

No. 691,474.

Patented Jan. 21, 1902.

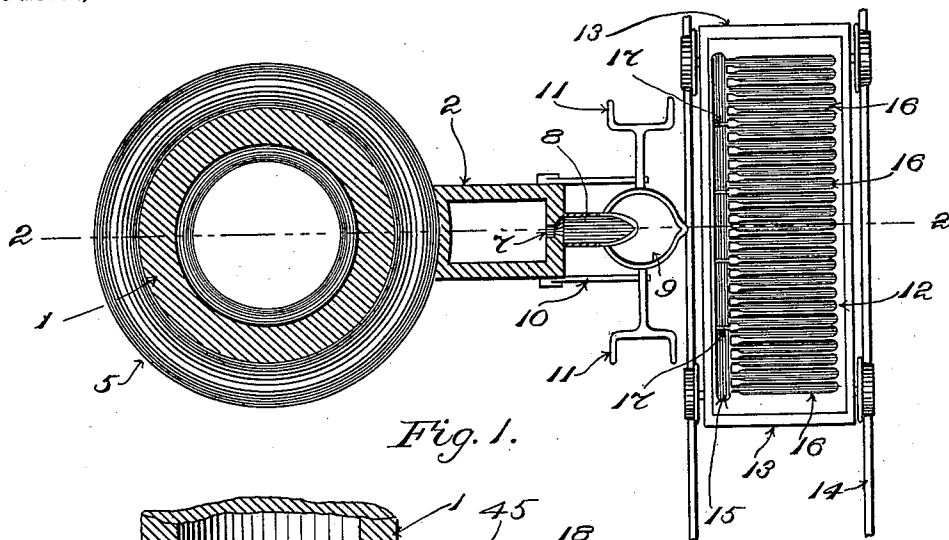
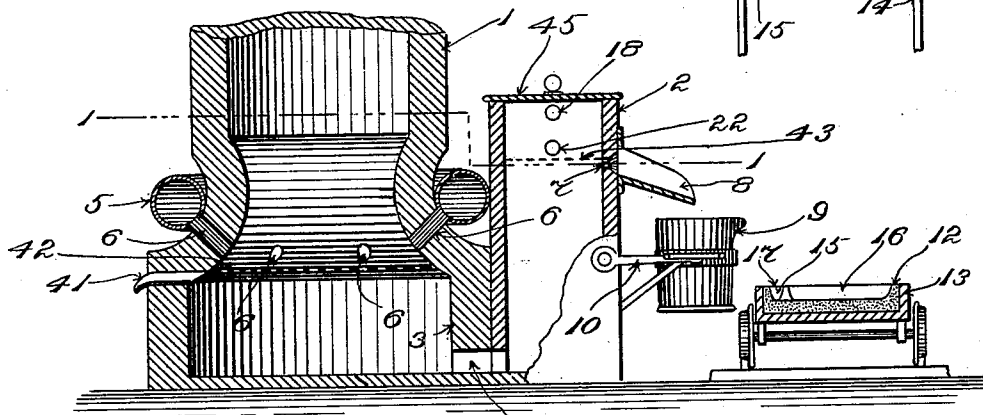
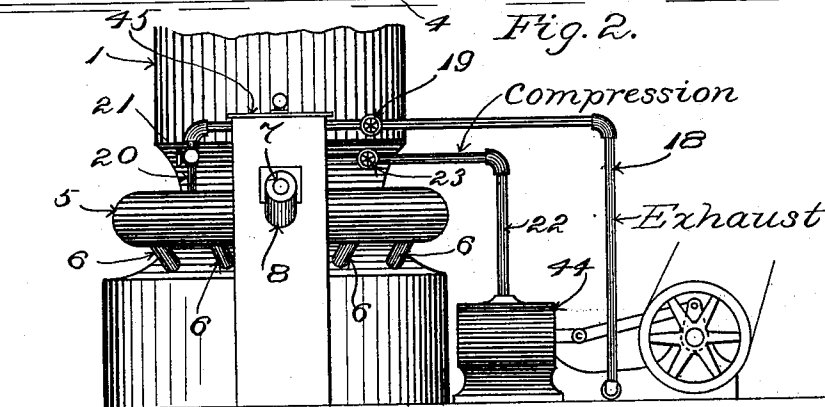
L. LINCOLN.

