(No Model.) 2 Sheets—Sheet 1.

G. LINDENTHAL.

ROTARY PUDDLING FURNACE.

No. 414,556. Patented Nov. 5, 1889.

FIG. 1.

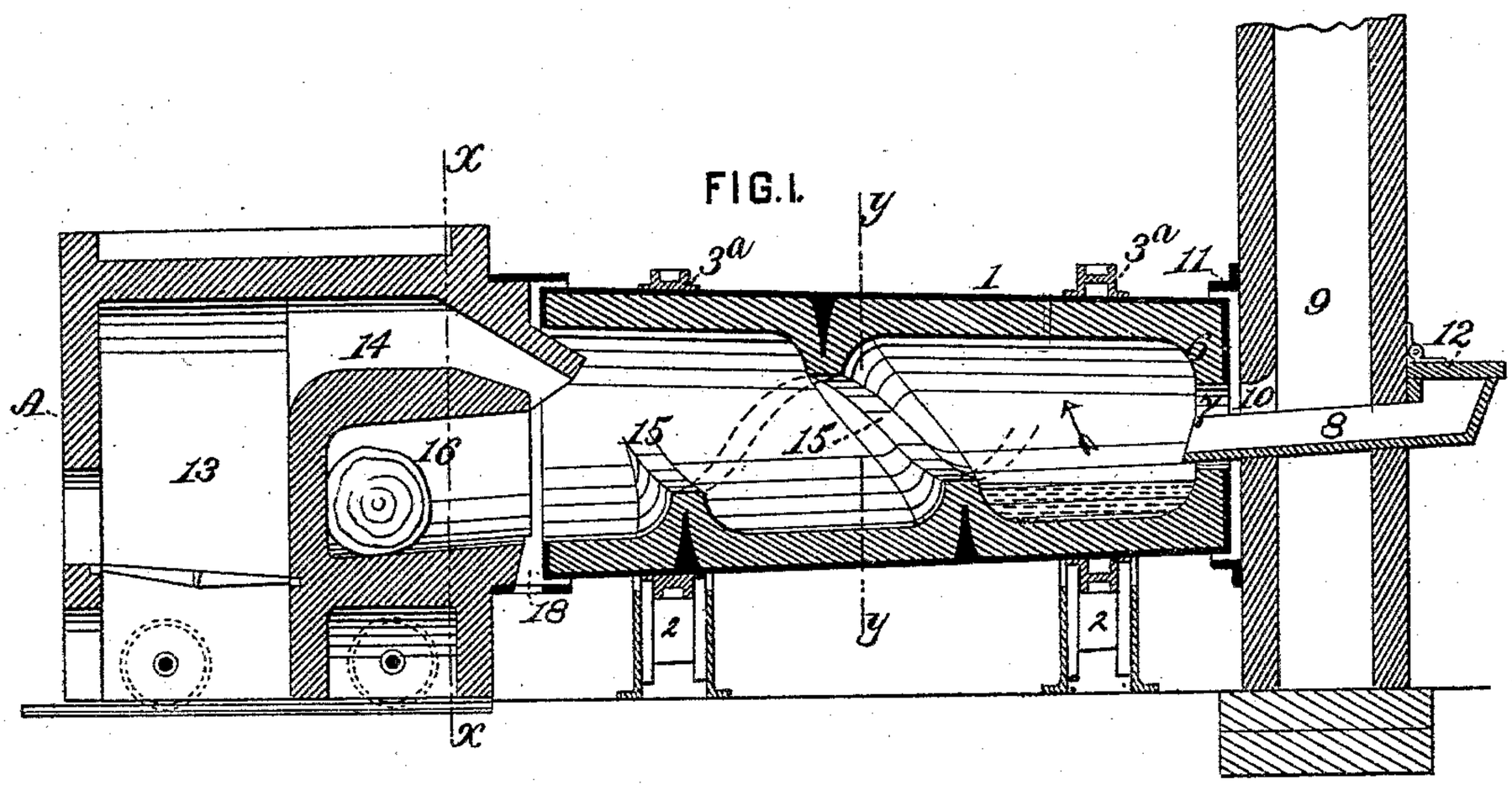


FIG. 2.

