No. 753,712. PATENTED MAR. 1, 1904.

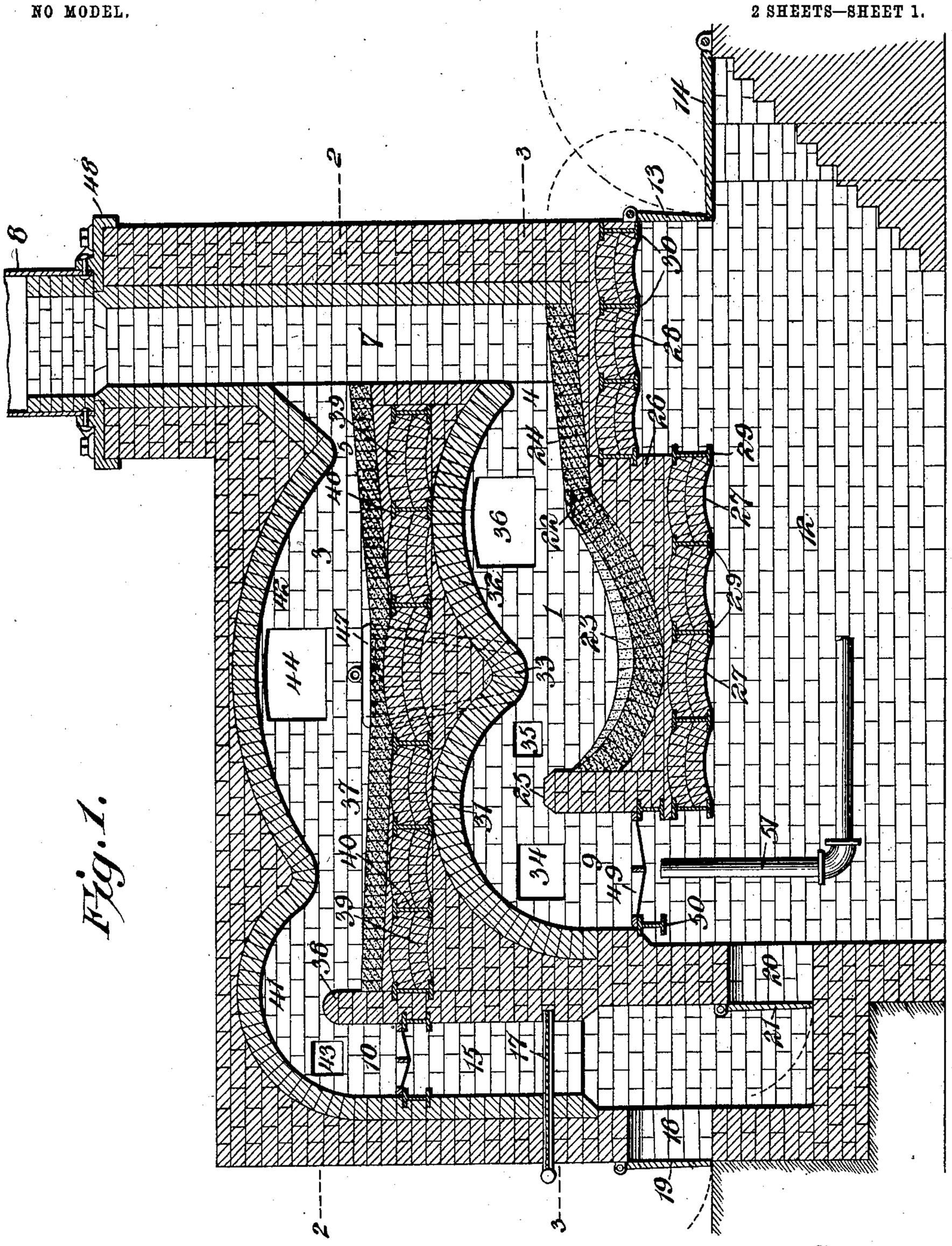
F. KEPP.

