W. M. PAGE.

FURNACE.

APPLICATION FILED SEPT. 2, 1908.

**929,701.** Patented Aug. 3, 1909.

Fig. 1.

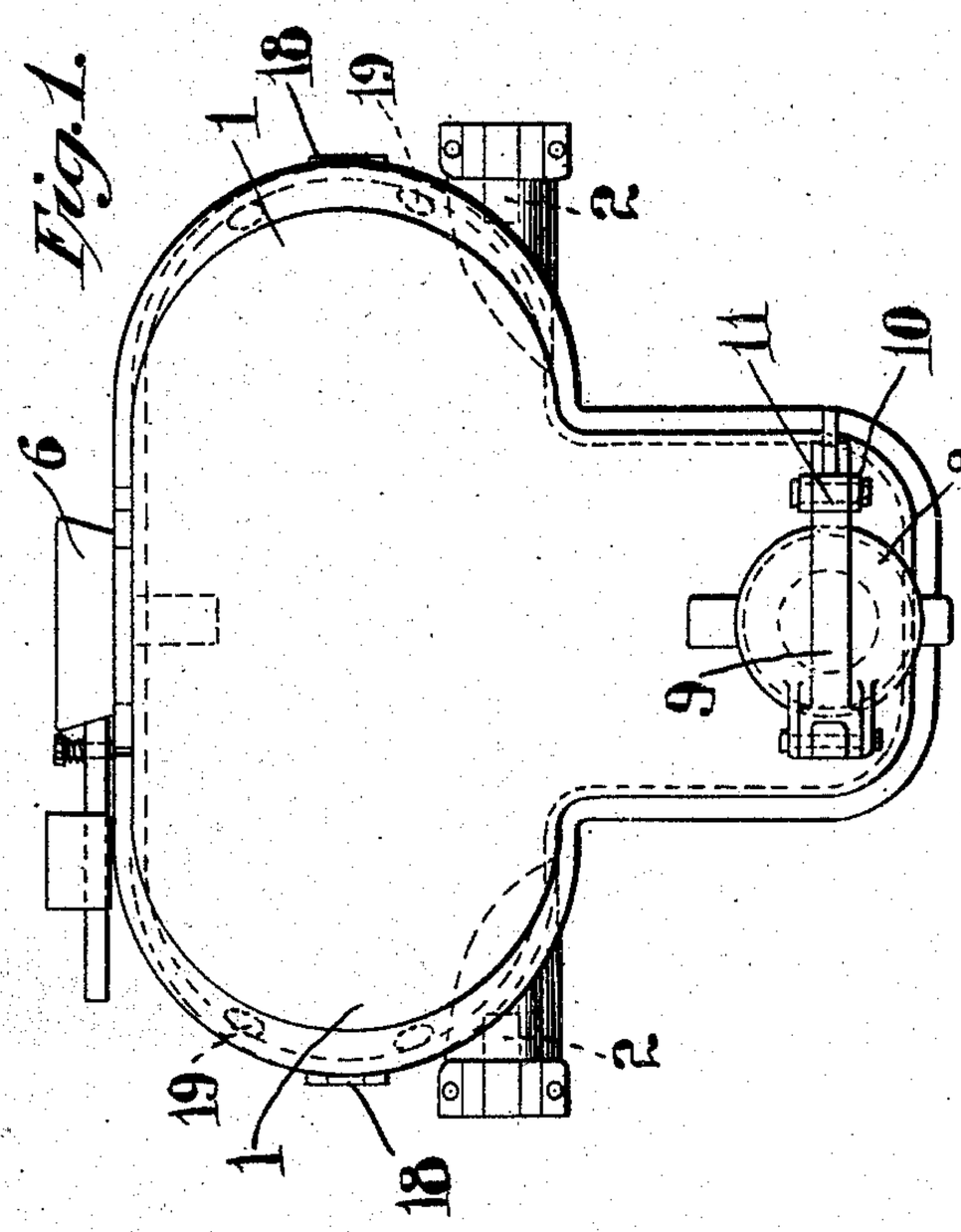


Fig. 2.

