W. W. CASE, Jr.

TILTING METALLURGICAL FURNACE.

APPLICATION FILED MAR. 15, 1913.

1,066,995.

Patented July 8, 1913.

2 SHEETS—SHEET 1.

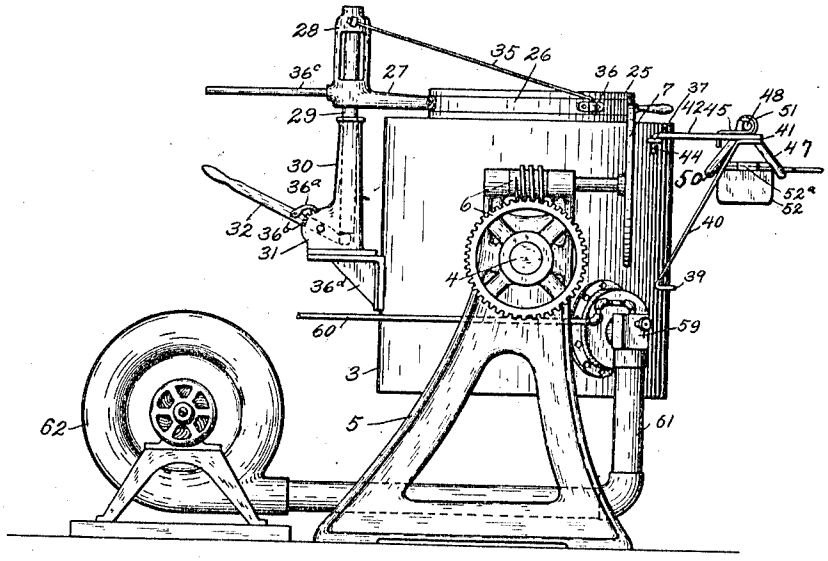


Fig. 1.

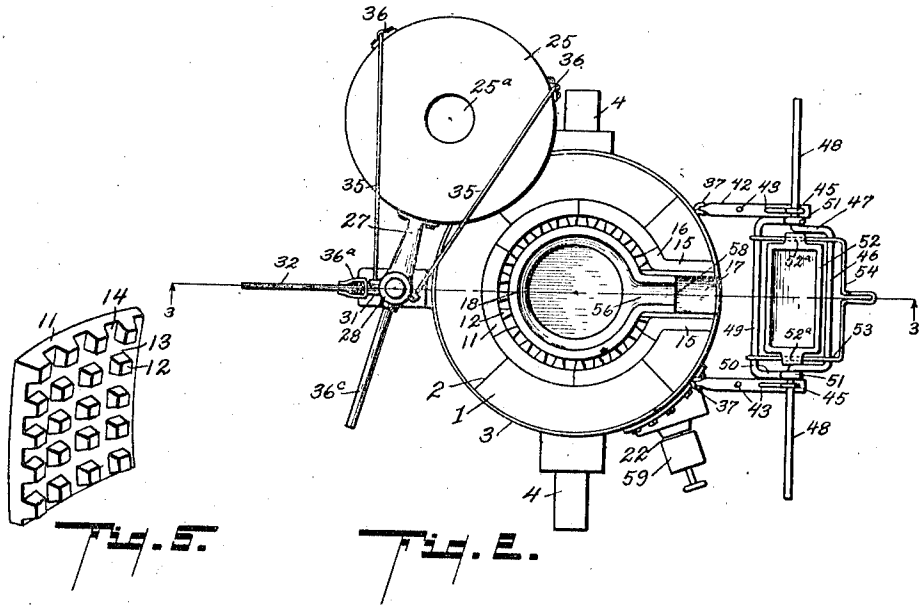


Fig. 5.

Fig. 2.