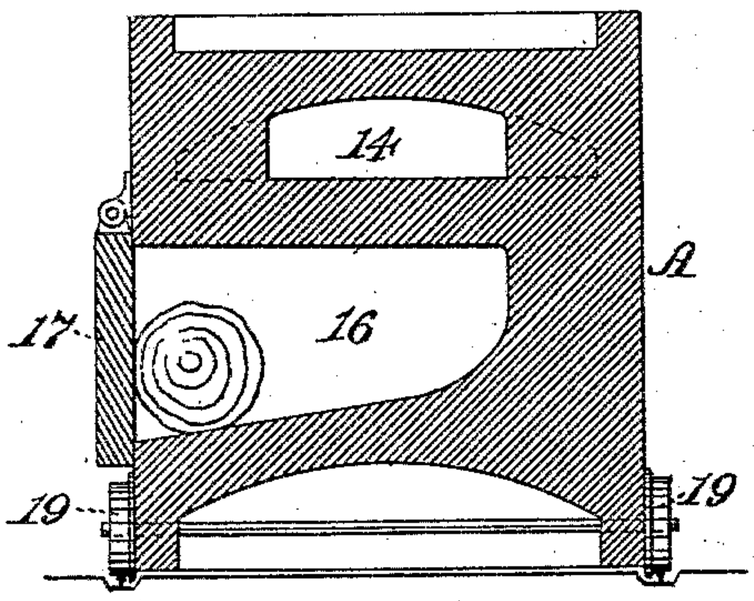


FIG. 3.

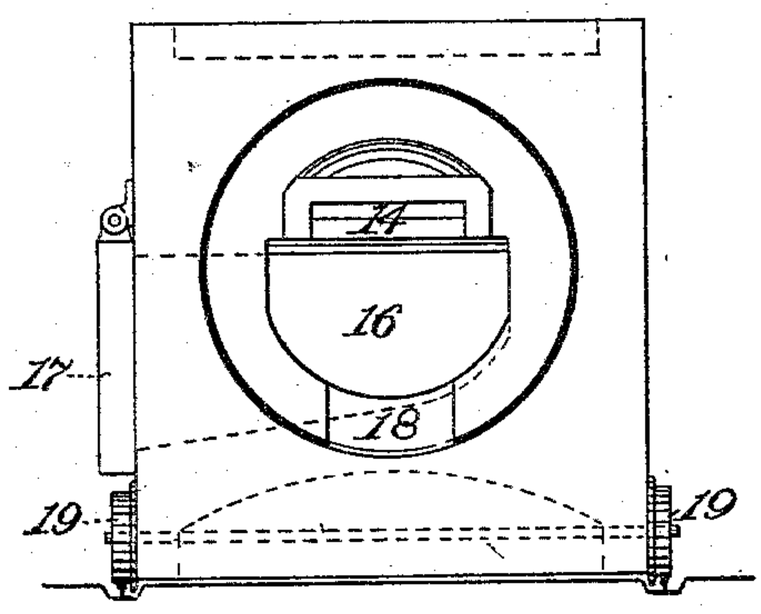
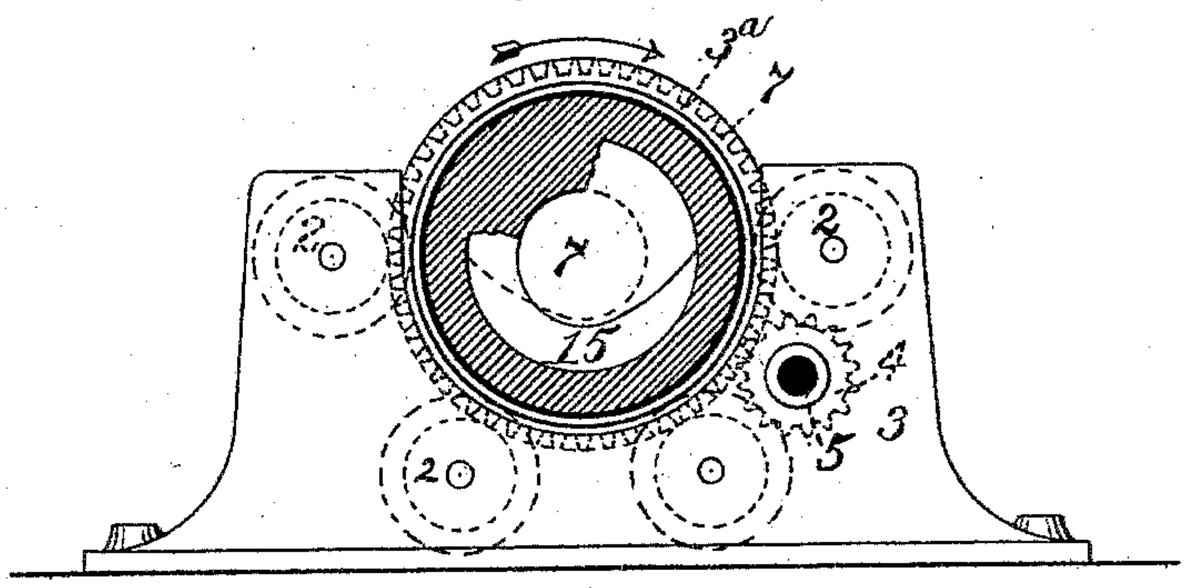