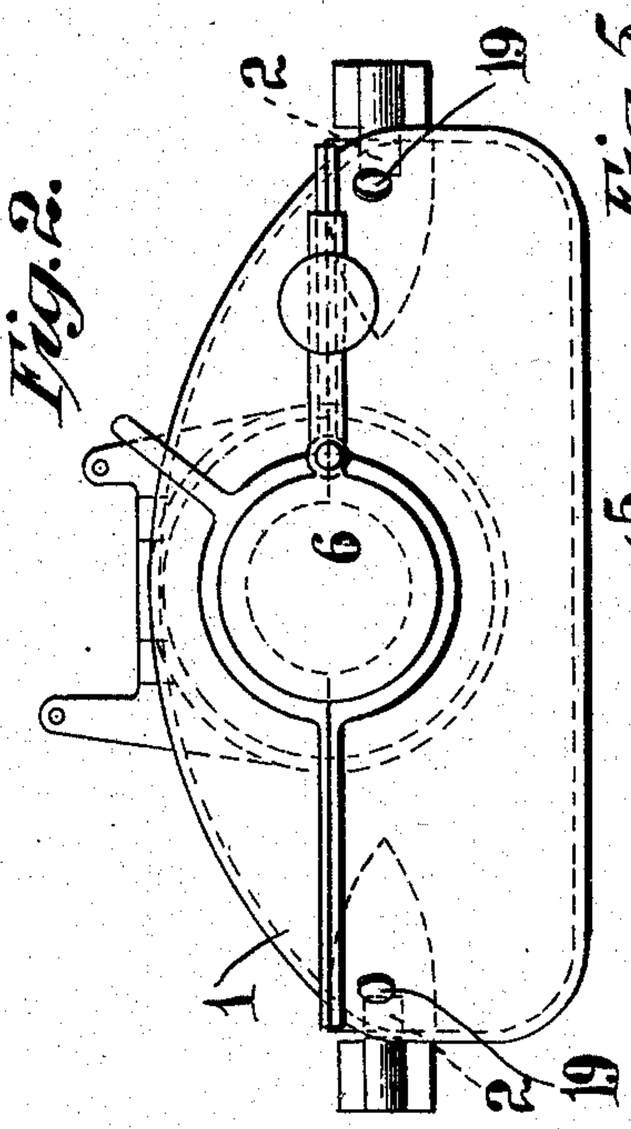


Fig. 3.

