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L. LINCOLN.

PROCESS OF DRAWING MOLTEN METAL FROM RECEPTACLES.

(Application filed June 10, 1901.)

(No Model.)

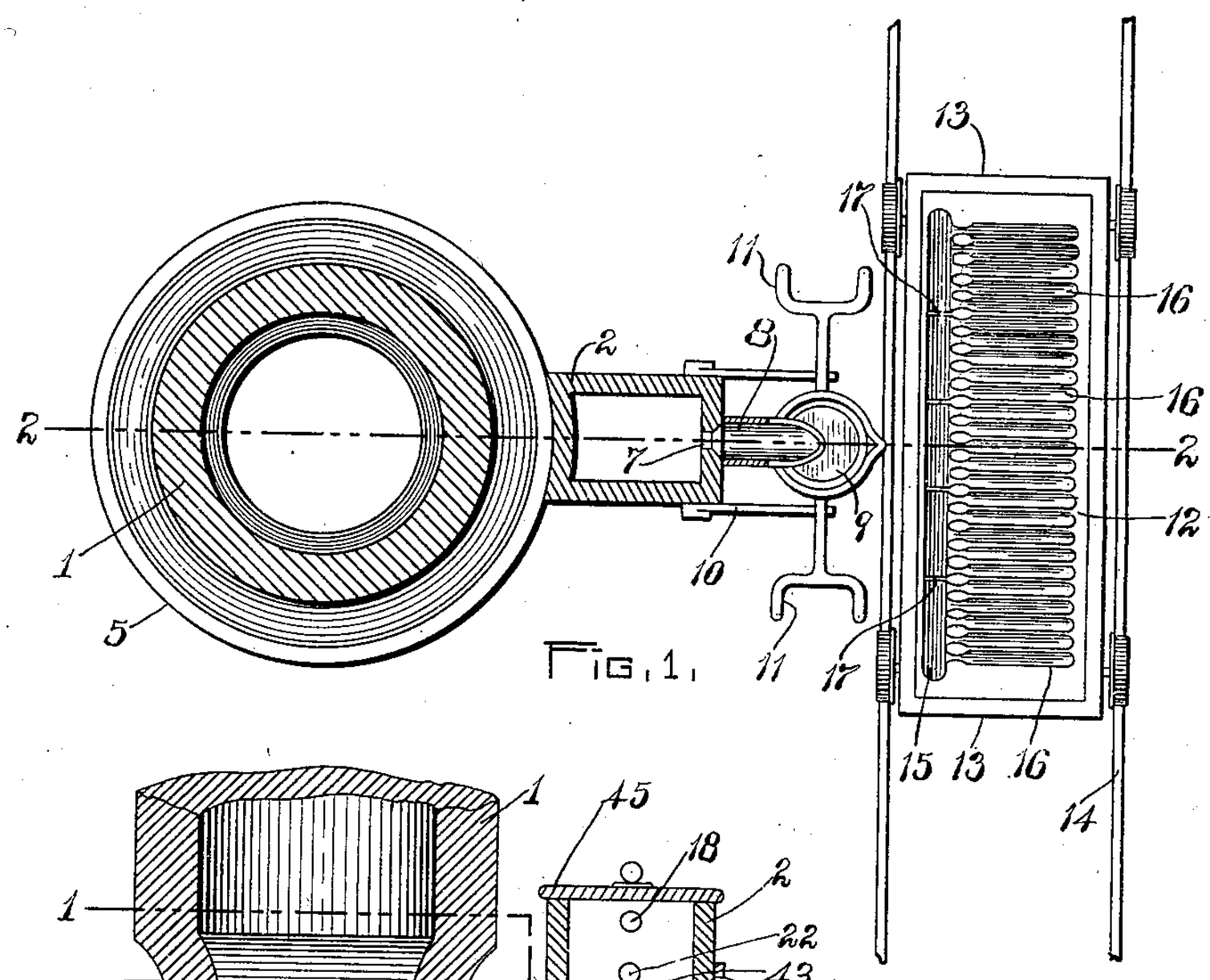

FIG. 1.