METALLURGICAL FURNACE.

APPLICATION FILED AUG. 18, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



Witnesses
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NO MODEL. 2 SHEETS—SHEET 2.

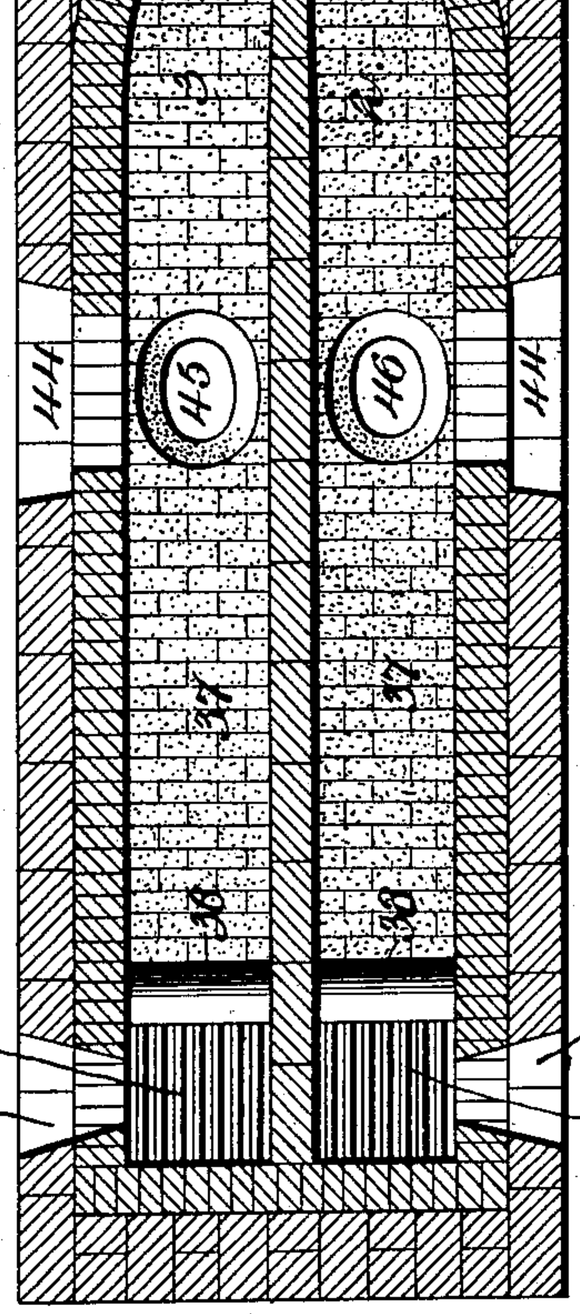

Fig. 2.