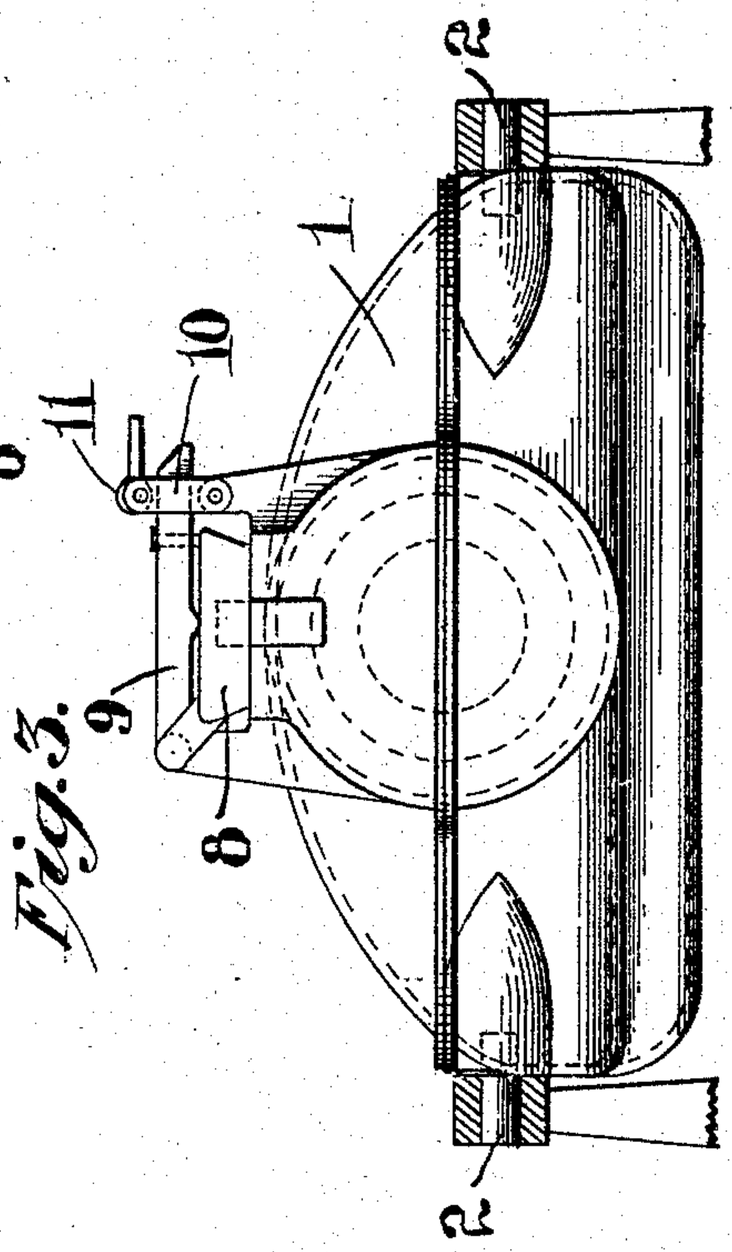


Fig. 4.