Witnesses
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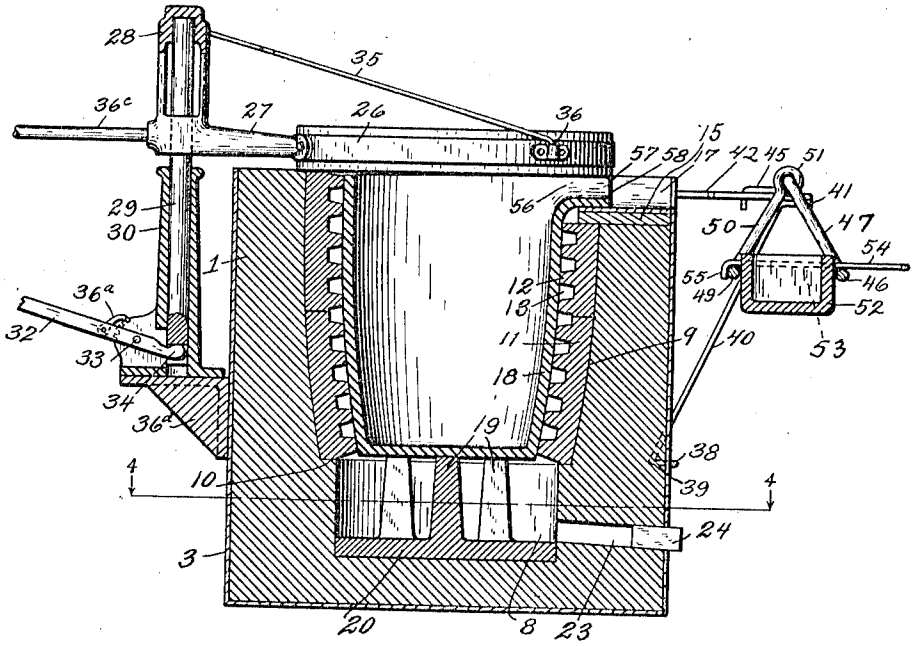


Fig. 3.

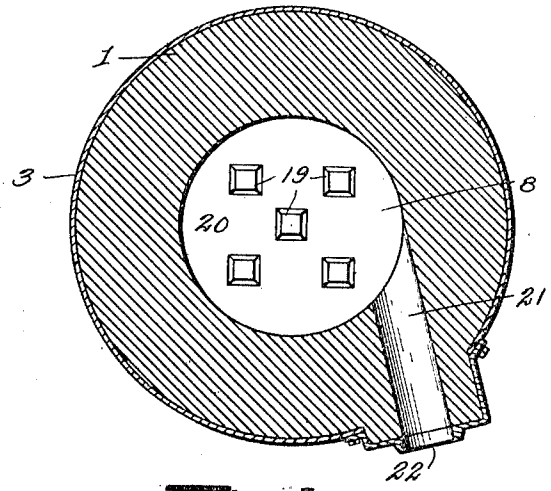


Fig. 4.

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UNITED STATES PATENT OFFICE.

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TILTING METALLURGICAL FURNACE.

1,066,995. Specification of Letters Patent. Patented July 8, 1913.

Application filed March 15, 1913. Serial No. 754,563.

To all whom it may concern:

Be it known that I, WILLIS W. CASE, Jr., a citizen of the United States, residing at Denver, in the county of Denver, State of Colorado, have invented certain new and useful Improvements in Tilting Metallurgical Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to metallurgical furnaces and has for its object to increase the efficiency of the action of such furnaces, and in a lesser space of time than has heretofore been required for melting operations.

A further object is to decrease the cost of operation to a minimum, and also to decrease loss by breakage of the crucibles and injury to the furnace lining. And a still further object is to reduce the usual roaring noise of such furnaces to a minimum.

While there are certain features illustrated which are not in themselves new, and which might be readily changed without departing from the spirit of the invention, still for the purpose of disclosure reference is had to the accompanying drawings illustrating a practical embodiment of the same, and the particular features of novelty will be more succinctly pointed out in the claims.

In the drawings forming a part of this specification like numerals designate like parts in the several views; of which,

Figure 1 is a view in side elevation of a completely equipped furnace built in accordance with the present invention, but with oil reservoir omitted and the pipe leading thereto broken off. Fig. 2 is a top plan view of same with the trunnion supports and the fan and piping to the burner omitted, and with the cover swung open, showing the crucible in operative position in the furnace. Fig. 3 is a vertical sectional view, taken in a plane along the line 3—3 of Fig. 2. Fig. 4 is a transverse sectional view, along the plane of the line 4—4 of Fig. 3, and Fig. 5 is a detail view of one of the liner plates.