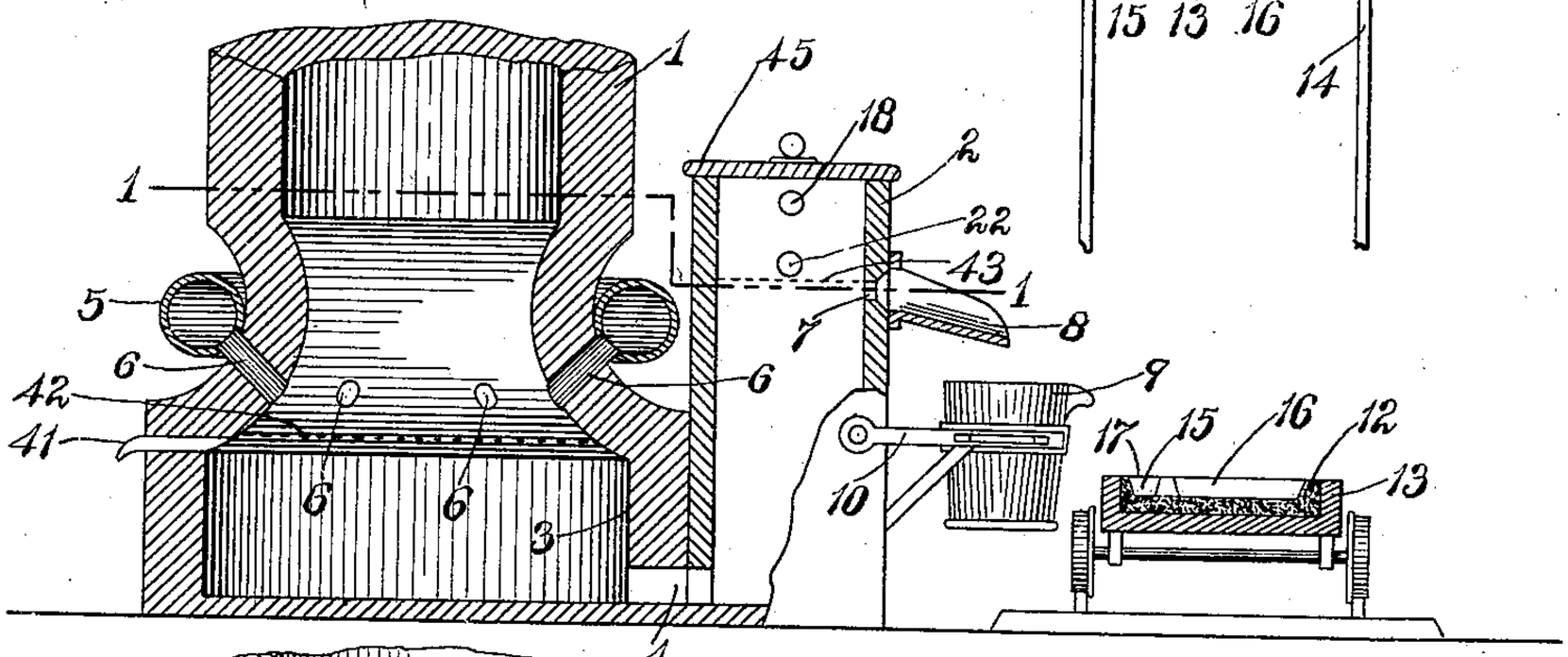

FIG. 2.