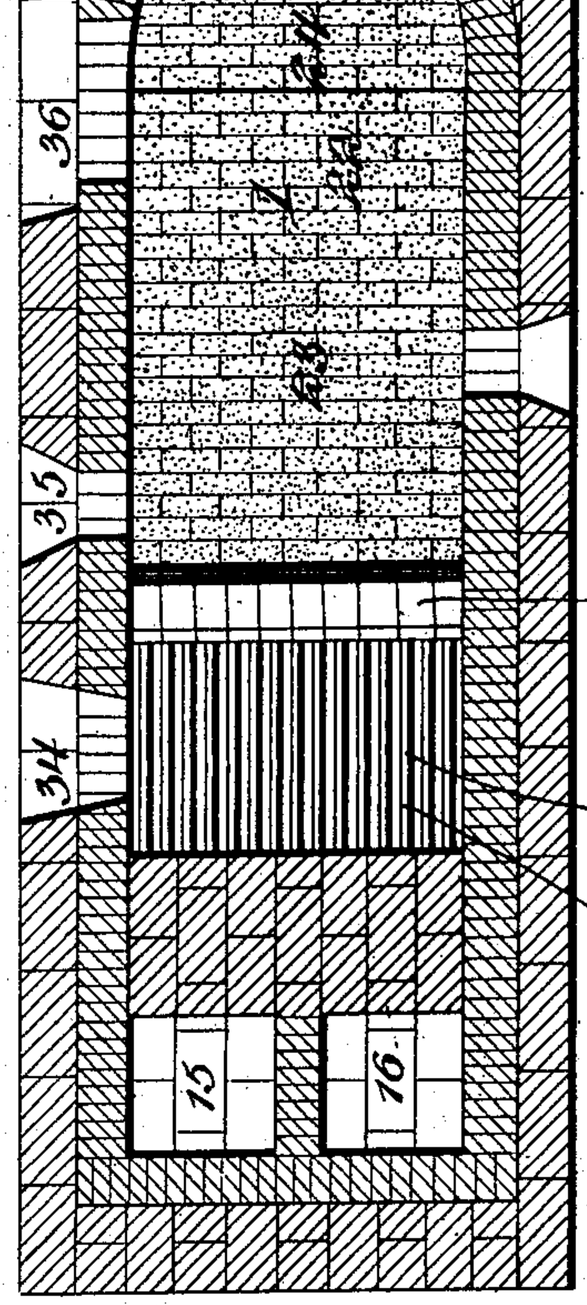

Fig. 3.

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No. 753,712. Patented March 1, 1904.

UNITED STATES PATENT OFFICE.

FERDINAND KEPP, OF BROOKLYN, NEW YORK.

METALLURGICAL FURNACE.

SPECIFICATION forming part of Letters Patent No. 753,712, dated March 1, 1904.

Application filed August 18, 1903. Serial No. 169,914. (No model.)

To all whom it may concern:

Be it known that I, FERDINAND KEPP, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented a new and useful Metallurgical Furnace, of which the following is a specification.

My present invention relates to a novel metallurgical furnace designed with special reference to the manufacture of brass, but capable of other metallurgical uses.

It is well understood by those skilled in the art that the manufacture of brass, which is an alloy of copper and zinc, is attended by objectionable oxidation of the metal and sometimes by actual vaporization of the zinc, the melting-point of which is many degrees below that of copper.

The primary object of this invention therefore is to produce a furnace by the use of which an alloy of high grade may be manufactured without material oxidation and without material loss by vaporization of its less refractory component metal or metals. This object is attained by making provision for the separate initial heating of the several component metals to melt the base metal and to bring the other metals nearly to their melting-points by thereafter effecting the separate introduction of the initially-heated metals last named into the path of the molten basic metal, and by the provision of means for regulating the introduction of air to the furnace to properly control the combustion and to prevent the oxidation of the alloy during its manufacture.

Another object of the invention is to secure a maximum output by providing for the concentration of the heat at the most effective points. This object is attained by so constructing the top wall of the melting-chamber that the flame from the furnace will be first projected against the body of molten metal and will be subsequently directed against the metal supported by the hearth-table at a point between the crucible and the stack.

A further object of the invention is to so arrange the initial heating-chambers with reference to the melting-chamber that certain of the metals after having been heated almost to the melting-point will be discharged into the metal-bath directly at that point of its surface against which the flame impinges in order that the precipitated metals will be instantly melted.

Other objects subordinate to those enumerated will appear during the succeeding description of the illustrated embodiment of the invention.

In the accompanying drawings, Figure 1 is a longitudinal sectional view of the furnace complete. Fig. 2 is a horizontal section on the line 2 2 of Fig. 1, and Fig. 3 is a similar view on the line 3 3 of Fig. 1.

Like numerals of reference designate corresponding parts throughout the several figures of the drawings.

The primary features characteristic of the furnace are a melting-chamber 1 and a plurality of initial heating-chambers 2 and 3, located above the melting-chamber to facilitate the separate heating of different metals—as, for instance, zinc and brass scrap. Each of these chambers is in direct communication through constricted throats 4, 5, and 6 with the chimney or discharge flue 7, above which extends a suitable stack 8, designed to insure the necessary draft. Each of the three chambers is provided at its front end with separate heating means, including fire-boxes 9, 10, and 11, equipped for the use of various kinds of fuel—for instance, wood, coal, or oil.