1 designates any suitable inclosing walls, preferably consisting of built up sectional blocks, of fire clay or other desirable material, as shown by the division lines 2 of Fig. 2, and this outer wall is preferably incased by an envelop or sheathing of sheet iron 3, to hold the wall assembled. This sheathing is provided with the trunnions 4, journaled in the side supports 5, and one of the trunnions is provided with worm gearing 6, operated by a hand wheel 7, for tilting the furnace when pouring out its contents, or for cleaning out its crucible.

The interior of the furnace wall may be of the contour shown in Fig. 3 providing a combustion chamber 8 of cylindrical contour, and a crucible containing chamber having an upwardly diverging curved wall 9 (Fig. 3), forming with the wall of the combustion chamber, an annular ledge 10, for supporting the lower refractory liner plates 11, forming the lining of the furnace. These liner plates, as shown in Fig. 5, consist of a base support, following the contour of the walls of the crucible chamber, and provided with a checker-work of heaters, consisting of projections 12, extending inwardly from the liner plates, and terminating in positions substantially corresponding with the outer contour of the crucible wall, to more intimately heat up the latter. The heaters 12 may be arranged in any desired manner, but are preferably so spaced as to form transverse and vertical channels 13 and 14, and in baffling the gases of combustion they become heated substantially to a point of incandescence, imparting a uniform heat to the crucible.

The liner plates are of sectional construction to permit of ready removal and replacement. The lower ones rest on the annular ledge 10, and they may be proportioned to fit snugly edge to edge, to prevent circumferential displacement, or may otherwise be held in position. In Fig. 2 the upper heater plates are shown as being held against circumferential displacement, by the wedge block 15, forming a refractory foundation wall for the pouring lip of the furnace, and having inwardly curved projections 16, abutting against the side edges of the adjacent top liner plates 11.

The pouring lip of the furnace consists of a semicylindrical depression formed in the top edge of the furnace wall, and this depression is lined with the curved wedge block 15, of plumbago or other suitable material, and the wedge block is lined with a semicylindrical open-ended metal trough 17, extending from the outer sheathing 3 to a position above the liner plates 11, and substantially adjacent the outer wall of the crucible.

The bottom of the crucible 18 rests on the legs 19 of an inverted stool or support, 20, in a position immediately above the combustion chamber 8, and the flame conduit 21 (Fig. 4) is arranged to deliver the flame tangentially within the combustion chamber, creating a swirling action. This arrangement not only prevents the blast of flame from directly striking the crucible, but the legs 19 break up the products of combustion, which circulate upwardly through the passage ways or channels 13 and 14 and completely envelop the bottom and wall of the crucible to heat the same up uniformly, thence passing out through an opening 25ª in the cover, hereinafter referred to, there being a slight space between the top row of heaters 12 and the cover, to allow the gases to escape to the opening 25ª in the center of the cover. The legs 19 also act as heating points for the bottom of the crucible.

23 is a port through the lower wall of the furnace, plugged by a stopper 24, and communicating with the combustion chamber to draw off the molten contents of the furnace, should the crucible break.

The cover for the furnace consists of a circular block of fire clay 25 with a central opening 25ª. Clamped around the edge of the cover is a band of iron 26 to which is attached an arm 27 connected to a bearing support 28 swiveled on a reciprocating rod 29 journaled in a hollow standard 30, having spaced lugs 31 at its bottom, between which is pivoted a lever 32, as at 33, having a short arm 34, on which the lower end of the rod 29 detachably rests. Stay rods 35 connect the swiveled support 28 with the cover as at 36 toward the far side of the cover.

36ª and 36ᵇ designate a pawl and ratchet arrangement between the lever 32 and the spaced lugs 31 for holding the cover locked in its elevated position, and 36ᶜ is a handle for swinging the cover from off of the furnace, and vice versa, when the cover is so locked.

The hollow standard 30 may be bolted to a support or shelf 36ᵈ carried by the furnace wall, in which event the furnace may be tilted with the cover closed, or the hollow standard 30 may be suitably supported in any other desired manner.