APPARATUS FOR CONTROLLING IRON IN BLAST FURNACES.

(Application filed July 25, 1899.)

(No Model.)

3 Sheets—Sheet 1.



Witnesses:

Oscar F. Gill
Lefine Hall Rice

Fig. 3.

by

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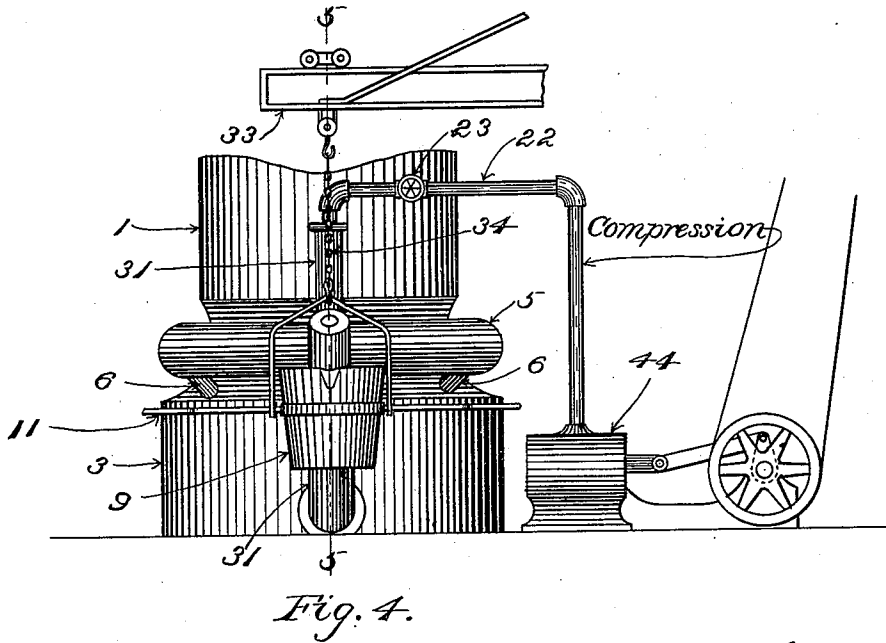
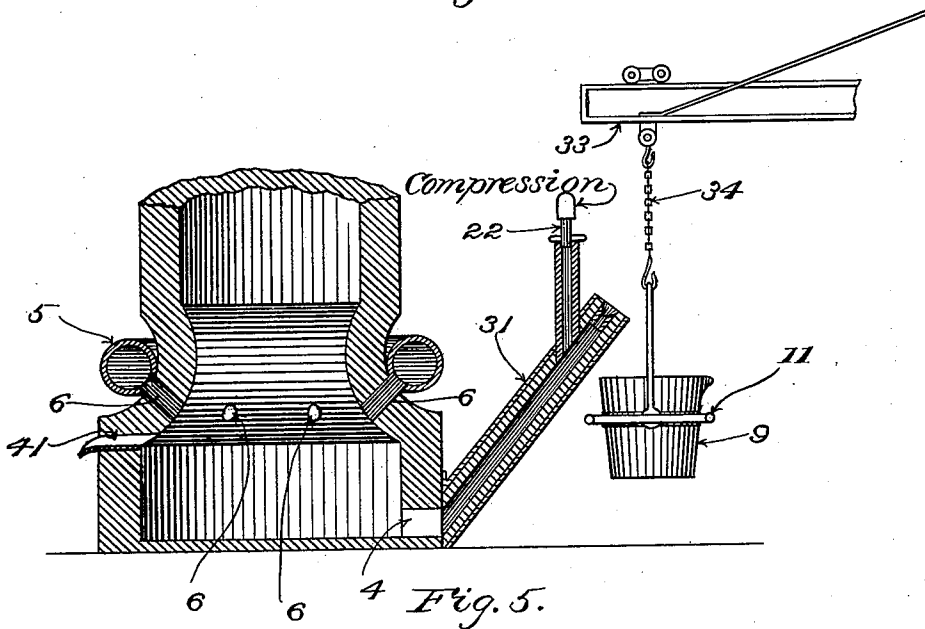
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APPARATUS FOR CONTROLLING IRON IN BLAST FURNACES.

