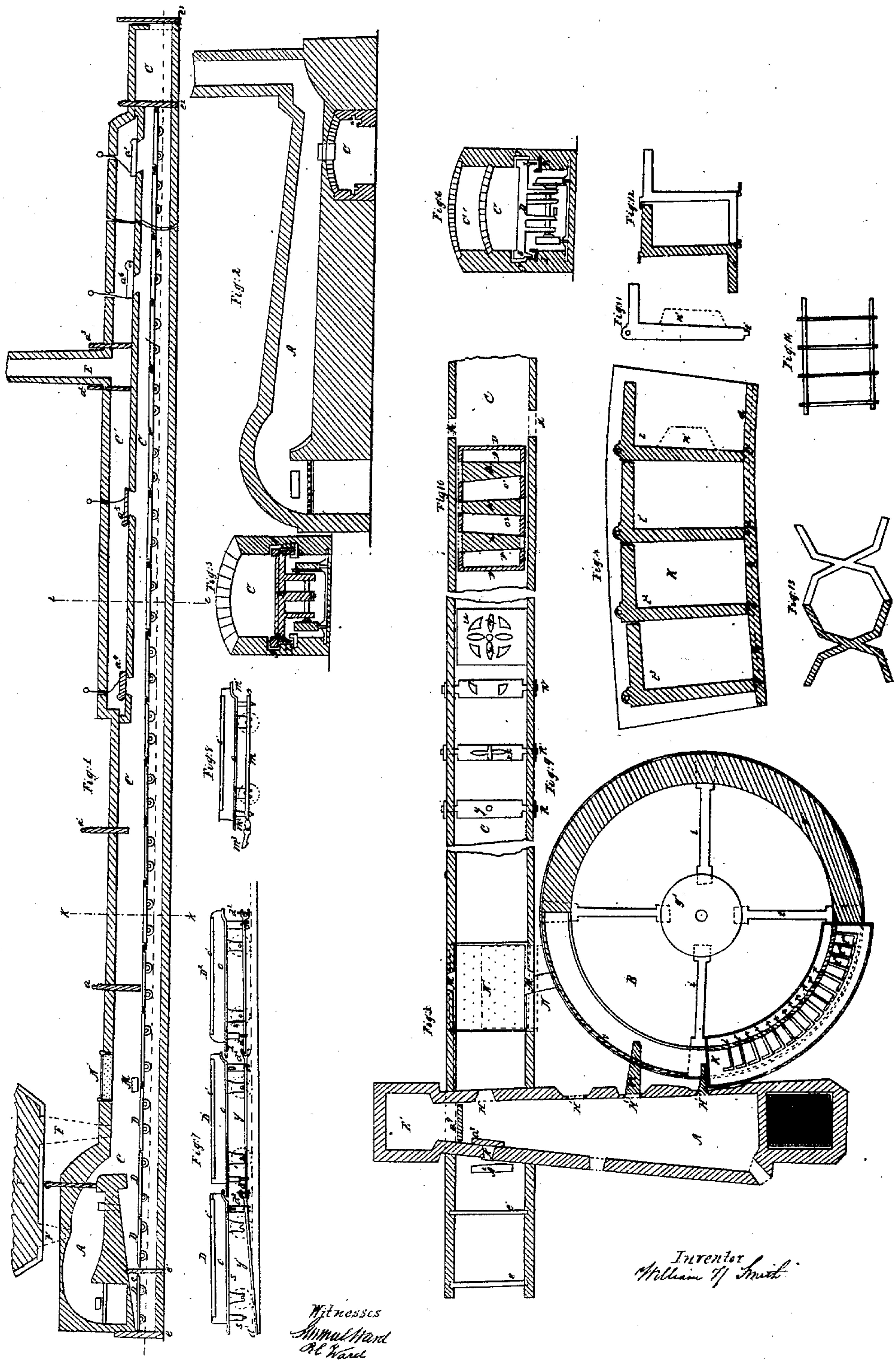


W. H. SMITH.
CASTING AND ANNEALING ARTICLES MADE OF SCORIA.
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Witnesses
M. M. Ward
R. C. Ward

Inventor
William H. Smith

UNITED STATES PATENT OFFICE.

WILLIAM H. SMITH, OF PHILADELPHIA, PENNSYLVANIA.

CASTING AND ANNEALING ARTICLES MADE OF SCORIA.

Specification of Letters Patent No. 23,317, dated March 22, 1859.