Below the melting-chamber 1 is a pit constituting an air-chamber or diving-flue 12, communicating at its rear end with the fire-box 9 of the melting-chamber 1 and having an opening at its rear end controlled by swinging doors or valves 13 and 14, the latter constituting also a trap controlling the entrance to the pit. The air-chamber 12 is designed to contain sufficient air for the maintenance of combustion in the fire-box 9 of the melting-chamber, the air-supply being capable of regulation by means of the doors or valves 13 and 14. For a similar purpose vertical air-flues 15 and 16 (see Fig. 3) are located below the fire-boxes 10 and 11 of the initial heating-chambers 2 and 3, each flue being equipped below its fire-box with a valve or damper 17, as shown in Fig. 1. The flues 15 and 16 are of identical construction and each is in com-

munication with the outer air through a passage 18, controlled by a valve or door 19, and with the chamber or flue 12 through a passage 20, controlled by a valve or door 21. Ordinarily the maximum ingress of air to the flues 15 and 16 is determined by the adjustment of the valves 19, and the passage of the air to the fire-boxes 10 and 11 is regulated by the dampers 17. If, however, an extraordinary circulation of air is desired, the air-chamber 12 may be placed in communication with the flues 15 and 16 by opening the valves 21, or either of them, as the occasion may demand.

The hearth 22, preferably constructed of silica brick and comprising the crucible 23 and the inclined table 24, extends from the bridge-wall 25 to the rear wall of the discharge flue or chimney. The hearth 22 has a suitable brick foundation 26, resting upon supporting-arches 27 and 28, carried by transverse **I**-beams 29 and 30, the arches 28 being disposed in a somewhat higher plane than the arches 27 and located under the table 24 and the rear wall of the chimney.

The top wall or roof of the melting-chamber 1 is defined by a pair of intersecting arches 31 32, which extend conjointly from the front of the fire-box 9 to the flue 7. The groin 33 or point of intersection of said arches is substantially centered over the crucible 23, but slightly nearer the front end thereof. The bridge-wall 25 is extended above the crucible and is located substantially under the crown of the arch 31, but slightly nearer the rear end of said arch, it being observed that the top of the bridge-wall almost reaches the horizontal plane of the groin 33. The rear extremity of the arch 32 is disposed above the table 24 of the hearth, the juncture of the crucible 23 and the table 24 being located substantially under the crown on said arch. It will be noted that the described relation of the top and bottom walls of the melting-chamber 1 imparts to said chamber a circuitous form, which form has been especially devised for the attainment of certain of the recited objects of the invention. The flames generated in the fire-box 9 are compelled to rise to a plane considerably above the crucible in order to pass over the bridge-wall 25 and are then deflected downwardly by the rear portion of the arch 31 in order to cause said flame to impinge upon the surface of the molten metal in the crucible 23 at a point directly below the groin 33 of the roof. After contacting directly with the molten metal in the crucible the flames rise in the arch 33 and in seeking an escape through the constricted throat 4 are projected directly against the solid metal placed on the table 24 of the hearth. It will be observed that by this peculiar arrangement the heat is concentrated at the most effective points—to wit, at the surface of the metal in the crucible 23 and at that point of the table 24 upon which the solid metal is placed for melting. As the metal melts it runs down the inclined table to the crucible 23, where it is still subjected to the direct action of the flames.

One side wall of the chamber 1 is provided with a fuel-opening 34, located above the fire-box, a pole-opening 35, and a charge-opening 36. The opening 34 permits the introduction of wood or coal into the fire-box. The opening 35 is designed to permit the observation of the bath and the necessary poling of the metal, and the opening 36 is utilized for the charging of the furnace, its location being such as to permit the placing of a suitable quantity of metal upon the table 24 of the hearth.