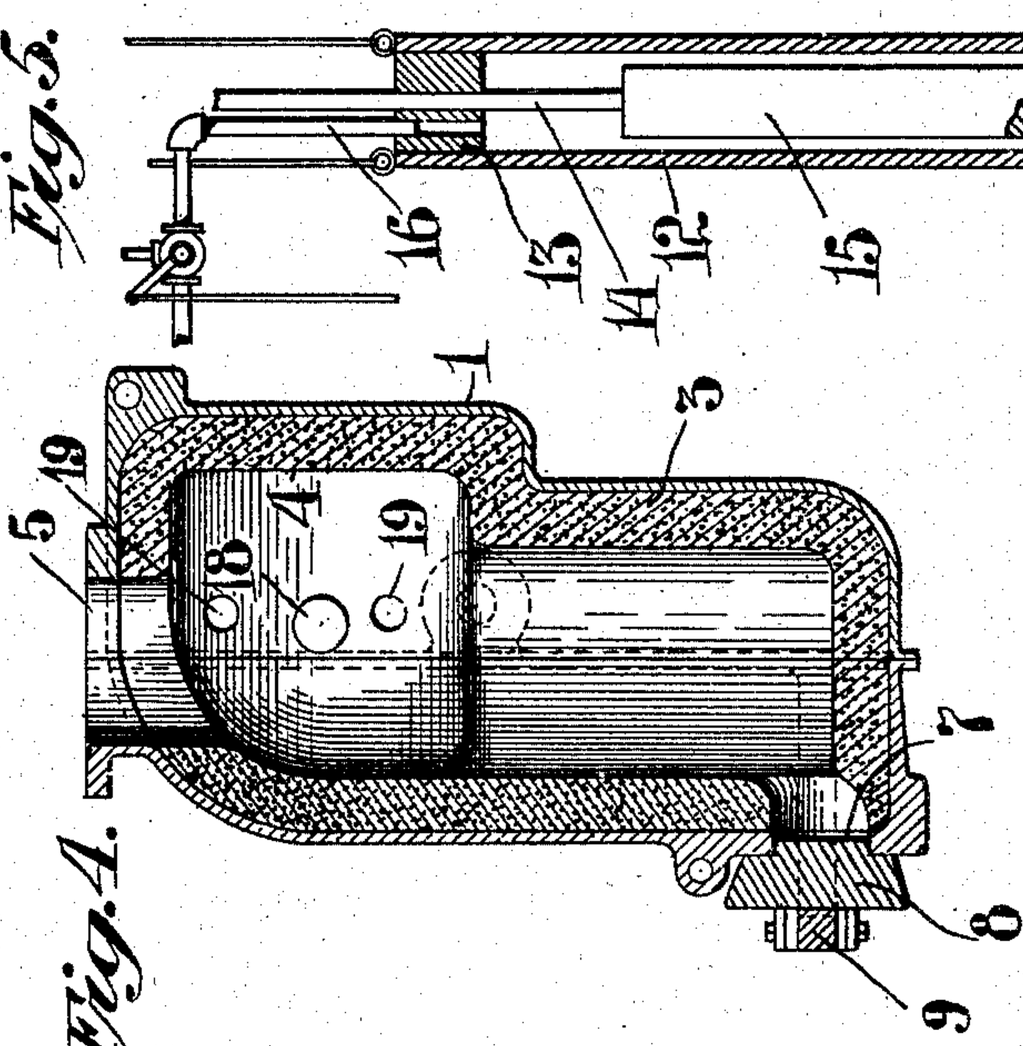


Fig. 5.




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# UNITED STATES PATENT OFFICE.

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## FURNACE.

No. 929,701. Specification of Letters Patent. Patented Aug. 3, 1909.

Application filed September 2, 1908. Serial No. 451,340.

*To all whom it may concern:*

Be it known that I, WILLIAM M. PAGE, a citizen of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

My invention relates to improvements in melting and coating furnaces, and is particularly intended for use in the production of clad metal ingots by surrounding a core of solid metal with a body of a molten unlike metal and permitting such molten metal to solidify against such core.

Processes for producing clad metal ingots in the manner described are set forth in the patent to John F. Monnot, 853,716.

The objects of my invention are to facilitate, and lessen the expense of, the melting and coating operations, to avoid the necessity of using expensive crucibles heated from the outside, to heat the metal more economically than can be done when heating from the outside of the crucible, to provide a relatively shallow layer of metal for the melting and heating operations, and a relatively deep layer of metal for the coating operation, and to make the furnace easy to handle and operate and simple, reliable and relatively inexpensive.

I will now proceed to describe my invention with reference to the accompanying drawings, in which one form of furnace embodying my invention is illustrated, and will then point out the novel features in the claims.

In said drawings: Figure 1 shows a top view of my improved furnace in its horizontal or normal position; Fig. 2 shows a rear view of said furnace in such horizontal position; Fig. 3 shows a front view of the furnace in such horizontal position; Fig. 4 shows a central vertical section of the furnace tilted to its vertical position, and Fig. 5 shows a central vertical section of coating apparatus adapted to be used in connection with said furnace.

My furnace comprises a chamber mounted upon trunnions whereby it may be swung from its normal horizontal position to a vertical position. In the horizontal position said furnace provides a relatively shallow hearth adapted to contain a layer of solid or molten metal, over which hearth flame may be projected so that the metal is heated by surface heating substantially as in an ordinary reverberatory furnace; while when the furnace is tilted to vertical position the molten metal runs down into what is then the body of the furnace, providing a deep body of molten metal. The furnace chamber usually consists of a metal casing lined with refractory metal, said chamber having suitable doors for the charging of the furnace with molten metal and for the entry and escape of the flame gases; also for the admission to the molten metal of the objects to be coated.