(Application filed July 26, 1899.)

(No Model.)

3 Sheets—Sheet 2.



Witnesses:

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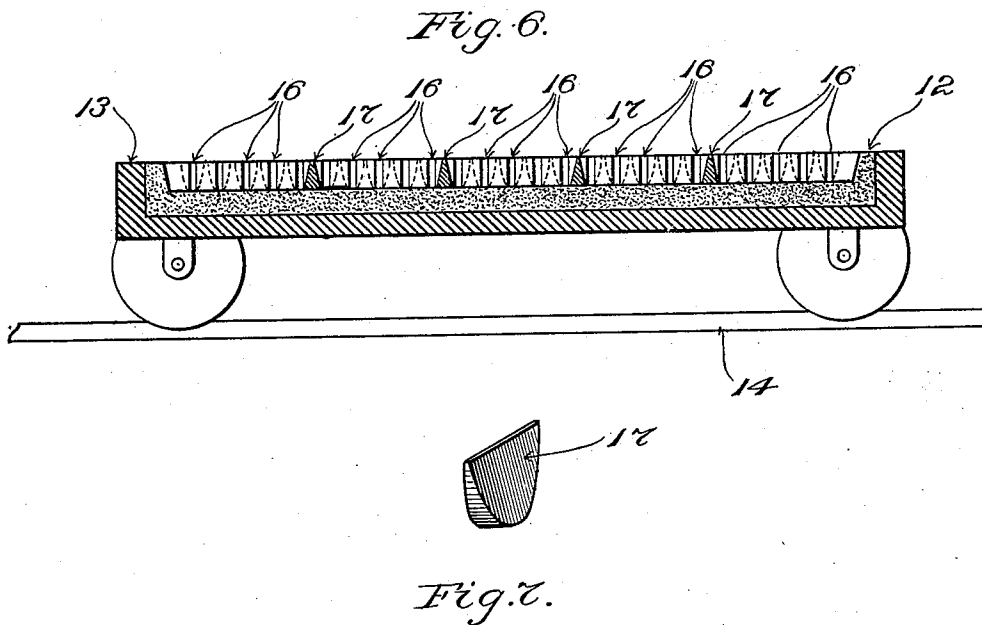
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3 Sheets—Sheet 3.



Witnesses:

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UNITED STATES PATENT OFFICE.

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TO CHARLES S. GOODING, OF BOSTON, MASSACHUSETTS.

APPARATUS FOR CONTROLLING IRON IN BLAST-FURNACES.

SPECIFICATION forming part of Letters Patent No. 691,474, dated January 21, 1902.

Application filed July 25, 1899. Serial No. 725,031. (No model.)

To all whom it may concern:

Be it known that I, LUTHER LINCOLN, a citizen of the United States, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Apparatus for Controlling Iron in Blast-Furnaces and Pigging the Same, of which the following is a specification.

My invention relates to an improvement in cupolas and blast-furnaces and apparatus connected therewith for pigging iron and illustrates one practical manner of carrying into operation my improved process for drawing molten metal from a receptacle, for which I have this day—June 4, 1901—executed an application for Letters Patent of the United States entitled "Process for drawing molten metal from a receptacle."

In a blast-furnace there is always a high pressure on the molten metal in the cupola or hearth of the furnace due both to the head and to the blast. When the metal is drawn off at or near the bottom, this high pressure is a serious obstacle to the proper handling of the metal and is much greater than in an air-furnace which has no blast.

The object of my invention is to control the iron in a cupola and blast-furnace, so as to get rid of or reduce the head and the pressure of the blast on the molten iron before the iron is drawn off and also to even the blast. In order to accomplish this, I combine with a cupola or blast-furnace an auxiliary reservoir or chamber connected with the hearth of the cupola or furnace by a passage for the molten metal and having an elevated discharge-outlet from the reservoir.

The invention will now be fully described, and the novel features thereof pointed out in the claims at the end of the specification.