The chambers 2 and 3 are of identical construction, each being provided with a silica-brick hearth 37, extending from the bridge-wall 38 to the flue 7 and downwardly inclined from its opposite ends to a point directly over the groin 33 of the melting-chamber roof. These hearths 37 are supported upon suitable foundations, including arches 39 and **I**-beams 40, supported above the arched roof of the chamber 1. The roof of each of the initial heating-chambers, like the roof of the melting-chamber, is formed with a pair of intersecting arches 41 and 42; but instead of being arranged like the arches of the melting-chamber these arches 41 and 42 are of widely-different radius, the arch 42 being comparatively long and having its crown disposed directly over the lowest point of the hearth 37 and the groin 33 of the melting-chamber roof. This arrangement is adopted because there is no necessity for securing that intense concentration of heat in the initial heating-chambers which is essential to the melting-chamber, since the metal in the chambers 2 and 3 is only intended to be heated until near the melting-point and not actually melted. In the side walls of the last-named chambers are formed fuel-openings 43 and charge-openings 44.

In the manufacture of brass copper is first placed on the table 24 of the hearth 22 and is melted to form a copper-bath in the crucible 23. Into this bath the other metals—as, for instance, zinc and brass, raised approximately to their respective melting-points—are designed to be precipitated from the initial heating-chambers. Provision must therefore be made for establishing communication between these chambers and the melting-chamber at the proper time. Such provision consists in downwardly-tapered shafts 45 and 46, extending from the lowest points of the hearths 37 of the chambers 2 and 3 and piercing the roof of the melting-chamber at the groin 33. The tapered form of these shafts prevents the too violent precipitation of the metal into the copper-bath, and it will be observed that as these shafts open into the melting-chamber at the groin of its roof the metal

will be dropped into the bath at the point thereof against which the flame is directed by the rear portion of the arch 31. In other words, the described arrangement results in introducing the previously-heated metal in the bath directly at that point where the heat is concentered by reason of the peculiar arrangement of the melting-chamber, and as the intense heat will instantly melt the metal and incorporate it in the bath oxidation and vaporization will be reduced to a minimum.

The upper ends of the shafts 45 and 46 are closed by caps or doors 47, which are removed at the proper time to permit the initially-heated metals to be dropped into the bath. The top of the chimney is protected by a cap-plate 48, bolted or otherwise secured in place and retaining the stack 8, which may be lined with fire-brick, as shown.

The arrangement of the heating apparatus and the several fire-boxes is not material; but I prefer to employ grates 49, resting on I-beams 50 to facilitate the use of either wood or coal as a fuel, and these grates are preferably augmented by oil-burners 51 of any approved construction to facilitate the use of liquid fuel. The grates 49 may, if desired, be removed when the burners 51 are in use. It will of course be understood that the various fuel charging and poling-openings will be provided with suitable closures.

Briefly, the operation of the furnace in the manufacture of brass is as follows: The various valves controlling the circulation of air having been adjusted the fires are started, the initial heating-chambers are charged with zinc and brass scraps, and the melting-chamber 1 is charged with copper. A free circulation of air through the diving-flue 12 will promote sufficient combustion to quickly melt the copper and cause it to run down into the crucible 23 to form a bath. The temperature of the zinc and brass having been raised approximately to the melting-points of these metals by different degrees of heat in the chambers 2 and 3, the cap 47 in the chamber 3 will first be removed and the brass dropped through the shaft 46 and into the copper-bath. After the lapse of a brief interval to permit the complete melting of the brass and its union with the copper the cap 47 in the chamber 2 will be removed and the zinc will be precipitated into the bath. Both caps 47 will then be replaced, the various valves will be closed to exclude air, except such as is contained in the chamber 12, and the combustion in the fire-box 9 will be increased as much as possible, in order to secure an intense heat in the melting-chamber. The molten metal is finally poled and skimmed, and the metal is tapped out of the crucible in the usual manner.

