthpiece 23 in place, the two halves 20—21 with linings 22 are secured together and the siphon made air tight throughout its entire length by the use of clay or other refractory material. As the pipe connection to the vacuum chamber is liable to get stopped up before the siphon is fully exhausted and the stream of hot metal started, I prefer to make the siphon with a riser 24 of such a height that the molten metal cannot be forced to the top by atmospheric pressure, placing the pipe connection 25 at the top where it cannot be reached by the hot metal. The siphon casing is made with a detachable section 26 to facilitate the placing of the mouth piece 23. As shown in Fig. 3, the siphon 6 is closed at the pouring end by the fusible plate 27 held in position by the ring 28, hinged at 29 and secured by a latch 30 engaging the releasing lever 31. The fusible plate 27 is cemented in with fire clay or other refractory material to close the siphon air tight. When built up, the siphon is thoroughly baked in a drying oven to remove all traces of moisture. The fusible plate 27 is strong enough to withstand the atmospheric pressure on the area of opening of the siphon, but thin enough to be fused by the molten metal. The siphon 6 is suspended by the chains 11 from the yoke 10, permitting the valve 12 to be placed directly above the riser 24. The air valve 32 is placed between the valve 12 and the riser 24 for the purpose of admitting air to stop the discharge of the siphon. The socket 33, shown in Fig. 4, is for the introduction of a handle by which the siphon is manipulated by the operator to tilt the siphon, either for the purpose of changing the level of the pouring end, or of raising the inner or suction end out of immersion, so that the operation of the apparatus is not entirely dependent upon the hoisting mechanism or air valve.

The operation of my invention is as follows: The siphon being built up and made air tight, is hoisted to a position convenient to the door, pipe connection is made, the valve 12 closed and the valve 17 opened, the vacuum chamber is exhausted by operating the pump 18 or by other means, the valve 17 is closed when a good vacuum is attained in the chamber 15. The furnace side door 2 is then opened, the siphon 6 swung through the door, the mouth piece 23 immersed in the bath 4, the pouring end 34 adjusted to a level lower than the surface of the bath 4, and over a ladle or other receptacle to be filled, and secured in place by the anchor chain or chains 35, the valve 12 is then opened, the small volume of air in the siphon expanding into the larger chamber 15 causing practically a vacuum in the siphon. The atmospheric pressure upon the surface of the bath 4 then causes the molten metal to flow through the siphon over the fore plate 3 and down the pouring end or lower leg till it strikes the plate 27 which is instantly fused, allowing the stream of molten metal to go on and discharge into the ladle, thus establishing a stream which will continue to flow as long as the siphon is immersed in the bath and the pouring end 34 is at a level lower than the bath 4, *i. e.* enough lower to overcome friction of the stream in the pipe. When the valve 32 is opened, admitting air to the siphon, the discharge stops immediately.

In the application of my invention to practical furnace work various modifications in the arrangement and detail of the apparatus will doubtless be found advisable, as for instance the production of the vacuum, the means employed being of no consequence provided the vacuum can be produced in the siphon instantly at the will of the operator. I, therefore, wish to reserve the right to make such changes which can be made without departing from the spirit and original conception of the invention as herein set forth.

What I claim is:

1. In a melting or smelting furnace, a portable siphon open at the suction end for immersion in the furnace bath, closed at the pouring end with a fusible closure and means for exhausting the siphon when immersed in the furnace bath.

2. In a melting or smelting furnace, a portable siphon 6, closed at the pouring end with a fusible closure 27, a riser 24 at the top of the said siphon, means for exhausting the said siphon through the riser 24 and means for admitting air to the riser 24 to stop the operation of the siphon, substantially as specified.

3. In a melting or smelting furnace, a siphon of refractory material with metallic casing, open at the suction end for immersion in the furnace bath, closed at the pouring end with a fusible closure, a riser on the siphon, means for producing a vacuum, operating valves, flexible pipe connection from the said vacuum producing means to the said riser and means for moving the siphon into the pouring position, substantially as specified.

4. In a melting or smelting furnace, a siphon of refractory material with metallic casing, open at the suction end for immersion in the furnace bath, closed at the pouring end with a fusible closure, a riser on the siphon, a vacuum chamber, means for producing a vacuum, flexible pipe connection from the

said vacuum chamber to the said riser, valves in the pipe connections, means for moving the siphon into the pouring position and means for admitting air to the siphon to stop the discharge, substantially as specified.

5. In a melting or smelting furnace, a portable siphon of refractory material in halves 22, 22, a metallic casing in halves 20, 21, means for fastening the halves 20, 21 together, means for making the siphon air tight throughout, the said siphon open at the suction end for immersion in the furnace bath, closed at the pouring end with a fusible closure, a riser on the said siphon and means for exhausting the said siphon through the said riser, substantially as specified.

6. In a melting or smelting furnace, a portable siphon of refractory material in halves 22, 22, a solid mouth piece of refractory material 23, a metallic casing in halves 20, 21, means for fastening the halves 20, 21 together, means for making the siphon air tight throughout, the said siphon open at the suction end for immersion in the furnace bath, closed at the pouring end with a fusible closure, a riser on the said siphon and means for exhausting the siphon through the said riser, substantially as specified.

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Witnesses:
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