FIG. 4.



WITNESSES:

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INVENTOR,

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(No Model.) 2 Sheets—Sheet 2.

G. LINDENTHAL.

ROTARY PUDDLING FURNACE.

No. 414,556. Patented Nov. 5, 1889.

FIG. 5.

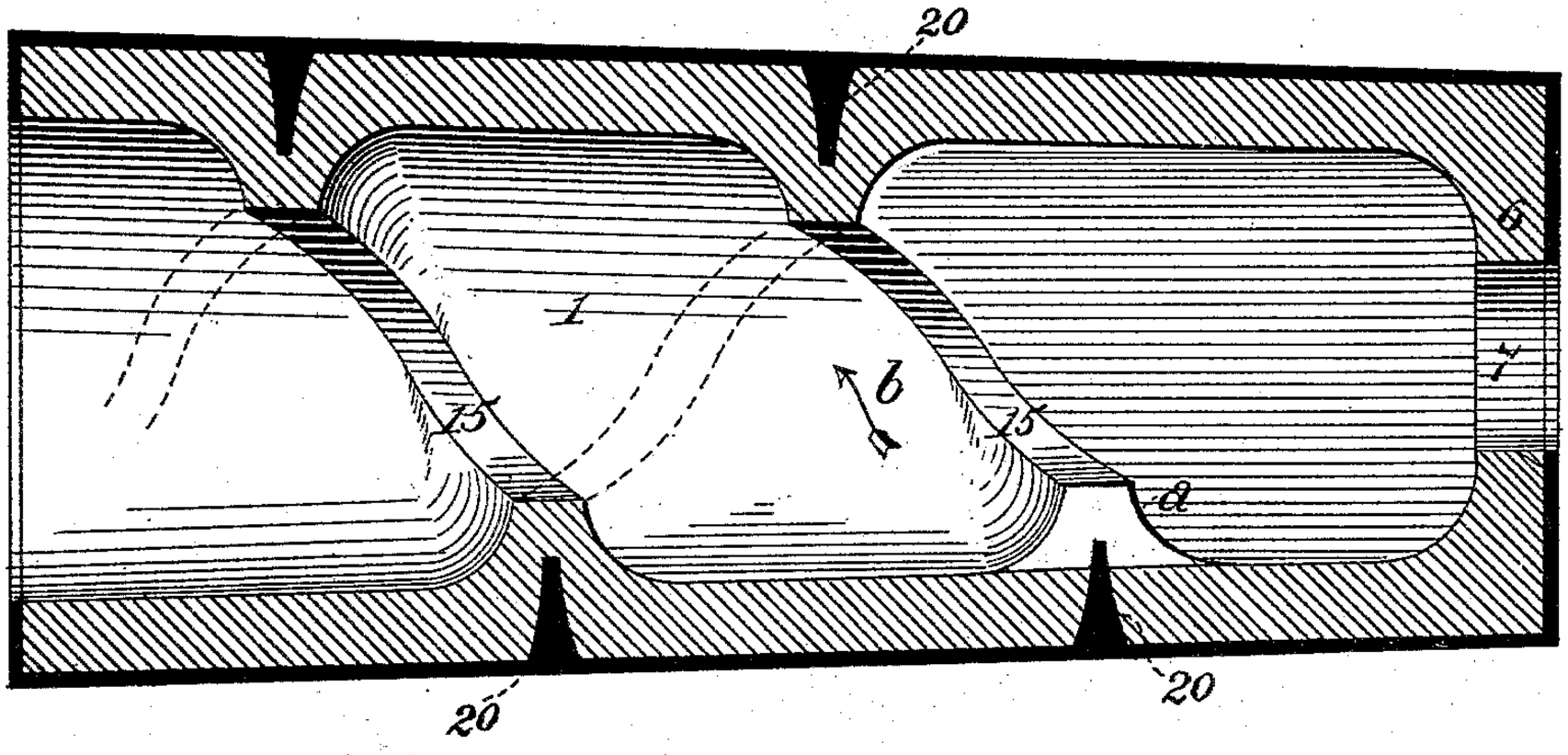
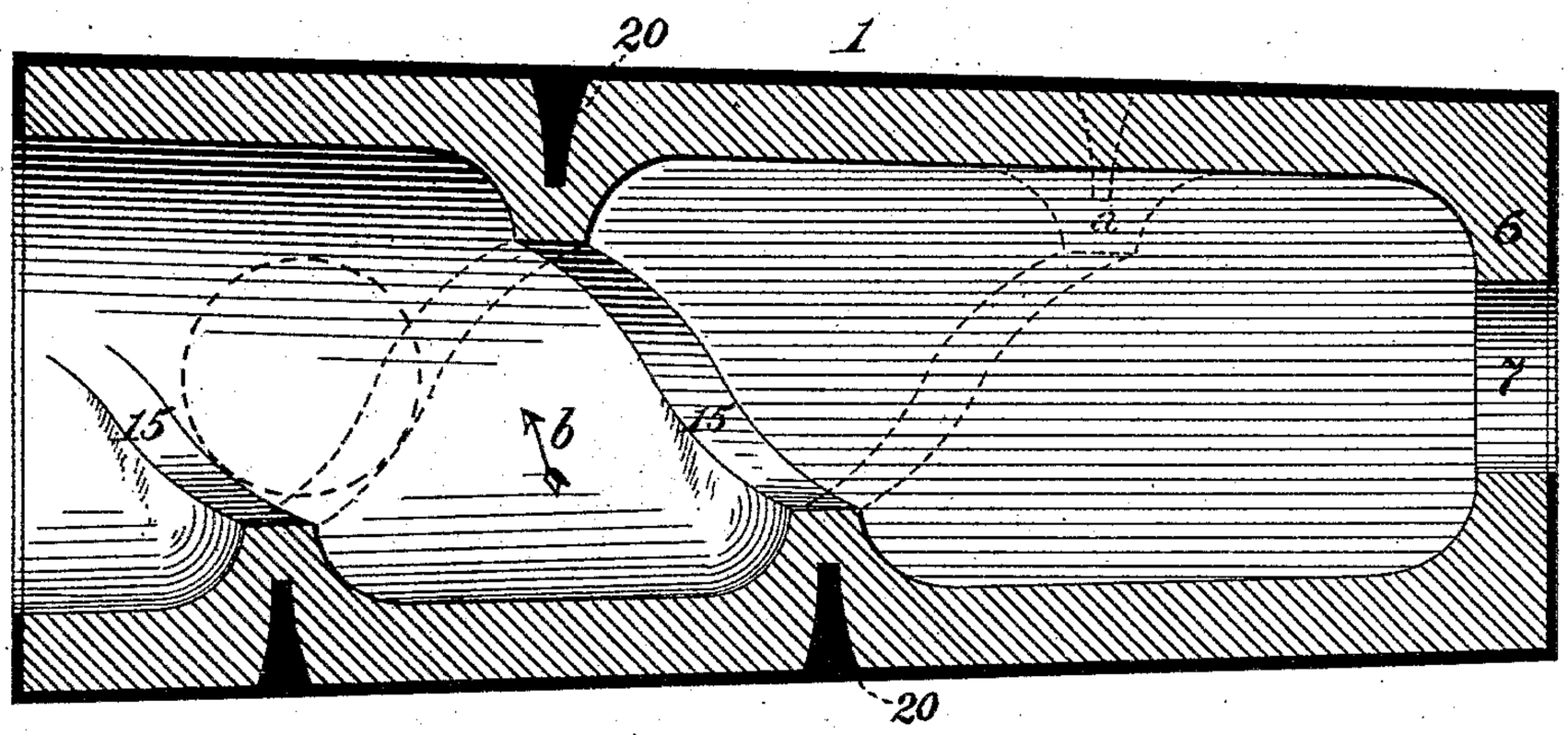