In Figs. 1 to 3 there is shown a bullion mold, and means for detachably supporting same on the furnace, in operative position to receive the molten precious metal as it is poured from the crucible, for forming the same into bricks.

37 designate a pair of eyelets carried by the outer wall of the furnace near the top thereof, and on opposite sides of the pouring lip.

38 is a lower transverse arm of a bracket member, preferably formed from a cylindrical rod of metal curved inwardly as at 39 (Figs. 1 and 3) to fit snugly the periphery of the outer furnace wall, thence bent to extend upwardly and outwardly to form the upper ends of the arms 40, being flattened out and bent back upon themselves to form the thickened portion 41 and the inwardly extending horizontal arms 42 provided with adjustment apertures 43, and terminating in pintles 44, extending downwardly and adapted to seat in the eyelets 37.

45 are a pair of substantially S-shaped supporting hooks adjustable on the arms 42, through the apertures 43, and in the outer ends of these hooks is mounted a pivoted frame work, for tiltingly supporting the bullion mold. This frame work consists of a pair of cylindrical rods of metal, bent upon themselves to form an open seat to receive the bullion mold, and as illustrated specifically consist of a longitudinal arm 46, bent at right angles to form a short arm 47, and again bent at right angles to form the pivot arms 48, supported in the outer ends of the hooks 45. 49 is an arm similar to 46, bent at right angles to form the short arm 50, and looped around the axis arms 48, as shown at 51. In their assembled position, the longitudinal arms 46 and 49 are held spaced apart and parallel to each other by the diverging arms 47 and 50, forming a space for the reception of the mold.

52 represents a rectangular mold provided with the end lugs 52ª, which are grooved transversely on their underneath faces to receive the transverse arms 53 of an open frame support 54, adapted to straddle the mold and rest upon the longitudinal arms 46 and 49 of the tilting support, the inner ends of the arms 53 being bent to form hooks 55 to engage the arm 49, as more clearly shown in Fig. 3.

From Figs. 2 and 3 it will be seen that the crucible 18 is of peculiar formation. In the ordinary crucible a slight lip is formed, the upper edge of which, however, is of the same height as the upper edge of the body portion of the crucible, but as clearly shown in Fig. 3, in accordance with the present invention the crucible is formed with a short spout 56, of semi-cylindrical contour, adapted to seat snugly within the inner end of the curved metallic trough 17, and being cut away in a vertical plane as at 57, so that the end of the short spout is open, forming a semi-cylindrical mouth, the base or pouring position of which is located considerably below the top edge of the crucible and rests on and discharges substantially in alinement with the bottom of the trough 17.

59 designates conventionally a low pressure oil burner, specifically of the type illustrated in the W. W. Case U. S. Patent No. 1,003,873 of September 19, 1911, and the flame from the burner is directed into the

flame chamber 21 through the inlet opening 22, the burner being slightly spaced from the inlet opening to enable the furnace to be tilted. This will appear clearly from Fig. 2. Connected with this burner is an oil pipe 60 leading to the oil reservoir, not shown, and 61 is a pipe or conduit leading from the burner to an electrically driven fan 62, directly connected to an electric motor, and while applicant claims no novelty in the principle of the fan itself, still the same is so designed and dimensioned that the air is furnished at a constant pressure, through the burner itself, not in excess of the maximum amount of air necessary, and at about substantially the very low pressure of six ounces.