To all whom it may concern:

Be it known that I, WILLIAM H. SMITH, of Philadelphia, in the State of Pennsylvania, have invented certain new and useful improvements in the working and manufacture of the slags, cinder, scoriæ, &c., of smelting-furnaces generally, whether of iron or other metal, and also of similar mineral products, of which the following is a full, clear, and exact description, reference being had to the annexed drawings, making part of this specification, in which analogous parts are referred to by the same letters, in which—

Figure 1 is a vertical section of an annealing oven chamber C and of a refining chamber or reservoir A elevated above the level of C upon which it rests or is adjacent thereto. Fig. 2 is a vertical section of the same in which the chamber C is shown as connected at right angles with the chamber A. Fig. 3 is a plan of the chambers C and A arranged in juxtaposition and relative connection with a horizontal revolving casting wheel B. Fig. 4 is an enlarged segment of a casting plate K fitted upon said wheel with molds l l' l^2 l^3 thereon. Fig. 5 a vertical section of the annealing chamber C and a traversing annealing bed D on the line l , l' , of Fig. 1. Fig. 6 a vertical section of the annealing chamber and traversing annealing bed on the line l , l' . Figs. 7 and 8 vertical sections of annealing bed or segments thereof D D' joined together so as to form a continuous bed. Fig. 9 a plan of annealing chamber C in connection with a series of rollers R R', etc., for printing entire colored patterns in slag, etc. Fig. 10 a plan of annealing bed D working in chamber C with sliding molds p thereon. Figs. 11, 12 and 13 plans of molds. Fig. 14 a transverse section of frame used in grinding and polishing slag.

The nature of my invention consists in the arrangement, construction and mode of working an apparatus for the above purpose—the chief features of which are a refining chamber, annealing chamber and casting wheel and the relative location of each.

The arrangement is substantially in locating, either in front of the smelting furnace hearth or as near alongside thereof as circumstances will allow, a refinery whose chamber is sunk below the ground level of the tapping hole of said smelting furnace. Immediately under or alongside of, but below the ground level of this chamber is

placed the annealing chamber and revolving casting wheel; in supplying the annealing chamber, for the purpose of regulating and confining the heat with chamber dampers, with parallel side grooves and sand boxes along the entire length of its inner side and in fitting the movable annealing bed or carriage traversing the chamber with horizontal flanges and perpendicular dippers to correspond with said grooves and sand boxes or troughs, and with double doors at each end; also in the mode of using a system of rollers for impressing colored patterns on the products—in the application of other molds—and in the use of a frame for grinding the annealed slag, etc.

To enable any one skilled in the arts most nearly in alliance with it, to work my said improvements I will particularly describe their construction and operation.

Adjacent to the hearth I Fig. 1, the front or alpha end of an annealing oven or chamber C constructed with side walls and top arch as in ordinarily built leers is located, said chamber being sunk below the level of the tapping outlet of said hearth sufficiently to allow the molten material to be run directly from I through the trough F into the chamber C where it is received upon an endless annealing bed D made in sections continuously connected and moving through chamber C. Inasmuch however as the slags are withdrawn from some smelting furnaces in an irregular manner and in an impure state this process may be varied by the employment of a refining chamber or in certain cases of a simple reservoir A, Fig. 1, elevated above the chamber C yet sunk below the hearth I and located with reference to the chamber C ordinarily as shown in Figs. 1, 2 and 3. Below the level of chamber A a revolving casting wheel B, Fig. 3, is located ordinarily as there shown, so that the slag after being run from the hearth I through the trough F, into the refinery A flows therefrom either into the annealing chamber C through the tapping hole H (Fig. 3) or through either of the tapping holes H' upon the molds l , l' etc., resting upon the revolving wheel B. By this arrangement space is economized and my process is adapted to various modes of casting the slag into suitable forms of ware. The wheel B, usually twenty feet more or less in diameter, is constructed of an entire circular iron plate V' or of concentric segments thereof v , v , sup-