In the drawings 1 indicates the said casing, formed in two sections as shown, and pivoted upon trunnions 2—2; 3 designates the refractory lining. As shown, this furnace is of approximately T shape, and when horizontal provides a broad hearth 4 of moderate depth, adapted to contain the metal to be melted or heated. When inserted into the vertical position shown in Fig. 4, the molten metal, of course, runs down into what is then the lower portion of the furnace, forming a deep body of molten metal in direct line with the opening 5, in what is then the top of the furnace, such opening then serving for the introduction of articles to be coated into the molten metal. A suitable swinging door 6, counter-weighted to hold it closed normally when the furnace is in a horizontal position, is provided for closing this opening 5. At the other end of the furnace, in what is the top of the furnace when the latter is in a horizontal position, there is another opening 7; and for closing this opening a door 8 is provided. Clamping means are also provided for holding this door closed against the weight of the molten metal, such means comprising a pivoted bar 9, a hasp 10 and a clamping eccentric 11. Such clamping means is required to prevent escape of molten metal through opening 7 when the furnace is turned to the vertical position, as shown in Fig. 4.

In Fig. 5 I illustrate one form of coating apparatus adapted to be used in connection with this furnace, the same comprising a casing 12 having a head 13, in which is a bearing for the passage of a porter bar 14 to the lower end of which is connected a billet 15 or like object to be coated. The casing is further provided with a valved pipe 16 for supplying to it a non-oxidizing gas, such as pro-

ducer gas made from charcoal, which will prevent oxidation of the billet prior to submersion in the molten metal and will also prevent oxidation of a film coating formed by momentary submission of the billet in supermolten metal followed by withdrawal of the billet from contact with the supermolten metal, as described in the Monnot patent No. 853,716. In these coating operations, involving the coating of steel with supermolten copper or like metal, it is usually preferable to have the billet preheated to a considerable extent before it is contacted with the molten metal. Nevertheless the surface of the said billet upon contact with the molten metal, must be absolutely free of oxid. It is easy to heat a billet in a suitable furnace under such conditions that it shall not be oxidized, and the casing 12 filled with a non-oxidizing atmosphere constitutes convenient means for protecting the surface of the billet from oxidation during transfer from the preliminary heating furnace to the coating furnace. When desired, the billet may have applied to it a bottom plate 17 which is adapted to make a tight joint with the bottom of the casing 12. In such case, the apparatus is adapted for forming coatings from the molten metal in the furnace by the so-called "segregation" method described in said Monnot patent 853,716, and in the Monnot patents Nos. 851,684 and 851,993 both dated April 30, 1907.

The manner of using my improved furnace is as follows:—The furnace is charged with metal either in the solid or molten state as preferred, and it is convenient, though not necessary, to tilt the furnace into its vertical position, or into nearly a vertical position when so charging. The furnace having been charged, it is swung back to its horizontal position, and the doors 6 and 7 being opened, flame from a suitable burner (not shown) is projected through the furnace and above the molten metal therein, the products of combustion emerging through the opening 7. Heating may take place in the furnace substantially as in an ordinary reverberatory furnace; and if desired, the surface of the molten metal may be protected from direct contact with the heating gases by means of a layer of molten flux, or the like, the heating in such case taking place by radiation and conduction of heat through the molten flux. During the heating, the molten metal may be treated with de-oxidizing and purifying agents as in the ordinary processes of melting copper and like metals, and may be poled or otherwise worked, as is common in the melting and working of such metals. The metal [illegible] been raised to the desired tempera- [illegible]mple, to the supermolten tem- [illegible]red to in the Monnot patent [illegible]e may be tilted to its ver- [illegible]r 8 having first been closed, and objects to be coated may be dipped into the molten metal in the furnace through the opening 5. When, by repeated dippings, the temperature of the molten metal has been lowered, the furnace may be swung back into horizontal position, and the burner operated again to raise the metal to higher temperature, and from time to time fresh charges of solid or molten metal may be added.

In the side of the furnace suitable peep holes 18 are provided. Instead of admitting the flame through the opening 5, other suitable openings may be provided in the sides of the furnace, as shown at 19; or flame may be introduced simultaneously through opening 5 and these openings 19.