It will be understood that I do not claim the broad idea of a tilting furnace, provided with a swiveled cover, and an oil fuel burner; but I do claim that my form of furnace as a complete unit, has in competition proved to be of greatly increased efficiency over furnaces of this type heretofore employed. For instance in using oil as a fuel, it has heretofore been necessary, for the successful operation of a furnace, to have an air compressor, a positive blower, or steam for the burner, and burners using air under high pressure utilize secondary air from the atmosphere, and as the combination of air and oil cannot under this condition be easily controlled, perfect combustion is seldom secured. Also besides being expensive, the use of air under high pressure in burners for melting furnaces causes a roar that is exceedingly annoying to the operatives, but with my furnace the face of the burner almost touches the boss of the inlet opening to the flame chamber and no secondary air is sucked in with great force, the air employed being delivered through the burner at a very low pressure from the low pressure fan, thus eliminating the roaring noise to such an extent, that operatives can converse beside a running furnace without raising their voices. Besides by employing a low air pressure with the burner a very low blast flame is produced, and delivering same tangentially to the furnace below the crucible, it does not wear out the crucible so quickly as flames from a high pressure burner. Again, while no special claim is made in this application, to the broad combination of a crucible mounted in a furnace lined with a checker work of heaters, it will be seen that the complete arrangement and combination of the several particular elements is of great importance, not only in heating up the crucible quickly and after the fashion of a clean coke fire by the lining of checker-work heaters, but also will prevent over-charging and "slopping over" of the charge, so disastrous to furnace linings. Should more ore be charged into the crucible, through the opening 25ª, than the crucible will contain, instead of slopping over the top of the crucible and between it and the checkered lining of heaters, the molten metal would first flow out through the trough 17, owing to the fact that the spout from the crucible delivers at a position 58, a substantial distance below the top edge of the crucible.

From the foregoing it is believed that the operation and advantageous features of the entire combination will be readily seen and further description is not essential, with the exception that it might be stated that the furnace may be charged and also poured with the cover in place, protecting the operative against excessive heat, which is one great objection to coke heated crucibles, while at the same time the checkered lining of the present furnace and the method of mounting the crucible therein causes the furnace to operate after the fashion of and with all of the advantages of a clean coke fire.

When the furnace is first tilted for pouring the bullion mold 52, is hung in the position shown, and as the furnace tilts the mold swings also, continuously assuming a horizontal position. But when the furnace is further tilted, to pour out the contents in the lower part of the crucible, the hooks 45 are moved inwardly to another set of adjustment holes in order to bring the mold closer to the pouring lip of the furnace, so that the flowing metal will not fall short of the mold.

It is understood that the broad idea of a tilting furnace with a mechanically operated cover for same, and worm gearing for tilting the furnace is old, and as before stated I make no broad claim to any such combination *per se*, as the present invention resides in the particular arrangement and dimensioning of its parts, whereupon, in addition to certain novel features, the combination of certain old elements specifically arranged produces a novel furnace, in its entirety, of increased efficiency, and which will melt with greater rapidity and lesser expense than such type of furnaces heretofore employed.

Having thus described my invention, what I claim is:—

1. In a metallurgical furnace, the combination of a pivotally-mounted furnace provided with communicating combustion and crucible chambers, a crucible, a lining in the crucible chamber provided with a plurality of closely-spaced refractory projections engaging the periphery of said crucible, an oil burner communicating with the combustion chamber, and means for supplying air at a low pressure to said burner.

2. In a metallurgical furnace, the combination of a pivotally-mounted furnace provided with communicating combustion and crucible chambers, a crucible, a lining in the

crucible chamber provided with a plurality of closely-spaced refractory projections engaging the periphery of said crucible, an oil burner communicating with the combustion chamber, and means for supplying air at a pressure of approximately six ounces to said burner.

3. In a metallurgical furnace, the combination of a pivotally-mounted furnace provided with a pouring lip, means for tilting said furnace, a crucible supported in said furnace having a spout discharging to said lip below the top edge of said crucible, a bracket secured to said furnace, bearings adjustably mounted on said bracket, and a pendant frame journaled in said adjustable bearings for supporting a mold in position for receiving the discharge from the furnace lip in the tilted position of said furnace.

4. In a metallurgical furnace, the combination of a pivotally-mounted furnace, a rod slidably supported on said furnace, means for shifting said slidably-mounted rod, means for locking said rod in its several positions, a bracket swiveled on said rod, and a furnace cover carried by said swiveled bracket.

5. In a metallurgical furnace, the combination of a pivotally-mounted furnace, a rod slidably supported on said furnace, a lever engaging said rod for shifting the latter, a notched segment on said furnace, a locking pawl on said lever for engaging said notched segment, a cap bracket rotatably supported on the upper end of said rod, and a furnace cover carried by said bracket.

In testimony whereof, I affix my signature, in presence of two witnesses.

WILLIS W. CASE, JR.

Witnesses:

EDW. S. STEWART,

J. S. GIUSTA.