It is thought that from the foregoing the construction and operation of my novel metallurgical furnace will be clearly comprehended; but while the present embodiment of the invention is thought at this time to be preferable I do not wish to be understood as limiting myself to the structural details defined, as, on the contrary, I reserve the right to effect such changes, modifications, and variations of the illustrated structure as may fall fairly within the scope of the protection prayed.

What I claim as new is—

1. A metallurgical furnace including a discharge-flue, a melting-chamber and a superposed initial heating-chamber, said chambers having independent communication with the discharge-flue at their rear ends, separate heating means arranged to direct products of combustion through the chambers to the flue, and means for establishing communication between said chambers at points intermediate of their ends.

2. A metallurgical furnace including a melting-chamber, a plurality of initial heating-chambers, separate heaters arranged to direct products of combustion through the melting and initial heating chambers respectively, and independent means for establishing communication between each heating-chamber and the melting-chamber.

3. A metallurgical furnace including a vertical discharge-flue, a melting-chamber communicating at its rear end therewith, an initial heating-chamber located above the melting-chamber and having independent communication at its rear end with the flue, a vertical shaft through which metal may be passed to the melting-chamber from the heating-chamber, and separate heating means for each chamber.

4. A metallurgical furnace including superposed chambers, a fire-box located at the front end of each chamber, a discharge-flue communicating with the rear ends of both chambers, and a vertical shaft establishing communication between the chambers intermediate of the ends thereof.

5. A metallurgical furnace including a melting-chamber, a plurality of superposed initial heating-chambers, separate heaters for the melting and heating chambers arranged to pass the products of combustion therethrough, and independent means controlling the communication between each heating-chamber and the melting-chamber.

6. A metallurgical furnace including a melting-chamber, a plurality of superposed initial heating-chambers, separate heaters for the melting and heating chambers and arranged to direct the products of combustion therethrough, and a vertical shaft extending from each heating-chamber to the melting-chamber.

7. A metallurgical furnace including a melting-chamber, a plurality of superposed initial heating-chambers, a discharge-flue having independent communication with each of the several chambers, independent heating means for each chamber, and means for establishing communication between each heating-cham-

ber and the melting-chamber to permit the discharge of metal into the latter.

8. A metallurgical furnace including a melting-chamber, a plurality of superposed initial heating-chambers, a discharge-flue having independent communication with each of the several chambers, a separate fire-box for each chamber, a vertical shaft extending from each initial heating-chamber to the melting-chamber, and independent means for closing each of said shafts.

9. A metallurgical furnace including a melting-chamber, an initial heating-chamber, separate heating means for said chambers, a diving flue for supplying air to the melting-chamber, and a controlling-valve for said flue.

10. A metallurgical furnace including a melting-chamber, a superposed initial heating-chamber, separate air-flues for supplying air to said chambers, means for establishing communication between the flues, and separate means controlling the passage of air to each flue.

11. A metallurgical furnace including a melting-chamber, a superposed heating-chamber, a separate fire-box for each chamber arranged to direct the products of combustion through the same, separate air-flues leading to the fire-boxes, and valves controlling the passage of air through said flues.

12. A metallurgical furnace including a melting-chamber having a fire-box at one end thereof, a large air-space located below the melting-chamber and communicating with the fire-box, a valve controlling the passage of air to the air-space, an initial heating-chamber, a shaft leading from said chamber to the melting-chamber, and means for closing said shaft.

13. A metallurgical furnace including a melting-chamber, a plurality of superposed initial heating-chambers, a discharge-flue having communication with the rear end of each chamber, a separate fire-box located at the front end of each chamber, a large air-space located under the melting-chamber and communicating with the fire-box thereof, a valve controlling the ingress of air to the air-space, an individual air-flue communicating with the fire-box of each initial heating-chamber, valves controlling the passage of air through said flues, and valves controlling the communication between each of said air-flues and the large air-space.