ported upon arms i connected to a central boss g' fixed to a central shaft p resting and moving in a socket bed or cup firmly embedded. This wheel may be suspended by
 5 rods or bolts connecting the arms or lower boss g' with an upper boss resting tightly upon a collar surrounding the upper part of the shaft which is clamped to a beam for support, or may work and be supported
 10 upon friction rollers placed underneath the rim thereof. Upon the circular plate V' or the concentric circular bands v, v , rests a casting plate K of iron, firebrick or other suitable material and upon this molds l, l'
 15 l^2, l^3 , etc., are arranged, usually sufficient in number to extend around the wheel, so that a continuous stream of slag fills mold after mold in succession, the wheel being stationary while the mold is filling and then
 20 moved so as to bring each mold in quick and regular succession under the stream of slag. In order to remove the molds from the slag cast therein and readjust them without delay, to render this process of casting
 25 continuous, I employ "segmental sliding molds" each of which ordinarily forms a portion of the sides of two separate castings or slag pieces molded therein, one form of these is shown in Fig. 10 and others
 30 in Figs. 11, 12 and 13. The mode of working these molds is shown in Fig. 4 in which K represents a segment of the casting plate resting upon the plate V' of the wheel B .
 35 Q represents a strip of metal or flange fixed to the plate K to form a supporting guide for the molds and to form one side of the casting. The mold l being a segment of the form in which the casting is to be made, is slid along the plate K until it assumes the position shown in Fig. 3 where it
 40 is supported in its place by the tongue t' inserted loosely in a groove d cut in the flange Q . Molds l, l', l^2, l^3 etc., to the number, say of several hundreds for castings
 45 such as brick, tile, etc., are arranged in a similar manner until they extend all around the surface of the wheel. The wheel as shown in Fig. 3 is moved from left to right, until the mold l^{13} comes under the spout t, t' ,
 50 and is filled. The mold l^{14} is then removed empty from the wheel so as to leave space for sliding back quickly the mold l^{13} into l^{14} 's place, as soon as the slag has set or cooled sufficiently for this purpose. As
 55 soon as l^{13} is thus removed the casting is in turn easily detached from the outer side of the segment l^{12} and conveyed along the open or covered through N into the chamber C through a side feeding hole M and tiered
 60 upon the annealing bed D Fig. 1, to be carried thereon along the chamber C in the process of annealing. In like manner each subsequent mold l^{13}, l^{12} , etc., is adjusted and readjusted without loss of time or inter-
 35 ruption of the flow of slag or regular move-

ments of the wheel. For pierced and hollow ware I use similar molds with a plunger n' Figs. 4 and 11, said plunger being beveled for easy withdrawal and affixed to the mold in any desired position. In Fig. 70
 10 another form of segmental sliding molds p and the mode of using them is shown. These consist of a solid or hollow wedge shaped bar or cone of metal or other suitable substance, any number of which are
 75 arranged crosswise upon the bed D at intervals to suit the width or thickness of the required casting. The bed D entering the chamber C , Fig. 3, and arriving under the opening H receives the fluid to the desired
 80 height in the space between these molds,—the bed resting as each space is filled successively but progressing at the proper time toward the terminus of the chamber. When
 85 each mold has arrived opposite the opening M , Figs. 3 and 10 in the side wall of chamber C it is withdrawn by sliding it in the direction of its wide end from the bed D out of the chamber C through the opening
 90 M leaving the casting o', o^2 formed between the molds to remain upon the bed D and be carried along the chamber C to be annealed therein.

My mode of printing an entire pattern of various figures and colors upon slag, is
 95 accomplished by means of rollers suitably adjusted within the chamber C . These vary in number, each roller of the series having raised or depressed upon it, the figures represented in one color only of those
 100 in the pattern to be imprinted, there being as many rollers as there are colors. The molten slag having been received upon the bed D , passes in its progression under roller R Fig. 9. This roller impresses upon it the
 105 figure Y designed upon its face—as soon as the slag casting or pattern comes from under this roller, slag or other molten material colored as required, is poured into the hollow or around the elevations thus im-
 110 printed. It next passes under the second roller R' receiving another impression x, x upon a part not imprinted by R , which is filled or surrounded with another colored material,—and again under a third roller
 115 R^2 and receives a third color, etc., so that the entire pattern U is produced with certain figures blue, others red, others yellow; by these means an entire design of any convenient length, width and thickness may be
 120 worked in as many colors as desired.

In order to devitrify the slag and to anneal thick and thin castings in the same chamber, without enlarging or diminishing the area of the fire grate, it is necessary at
 125 times to confine the greater portion of the heat, or to check its passage so as to raise the temperature in the first forty, eighty or one hundred feet as circumstances require, of the chamber which may be six
 130