In the drawings, Figure 1 is a section plan on line 1 1 of Fig. 2 of a blast-furnace and connected apparatus for pigging iron embodying my invention. Fig. 2 is a vertical section on line 2 2 of Fig. 1, the upper part of the furnace being broken away and the tilting ladle, with its supports, being shown in full. Fig. 3 is a side elevation of the furnace and reservoir. Fig. 4 is a side elevation, and

Fig. 5 is a vertical section, of a modified form. Fig. 6 is a longitudinal vertical section through the sow of the movable pig-bed on an enlarged scale. Fig. 7 is a perspective view of one of the movable wedges removed.

Adjacent to or adjoining the furnace 1 is a reservoir 2, connected with the hearth 3 of the furnace by a passage 4, preferably at or near the bottom. The relative heights of the furnace and the reservoir are not essential; but the reservoir should be high enough for the metal not to flow over the top or run into the compression or exhaust pipe or twyers, and this will depend upon the pressure of the blast. Surrounding the furnace is a twyer-pipe 5, having twyers 6 leading therefrom into the furnace, through which there is a constant blast of air into the furnace of from five to fifteen or more pounds pressure. In the side of the reservoir 2 at some elevation above the bottom there is a discharge-orifice 7, provided with a spout 8. In practical operation the mass of ore and burning coal in the contracted portion of the furnace formed by the bosh above the twyers is so compact that a draft through is obtained only by forced pressure, and although the top of the furnace is open there is practically no atmospheric pressure from that source on the molten metal in the hearth. The normal level 42 of the molten metal in the furnace is at the slag-hole 41, and in the reservoir the normal level 43 is at the spout-hole 7. In some kinds of blast-furnaces there is no slag-hole. In such furnaces the normal level will depend upon the force of the blast; but in all cases the normal level will be higher than the top of the passage-way leading from the cupola to the reservoir. The forced blast-pressure of the air in the furnace from the twyers is ordinarily sufficient to force the molten iron to rise in the reservoir and discharge through the spout 8. The height of the discharge-opening should be determined by the pressure of the blast. From the spout 8 the metal is delivered into the ladle 9, pivoted in brackets 10 and operated by handles 11. When the ladle is full or contains as much as is desired for a pouring, it is tilted on its pivots and poured into the pig-bed 12 beneath. There need be no inter-

ruption of the flow from the reservoir during the pouring, as the ladle will still remain in such position underneath the spout as to catch the discharge therefrom even when the ladle is tilted. The movable pig-bed 12 is preferably formed in an open box-car 13, running on a track 14. The molds are formed with a sow 15, extending along one side of the bed, and pigs 16, connected therewith. At intervals in the sow wedges or blocks 17 are placed to divide it into sections.

One of the advantages of my auxiliary reservoir is that it serves to even the blast. As the air is usually pumped into the twyers, the blast is uneven, being intermittent, according to the strokes of the piston. The pressure of the blast forces the metal up into the auxiliary reservoir and makes a reservoir in the hearth of the furnace and evens and steadies the blast and will keep the melted iron in circulation and mix it.

The pressure from the twyer-pipe alone is ordinarily sufficient to keep the metal in the reservoir 2 up to the full height of the discharge-orifice 7, so that the metal will discharge freely, but not forcibly, as when drawn out at the bottom of the hearth directly into runners. In order, however, to provide means by which the discharge can be quickened or the metal raised in case the pressure from the twyers is not sufficient, I connect the reservoir with an exhaust pump or chamber by a pipe 18, entering the reservoir 2 near the top. The exhaust-pipe is provided with a valve 19, which will be kept closed except when the exhaust is required to lift the metal in the reservoir.

Sometimes it is desired to equalize the pressure in the hearth and in the reservoir, so that the metal will be on a level in both places. In order to attain this result, I connect the twyer-pipe 5 with the upper part of the reservoir by a pipe 20, provided with a valve 21, so that by opening the valve the pressure will be equalized and the iron will drop down below the discharge-outlet.