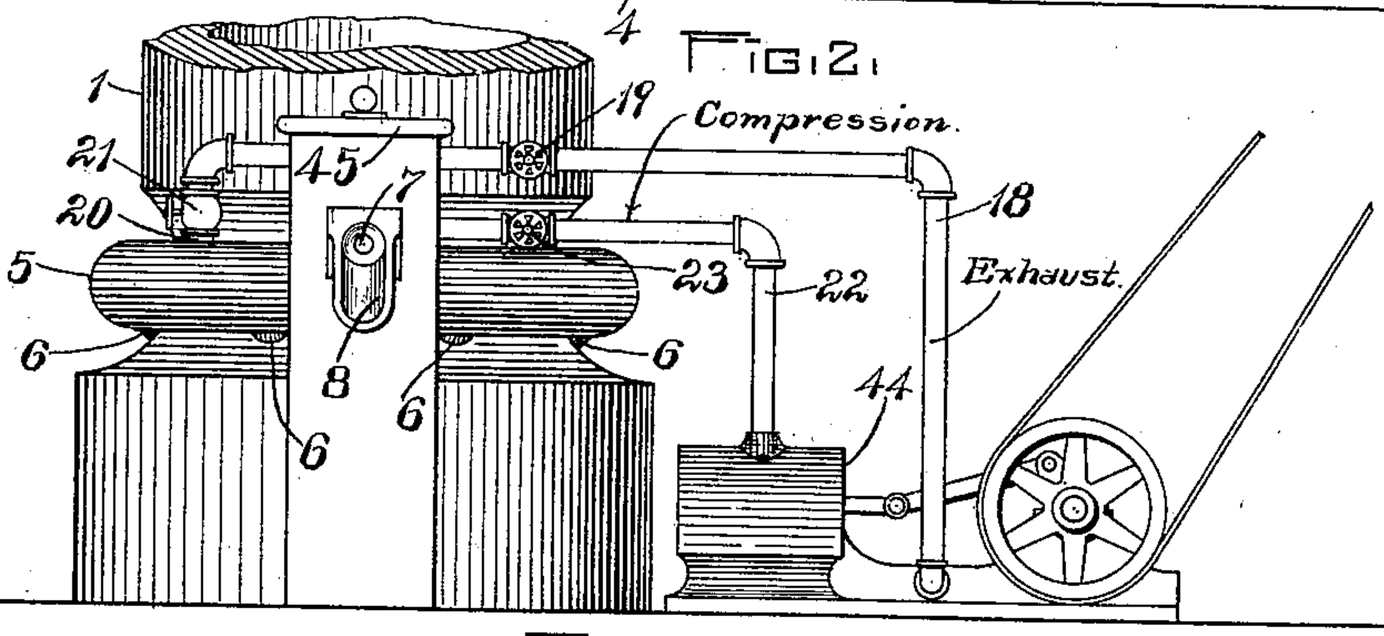

FIG. 3.

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UNITED STATES PATENT OFFICE.

LUTHER LINCOLN, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO CHARLES S. GOODING, OF BOSTON, MASSACHUSETTS.

PROCESS OF DRAWING MOLTEN METAL FROM RECEPTACLES.

SPECIFICATION forming part of Letters Patent No. 697,638, dated April 15, 1902.

Application filed June 10, 1901. Serial No. 63,898. (No specimens.)

To all whom it may concern:

Be it known that I, LUTHER LINCOLN, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented new and useful Improvements in Processes of Drawing Molten Metal from Receptacles, of which the following is a specification.

This invention relates to an improved process for drawing molten metal from a receptacle, and in another application, Serial No. 725,031, filed July 25, 1899, I have illustrated and described the construction and operation of an improved apparatus for controlling iron in a blast-furnace, by means of which I carry my process into practical operation. 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 improved process is to control the iron in a blast-furnace, so as to get rid of or reduce 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 consists in collecting the molten metal in a suitable receptacle, creating a superatmospheric air-pressure upon the surface of said molten metal, thereby maintaining it at a level below its normal level, forcing the molten metal into a second receptacle to a level higher than its normal level in said first-named receptacle, then tapping said molten mass in said second receptacle at a certain point, as set forth in the following specification and particularly pointed out in the claims thereof, and finally creating a superatmospheric air-pressure upon the surface of the molten metal in said second receptacle.