FIG. 6.



WITNESSES:

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GUSTAV LINDENTHAL, OF PITTSBURG, PENNSYLVANIA.

ROTARY PUDDLING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 414,556, dated November 5, 1889.

Application filed October 29, 1888. Serial No. 289,473. (No model.)

To all whom it may concern:

Be it known that I, GUSTAV LINDENTHAL, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered certain new and useful Improvements in Rotary Puddling-Furnaces, of which improvements the following is a specification.

The invention described herein relates to certain improvements in mechanical puddlers of the type generally known as the "Danks puddling-furnace," wherein the metal is agitated or caused to present new surfaces to the action of the reducing-flame by the rotation of the hearth containing the metal to be treated.

The object of the invention herein is to provide for such vertical and horizontal movement of the body of molten metal as to effect a constant shifting of the metal, thereby increasing and changing the exposed surfaces; and it is further the object of my invention to provide for the automatic discharge of the ball or bloom from the hearth and the charging of the molten metal into the same without removing or shifting any part or parts of the furnace.

In general terms the invention consists in the construction and combination of parts or elements, all as more fully hereinafter described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a sectional elevation of my improved puddling-furnace. Fig. 2 is a transverse section on the line *x x*, Fig. 1. Fig. 3 is a rear end elevation of the fire-box. Fig. 4 is a transverse section on the line *y y*, Fig. 1; and Figs. 5 and 6 are horizontal sections through the hearth, showing the same in different positions.