Sometimes the metal in the reservoir becomes somewhat chilled, and it is desirable to drive it back into the furnace for reheating. In order to accomplish this, I connect the upper part of the reservoir with a compressed-air pipe 22, provided with a valve 23. By opening the valve of the compressed-air pipe 22 and closing the valve of the pipe 20, leading to the twyer-pipe, and closing the valve of the exhaust-pipe 18 the pressure on the metal in the reservoir will exceed that on the metal in the hearth and will drive the metal out of the reservoir back into the hearth. This method can also be employed to stop the discharge temporarily, if desired, for other purposes than reheating.

With a blast-furnace embodying my invention the pigging can be carried on continuously as fast as the iron melts, which is impossible in the usual form of construction.

When the metal is not being drawn off, the

spout may be plugged up with clay in the usual manner, and the cover 45 (see Figs. 2 and 3) may be removed to make an air-vent.

In the modification shown in Figs. 4 and 5, instead of a reservoir such as previously described I connect an upturned pipe or covered spout 31 with the passage 4 from the hearth, the spout rising to a sufficient height to discharge into a ladle 9. Such a spout I regard as an equivalent of the reservoir 2. The ladle can be tilted to pour the metal into a bed in a car beneath, or the ladle may be suspended from a crane 33 by a chain 34, as shown in Figs. 4 and 5, so that the ladle may be carried to a bed or mold or other receptacle farther away. The compressed-air pipe 22 can be connected with the spout 31 near its upper end and utilized in the same way as the compressed-air pipe previously described to force the metal back into the hearth. Also, if desired, an exhaust-pipe can be connected with the spout, and the spout can be connected with the twyer-pipe.

What I claim is—

1. In combination with a blast-furnace or cupola, an auxiliary reservoir or chamber for the molten metal connected with the hearth of the furnace or cupola by a continuous passage and having a discharge-outlet at an elevation higher than the bottom of the hearth, a twyer-pipe and twyers leading to the furnace, and a valved pipe leading from the twyer-pipe into the upper part of said reservoir or chamber, substantially as described.

2. In combination with a blast-furnace or cupola, an auxiliary reservoir or chamber for the molten metal connected with the hearth of the furnace or cupola by a continuous passage and having a discharge-outlet at an elevation higher than the bottom of the hearth, a compressed-air chamber and a valved pipe leading therefrom into said auxiliary reservoir or chamber at the upper part thereof, substantially as described.

3. In combination with a blast-furnace or cupola, an auxiliary reservoir or chamber for the molten metal connected with the hearth of the furnace by a continuous passage and having a discharge-outlet at an elevation higher than the bottom of the hearth, an exhaust-chamber and a valved pipe leading therefrom into the upper part of the auxiliary reservoir or chamber, substantially as described.

4. In combination with a blast-furnace or cupola, an auxiliary reservoir or chamber for the molten metal connected with the hearth of the furnace by a continuous passage and having a discharge-outlet at an elevation higher than the bottom of the hearth, a twyer-pipe and twyers leading to the furnace, a valved pipe leading from the twyer-pipe to the upper part of said auxiliary reservoir or chamber, a compressed-air chamber and a valved pipe leading therefrom into the upper part of said auxiliary reservoir or chamber, substantially as described.

5. In combination with a blast-furnace or cupola, twyers connected therewith, an auxiliary reservoir, a continuous passage for the molten metal leading from the hearth to said reservoir, a slag-outlet leading from the hearth without connecting with the reservoir, said reservoir rising higher than said slag-outlet, and an elevated discharge-outlet for the metal from the reservoir, substantially as described.
6. In combination with a blast-furnace or cupola having a slag-outlet leading directly from the hearth of the furnace or cupola, an auxiliary reservoir or chamber, a continuous passage for the molten metal between the hearth of the furnace and the auxiliary reservoir or chamber, a discharge-outlet for the metal from the auxiliary reservoir or chamber at an elevation higher than the slag-outlet from the hearth, and means by which a forced blast is introduced into the furnace or cupola above the molten metal, substantially as described.
- In testimony whereof I have affixed my signature in presence of two witnesses.
- LUTHER LINCOLN.
- Witnesses:
ROBERT WALLACE,
WILLIAM A. COPELAND.