14. A metallurgical furnace including a melting-chamber, a fire-box located at one end of the chamber and a discharge-flue at the opposite end thereof, a hearth constituting the bottom of the chamber and including an inclined table and a crucible, a pair of intersecting arches extending conjointly from the front of the fire-box to the front of the discharge-flue, said arches constituting the top wall of the melting-chamber and having their point of intersection or groin located above the crucible to deflect the flames downwardly against the molten metal therein and an initial heating-chamber having communication with the melting-chamber.

15. A metallurgical furnace including a melting-chamber, a fire-box and a discharge-flue at opposite ends of the chamber, a bridge-wall at the rear side of the fire-box, a hearth extending from the bridge-wall and including an inclined charge-table and a crucible extending from the charge-table to the bridge-wall, and a pair of intersecting arches extending conjointly from the front of the fire-box to the front of the discharge-flue, the groin or point of intersection of said arches being located above the crucible and the rear arch terminating at a point above the charge-table whereby the flames issuing from the fire-box and passing over the bridge-wall are deflected downwardly against the molten metal in the crucible and are subsequently directed against the charge of metal supported by the charge-table.

16. A metallurgical furnace including a melting-chamber a superposed initial heating-chamber, a hearth constituting the bottom of the melting-chamber and having a dished portion or crucible, a pair of intersecting arches constituting the top wall of the melting-chamber and having their groin or point of intersection located above the crucible, and a shaft establishing communication between the chambers said shaft opening through the top wall of the melting-chamber at the groin thereof.

17. A metallurgical furnace including a melting-chamber, a superposed initial heating-chamber, a hearth constituting the bottom of the melting-chamber and having a dished portion or crucible, a pair of intersecting arches constituting the top wall of the melting-chamber and having their groin or point of intersection located above the crucible, and a shaft establishing communication between the chambers, said shaft opening through the top wall of the melting-chamber through the groin thereof, the top wall of the initial heating-chamber being formed by front and rear arches, the crown of the rear arch being located directly above the shaft.

18. A metallurgical furnace including a melting-chamber, a hearth constituting the bottom wall of the melting-chamber and formed with a dished portion or crucible, a pair of intersecting arches constituting the top wall of the melting-chamber and having their groin or point of intersection located above the crucible, a plurality of initial heating-chambers located above the melting-chamber, and separate shafts establishing communication between the melting-chamber and each initial heating-chamber, said shafts opening through the top wall of the melting-chamber at the groin thereof.

19. A metallurgical furnace including a melting-chamber, a superposed initial heating-

chamber, separate heaters for directing products of combustion through the chambers, and a vertical downwardly-tapered shaft establishing communication between said chambers and a removable closure at the upper end of said shaft.

20. A metallurgical furnace including a discharge-flue, a melting-chamber, a superposed initial heating-chamber, said chambers having independent communication at their rear ends with the discharge-flue, separate heating means for said chambers arranged to direct the products of combustion through the same to the flue, and means for establishing communication between the chambers to permit the passage of the metal from the heating-chamber to the melting-chamber.

21. A metallurgical furnace including a melting-chamber, and an initial heating-chamber, a separate heater for each chamber arranged to direct the products of combustion through the same, and means for opening communication between the chambers to permit the transfer of the metal from the initial heating-chamber to the melting-chamber.

22. A metallurgical furnace including a melting-chamber and a superposed initial heating-chamber, each having a discharge-opening at one end thereof, a separate heater for said chambers located at the ends thereof opposite the discharge-openings and arranged to direct the products of combustion through the chambers, and means for establishing communication between the chambers to permit transference of the metal from one chamber to the other.

23. A metallurgical furnace including a melting-chamber and a superposed initial heating-chamber, each having a discharge-opening, separate heaters for the chambers arranged to direct the products of combustion through the same, and a vertical shaft connecting the chambers intermediate of the ends thereof and serving as a conduit for the metal during its transference from one chamber to the other.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

FERDINAND KEPP.

Witnesses:

WILFRED A. DE WHITRIDGE,

CLARENCE W. DEXTER.