In the practice of my invention I provide a hearth or working-chamber 1, practically cylindrical or polygonal in cross-section, the sides being only slightly tapering, as shown in Fig. 1, and support said cylinder at or near its ends and elsewhere along its length, as circumstances may require, upon friction-rollers 2, mounted in suitable bearings in the frames 3, as shown in Fig. 4. Around the cylinder are secured the circular racks 3^a, with which the pinions 4, Fig. 4, on the power-shaft 5 engage for the purpose of rotating said cylinder. The smaller end of the cylinder is provided with a head 6, having a central opening 7 therein for the escape of the products of combustion, and also for charging the molten metal into the hearth. The molten metal is charged into the hearth by means of a spout or trough 8, passing through the stack 9 and projecting into the cylinder, as shown in Fig. 1, said stack being arranged in close proximity to the end of the cylinder and provided with an opening 10, registering with the opening 7 in the head of the cylinder. In order to prevent the escape of products of combustion through the space necessarily left between the end of the cylinder and the stack, a sleeve 11, inclosing the end of the cylinder, is secured to the stack 9. The outer end of the spout or trough 8 is provided with a cover 12, which may be hinged to the stack for the purpose of preventing any escape of the products of combustion. At the opposite end of the cylinder 1 is arranged the furnace A, having the combustion-chamber 13 and the flue 14, connecting the combustion-chamber with the cylinder or working-chamber 1. The outer end of said flue 14, which enters the cylinder above its axial line, has a downward inclination, so as to prevent a direct impact of the flames and products of combustion against the wall of the working-chamber and the spiral wall or dam 15, projecting inwardly from the side wall, and the consequent cutting away of the lining of said chamber.

The furnace A is provided with a chamber 16, which is situated below the flue 14 and behind the combustion-chamber, and has its floor on a level with or a little below the inner wall of the cylinder at its lowest point, so as to facilitate the discharge of the bloom or ball from the cylinder. This chamber 16 is provided with an opening on one side, as shown in Fig. 2, to permit of the withdrawal of the bloom or ball therefrom, such withdrawal being facilitated by an inclination of the floor of the chamber toward such lateral opening, which is normally closed by a door 17, which may be hinged at its top to the furnace, forming a flap adapted to be opened by

the ball or bloom rolling down the inclined bottom of the storage-chamber. In the edge of the floor of the chamber adjacent to the cylinder is formed a notch 18 for the escape of the cinder from the cylinder when the latter is rotated to discharge the ball or bloom, as hereinafter stated.

In order to permit of ready access to the interior of the cylinder for repairs, &c., the furnace A is mounted on rollers 19, thereby permitting of the furnace being moved away from the cylinder.

Within the cylinder or working-chamber is formed a spirally-arranged wall or dam 15, said wall or dam commencing at a point, as *a*, a suitable distance from the rear end, dependent upon the amount of metal to be treated at any one time, and extending around on and along the wall of the cylinder toward the front thereof until such wall completes at least one and a quarter turn around the cylinder. The pitch of this spiral is preferably such that the distance between two portions of the spiral lying in the same plane and measured longitudinally of the cylinder is approximately the same as or a little greater than the distance between the starting-point of the spiral and the end of the cylinder. The pitch of the spiral dam or wall, the location of its starting-point, and the number of turns formed are immaterial, and may be changed according to the character and amount of metal to be treated. The cylinder or working-chamber is lined in the usual manner, and the spiral dam or wall is formed of the same material as the lining, the position of the dam being determined by metallic ribs secured to the shell of the cylinder and projecting inwardly a sufficient distance to support and strengthen the dam.

In operating my apparatus the charge of molten metal is poured into the cylinder through the spout 8, and the cylinder is then rotated in reversed direction to the lead of the spiral dam, or, as the spiral is formed in the drawings, in the direction of the arrow *b*. For the purposes of description let it be supposed that the cylinder at the time of charging is in the position shown in Figs. 1 and 5. If, now, the cylinder be rotated in the direction of the arrow *b*, the end *a* of the dam will be moved below the level of the metal, which will then flow forward, the front end of the cylinder being lower than the rear end, until it is arrested by the next adjacent turn of the dam, as shown in Fig. 6. As the metal flows forward, as above stated, the surface of exposure to the action of the flame is constantly increasing and changing. As the rotation of the cylinder is continued in the same direction the molten metal is pushed back into the portion of the cylinder originally occupied by it, as shown in Figs. 1 and 5, by the action of the spiral dam, and as the rotation of the cylinder is continued the metal will again flow forward and be again pushed back. In addition to the change of surface caused by these back and forth movements of the metal, portions of the metal are carried upward by the walls of the cylinder in its rotation, as is customary in the ordinary forms of mechanical puddlers. The rotation of the cylinder is continued until the metal has been brought to nature and rolled into a ball or bloom. The direction of rotation is then changed—*i. e.*, the cylinder caused to rotate in the direction of the lead of the spiral dam, which then operates to force the ball or bloom forward along the cylinder and finally into the chamber 16, whence it can be removed as desired, said chamber serving as a storage-chamber in which the balls may be retained at their normal temperature, said chamber being heated by conduction from the combustion-chamber and by radiation from the cylinder.