The invention further consists in collecting the molten metal in a suitable receptacle, creating a superatmospheric air-pressure upon the surface of said molten mass, thereby maintaining it at a level below its normal level and forcing a portion of the molten metal into a second receptacle, in which a partial vacuum is formed, to a level higher than its normal level in said first-named receptacle, then tapping said molten mass in said second receptacle at a certain point hereinafter set forth, and particularly pointed out in the claims.

In the drawings, Figure 1 is a section-plan on line 1 1 of Fig. 2 of a blast-furnace adapted to carry my improved process into practical operation and showing also connected therewith an apparatus for pigging iron. 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.

Like numerals refer to like parts throughout the views of the drawings.

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 nor-

mal 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 interruption 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.

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 substantially 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. The diameter of the pipe 20 and the area of the opening of the valve 21 are each larger than the diameter of the orifice or discharge-outlet 7, so that by opening said valve 21 a superatmospheric air-pressure will be created in the reservoir. The pressure in the reservoir and furnace thus being substantially equalized, the iron will drop down in said reservoir 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, also closing the discharge-outlet 7, 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.

While I have particularly shown and described my invention as applied to a blast-furnace, it will be understood that the blast-furnace is only one application of my improved process and that the said process may be applied to other receptacles containing molten iron beside a blast—as, for instance, molten metal may be contained in a closed ladle or other receptacle and a second receptacle joined to said ladle with an opening from the first to the second receptacle at the bottom thereof and a blast of air directed upon the surface of the molten mass in the first receptacle, raising the molten metal in the second receptacle to a level higher than its normal level in said first-named receptacle, and then tapping said molten mass in said second receptacle at a point above its normal level in said first-named receptacle, without departing from the spirit of my invention as claimed.

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

1. The process of drawing molten metal from a receptacle which consists in collecting the molten metal in a suitable receptacle; creating a superatmospheric air-pressure upon the surface of said molten mass, thereby maintaining it at a level below its normal level and forcing a portion of the molten metal into a second receptacle to a level higher than its normal level in said first-named receptacle, then tapping said molten mass in said second receptacle at a point above its normal level in said first-named receptacle, and finally creating a superatmospheric air-pressure upon the surface of the molten metal in said second receptacle.

2. The process of drawing molten metal from a receptacle which consists in collecting the molten metal in a suitable receptacle; creating a superatmospheric air-pressure upon the surface of said molten mass, thereby main-

taining it at a level below its normal level and forcing a portion of the molten metal into a second receptacle to a level higher than its normal level in said first-named receptacle; then tapping said molten mass in said second receptacle at a point above its abnormal level in said first-named receptacle; and finally creating a superatmospheric air-pressure upon the surface of the molten metal in said second receptacle.

3. The process of drawing molten metal from a receptacle which consists in collecting the molten metal in a suitable receptacle; creating a superatmospheric air-pressure upon the surface of said molten mass, thereby maintaining it at a level below its normal level and forcing a portion of the molten metal into a second receptacle to a level higher than its normal level in said first-named receptacle; then tapping said molten mass in said second receptacle at the surface of its abnormal level; and finally creating a superatmospheric air-pressure upon the surface of the molten metal in said second receptacle.

4. The process of drawing molten metal from a receptacle which consists in collecting the molten metal in a suitable receptacle; creating a superatmospheric air-pressure upon the surface of said molten mass, thereby maintaining it at a level below its normal level and forcing a portion of the molten metal into a second receptacle to a level higher than its normal level in said first-named receptacle; creating a partial vacuum in said second receptacle and then tapping said molten mass in said second receptacle at a point above its abnormal level in said first-named receptacle.

5. The process of drawing molten metal from a receptacle which consists in collecting the molten metal in a suitable receptacle; creating a superatmospheric air-pressure upon the surface of said molten mass, thereby maintaining it at a level below its normal level; forcing the molten metal into a second receptacle to a level higher than its normal level in said first-named receptacle; creating a partial vacuum in said second receptacle and then tapping said molten mass in said second receptacle at the surface of its abnormal level.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

LUTHER LINCOLN.

Witnesses:

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ANNIE J. DAILEY.