What I claim is:—

1. A furnace for molten metal comprising a swinging chamber of greater length than height, one side of which, in the horizontal position of said chamber, forms a hearth to contain molten metal, said chamber, when tilted from such horizontal position, forming a relatively deep receptacle for molten metal, said chamber having an opening in that side which is the top when the chamber is so tilted and in vertical line with said receptacle, adapted to permit passage of objects to be coated into the molten metal, and having means for heating its contents.

2. A furnace for molten metal comprising a swinging chamber of greater length than height, one side of which, in the horizontal position of said chamber, forms a hearth to contain molten metal, said chamber, when tilted from such horizontal position, forming a relatively deep receptacle for molten metal, said chamber having an opening in that side which is the top when the chamber is so tilted and in vertical line with said receptacle, adapted to permit passage of objects to be coated into the molten metal, said chamber having also an opening for the escape of flame gases.

3. A furnace for coating with molten metal comprising a swinging chamber of greater length than height, one side of which, when the chamber is in its horizontal position, constitutes a hearth for holding molten metal, the chamber when tilted from its horizontal position forming a relatively deep receptacle for molten metal, said chamber being provided with means for passing flame over said hearth and for passing articles to be coated through the top of such chamber down into the molten metal when such chamber is in its tilted position.

4. A furnace for molten metal comprising a swinging chamber which, when horizontal, has relatively great breadth as compared with its depth, and which, when tilted, forms a relatively deep receptacle for molten metal, said chamber having means for heating its contents prior to tilting and for passing ob-

jects into contact with the molten metal within it after tilting.

5. A furnace for molten metal comprising a swinging chamber of approximately T shape, one side of which chamber forms a hearth for holding molten metal when the chamber is in its horizontal position, said chamber having means for heating its contents in said horizontal position and for passing objects into contact with the molten metal within it when in the vertical position.

6. A coating furnace comprising a deep chamber adapted to be swung into a horizontal position and having openings at each end constituting respectively firing and waste gas ports when in such horizontal position, the firing port being in line with the chamber and adapted for use as a dipping port when said chamber is in a vertical position and the waste gas port being adapted for liquid-tight closure when such chamber is in such vertical position.

7. A coating furnace comprising a deep swinging chamber provided with a hearth depression in one side, and having openings at each end constituting respectively firing and waste gas ports when in a horizontal position, the firing port being in line with the chamber and adapted for use as a dipping port when said chamber is in a vertical position and the waste gas port being adapted for liquid-tight closure when such chamber is in such vertical position.

8. A coating furnace comprising a deep chamber having a lateral enlargement at its head and adapted to be swung into a horizontal position, said chamber having openings at each end constituting respectively firing and waste gas ports when in such horizontal position, the firing port being in line with the chamber and adapted for use as a dipping port when said chamber is in a vertical position and the waste gas port being adapted for liquid-tight closure when such chamber is in such vertical position.

9. A coating furnace comprising a deep chamber having a dished lateral enlargement at its head and adapted to be swung into a horizontal position, said chamber having openings at each end constituting respectively firing and waste gas ports when in such horizontal position, the firing port being in line with the chamber and adapted for use as a dipping port when said chamber is in a vertical position and the waste gas port being adapted for liquid-tight closure when such chamber is in such vertical position.

10. A coating furnace comprising a chamber having approximately a T-shape and provided with an opening in the head of the T adapted to serve both as a firing port and a dipping port, and with a closable opening at the other end adapted to serve as a waste gas port when open, means for swinging said chamber into vertical or horizontal position, and a closure adapted to seal said waste-gas port liquid-tight.

11. A coating furnace comprising a chamber having approximately a T-shape and dished on one side of the head of the T, said chamber being provided with an opening in the head of the T adapted to serve both as a firing port and a dipping port, and with a closable opening at the other end adapted to serve as a waste gas port when open, means for swinging said chamber into vertical or horizontal position, and a closure adapted to seal said waste-gas port liquid-tight.

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

WILLIAM M. PAGE.

Witnesses:
H. M. MARBLE,
FRANK E. RAFFMAN.