Simultaneous with the discharge of the ball or bloom into the storage-chamber the cinder and slag are discharged through the notch 18.

I am aware that puddling-furnaces have been constructed with a rocking hearth provided with a series of passages or small transverse hearths alternately connected at their ends, whereby the metal is transferred continuously onward through the rocking hearth, and then delivered into a cylindrical chamber having a spiral wall throughout its entire length and continuously rotating in one direction, thereby causing it to advance continuously through the cylindrical chamber. Such a puddling-furnace is objectionable on account of the necessarily great length of both the rocking hearth and the cylindrical chamber, and also on account of the liability of either the small hearths of the rocking chamber or the spaces between the spiral wall becoming clogged, it being nearly impossible to maintain either part of the apparatus at a sufficiently high temperature. In my improved hearth, however, the spiral wall starts at such a distance from the charging end of the hearth as to form a basin for working metal, and forms during the rotation of the hearth in one direction a dam which will permit the metal to flow forward a certain distance at one point of the rotation of the hearth, but will force it back toward the rear end at another point in the rotation of the hearth. When the hearth is rotated in the opposite direction, the spiral dam will effect the further function of feeding the balled metal onward toward the discharge end of the hearth. Thus it will be seen that the spiral wall forms, when the hearth is rotated in a reverse direction, a basin of constantly-varying dimensions.

I claim herein as my invention—

1. The combination, with a furnace, of a working-hearth capable of rotation in opposite directions, the working-hearth being provided with a dam or wall commencing at a distance from the rear or charging end of the

hearth and extending spirally on and around the cylinder for a distance greater than one turn, substantially as set forth.

2. The combination of a furnace, a storage-chamber, and a working-hearth capable of rotation in opposite directions and provided with a spirally-arranged dam or wall, the inner end of said dam or wall commencing at a distance from the rear or charging end of the hearth, thereby forming a working-chamber for the agitation of the metal during the reverse rotation of the hearth and providing for the feeding forward of the metal during the direct rotation of the hearth into the storage-chamber, substantially as set forth.

3. The combination of a furnace and a working-hearth inclined from its receiving to its discharge end and capable of rotation in opposite directions, said hearth being provided with a dam or wall commencing at a distance from the rear or charging end of the hearth and extending spirally on and around the cylinder for a distance greater than one turn, and thereby forming a working-basin, substantially as set forth.

4. The combination of a furnace, a rotating working-hearth provided with a dam or wall commencing at a distance from the charging end of the hearth and extending around the hearth at gradually-increasing distances from such charging end and of a length greater than the internal circumference of the hearth, thereby forming, when the hearth is rotated, a working-chamber of varying dimensions, so as to effect a back-and-forth surging of the metal, substantially as set forth.

5. The combination of a furnace, a storage-chamber having an inclined bottom and a lateral opening, and a hearth capable of rotation in opposite directions and provided with a spirally-arranged dam or wall commencing at a distance from the rear or charging end of the hearth, thus forming during the reverse rotation a working-chamber for the metal and providing for a forward feed of the metal into the storage-chamber during the direct rotation of the hearth, substantially as set forth.

In testimony whereof I have hereunto set my hand.

GUSTAV LINDENTHAL.

Witnesses:

DARWIN S. WOLCOTT,

R. H. WHITTLESEY.