hundred to one thousand feet in length. This is regulated by a series of dampers some of which are fixed perpendicularly as a a' a^2 a^3 , Fig. 1, others horizontally or perpendicularly as a^4 , a^5 , a^6 , a^7 . When these last (communicating with a top flue when horizontal or an equivalent side flue when perpendicular, leading into the stack E) are raised or opened, a longer or shorter length of the rear end of the chamber is cooled, the heat being retained in proportion to the thickness of the ware and the degree of devitrification desired. Thus when dampers a^2 a^3 a^4 are closed and a^5 is open, only that part of the oven between a^5 and the rear end is of a reduced temperature, but when a^4 is open a greater portion and when a^2 , a still longer portion of the chamber is cooled. As additional means of regulating the temperature I restrict and confine the hot air, flame, etc., to the space above the top of the annealing bed or carriage D by constructing a niche or groove J, Figs. 5, 6, in the inner side of each wall of the chamber for its entire length, to receive the sides of the bed D widened for the purpose and thus check the heat in its descent, and as further obstruction a trough L is also constructed Figs. 5, 6 to receive an iron or other flange or dipper S fixed to the under surface of the bed D which when the trough L is filled with sand and whether the bed is moving or stationary, is buried therein and effectually intercepts the passage of heat or cold in that direction. And to prevent the passage between the segments or sections of the bed which usually is composed of a wrought or cast iron wagon frame or plate o Figs. 7, 8 with a fire brick top o' firmly embedded thereon, the iron plate o is constructed so as to overlap the end of the next section as shown at z Fig. 7 and may be fitted with groove and flange as on the side, using sand as before mentioned—or other device may be employed to produce the intended result of forming an air tight division between the upper and lower part of the chamber C. To prevent any disturbance of temperature whenever a wagon or section of the bed is admitted or removed, an antechamber is constructed at each end of the chamber C by using outer doors e , e^3 , Fig. 1, and inner ones e' e^2 so that when the wagon enters the alpha end, the door e' is shut and e is opened but when the wagon is being coupled to the train in the chamber the door e is shut and e' is opened. When a wagon is removed at the omega end the doors are managed in a corresponding manner.

In order to economize fuel, the escape heat from the refinery A, Fig. 3, is admitted into the chamber C, descending through the flue A' by opening the damper a^8 and shutting the damper a^9 instead of allowing it to es-

cape at the refinery stack E which is only occasionally used.

I will observe here that whether chamber C is heated by flame or heat from a distinct fire grate communicating with said chamber through the top flue A² or any other convenient manner, or is heated as above stated from the chamber A, through the flue A' said heat is to be admitted above the bed D and at a sufficient distance in advance of the opening or feeding hole M Fig. 3 to allow the bed D Fig. 1 to become heated gradually by radiation before it passes directly under the jet of flame admitted through A' A² or any other flue.

To attach and detach a wagon I make use of a draw bar Y' of iron having a tongue d' , Fig. 7, at one end and a groove or socket d^2 at the other. The wagon D' having been coupled to the train previously, the end d^2 of the draw bar for the wagon D is attached to the end d' of the bar of wagon D' while the end d' trails upon the ground. When the wagon D is ready for coupling it is shoved close to D' over the bar Y', the end d' of which is then lifted and fastened to the bolt s^2 . This form of bar for rear coupling necessarily rests below the axle of the wagon. Another mode of coupling is shown in Fig. 8 and is effected by a bar m having a hole or groove m' in one end and a rising and falling latch m^3 at the other adapted to fit in m of a previous draw bar, working on a joint m^2 . This mode is self connecting.

That the hot slag castings may be prevented from adhering to each other when tiered or piled upon the bed I interpose fire brick or other suitable material between them, or instead, sprinkle layers of sand over the layers of slag by means of a sliding iron plate or box inserted in and across the arch of the chamber as shown at N', Figs. 1 and 3, directly over the feeding or tiering opening M, said plate being pierced with holes of a size convenient for the sprinkling of sand. Over and upon this plate a second similarly pierced but arranged to slide backward and forward, is located. Hot sand is kept on the upper plate which when used, is moved until the holes therein are over those of the under plate, and the sand falls as required upon the ware in the chamber.

In grinding and polishing slag articles by the ordinary methods, the edges are sometimes fractured. To prevent this I incase or bind the slag securely in a frame (Fig. 14) constructed of any desirable number of iron or wooden bars fitting loosely in a frame work in such a manner that they can be adjusted and wedged tightly around any number of castings, and in that manner brought to the grinding or polishing wheel so as to allow the top, bottom or sides as

required of said castings to touch the wheel while they are protected from striking against each other.

Having now described the nature of my invention and shown the modes of carrying the same practically into effect I wish it to be understood that I do not confine myself to the precise details herein described and represented, as various modifications can be made in the process and apparatus without affecting substantially the principle of my invention. Nor do I claim any of the processes and apparatus separately except as stated below.

What I claim and desire to secure by Letters Patent is—

1. The construction and use of the horizontally revolving casting wheel B for facilitating the casting of slag and similar mineral products.

2. The construction of an annealing chamber having various modes of retaining and

regulating the heat therein, viz. by a series of dampers;—by the construction of grooves and troughs in the walls, in connection with the flanges and dippers of the bed D, with or without the use of sand;—by the devices at the ends of the wagons, and by the use of the antechambers, substantially as above described.

3. The use and combination of a series of rollers with a traversing bed substantially as described for imprinting an entire pattern of differently colored figures.

4. The construction and employment of segmental sliding molds as shown or of similar character and the mode of arranging and working the same substantially as described.

WILLIAM H. SMITH.

Witnesses:

A. LEE WARD,
R. E. WARD.