2 Sheets--Sheet 1.

C. GRASSER & J. STEPP.

Apparatus for Casting Metals.

No. 165,164. Patented July 6, 1875.

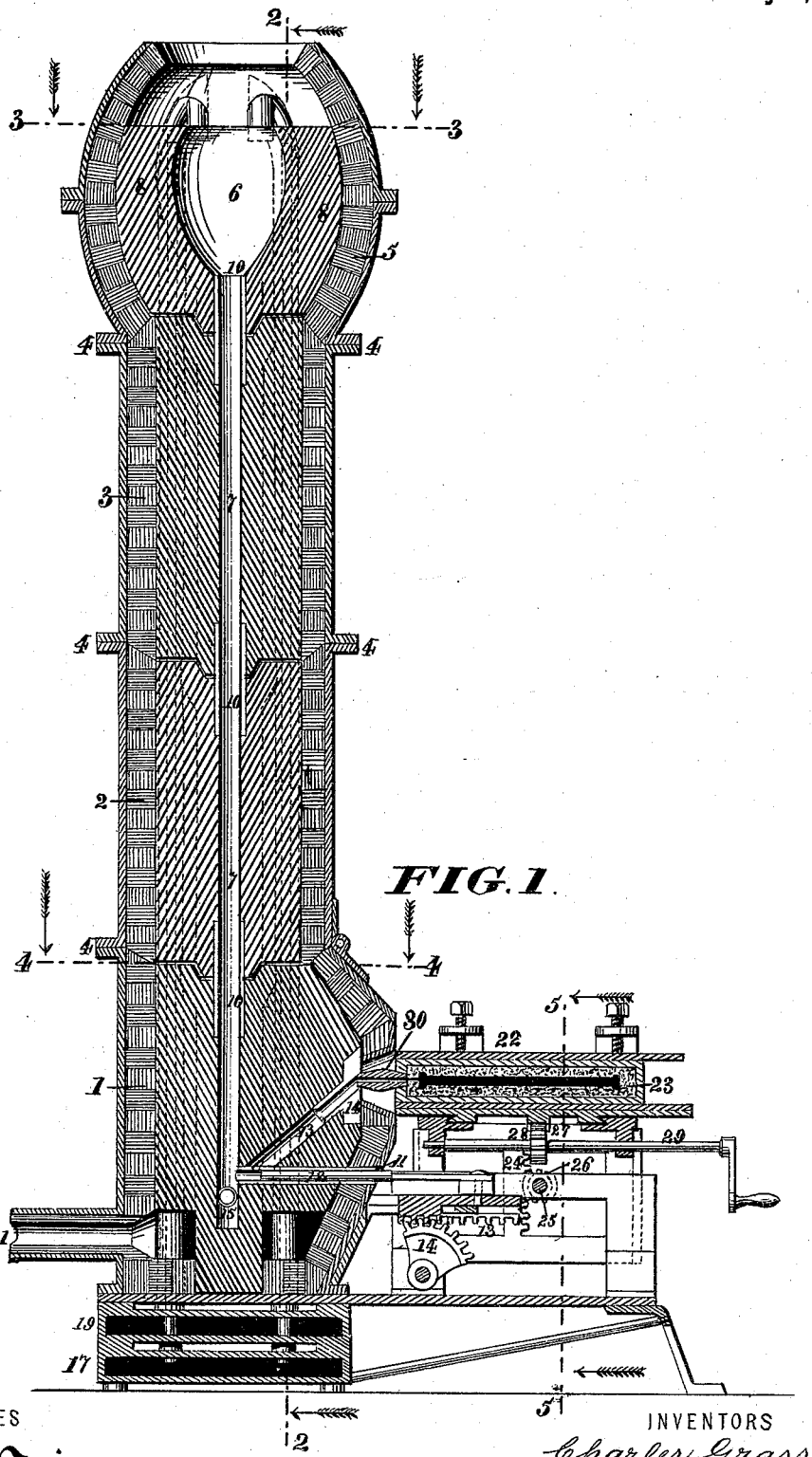

FIG. 1.

WITNESSES

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FIG. 2.

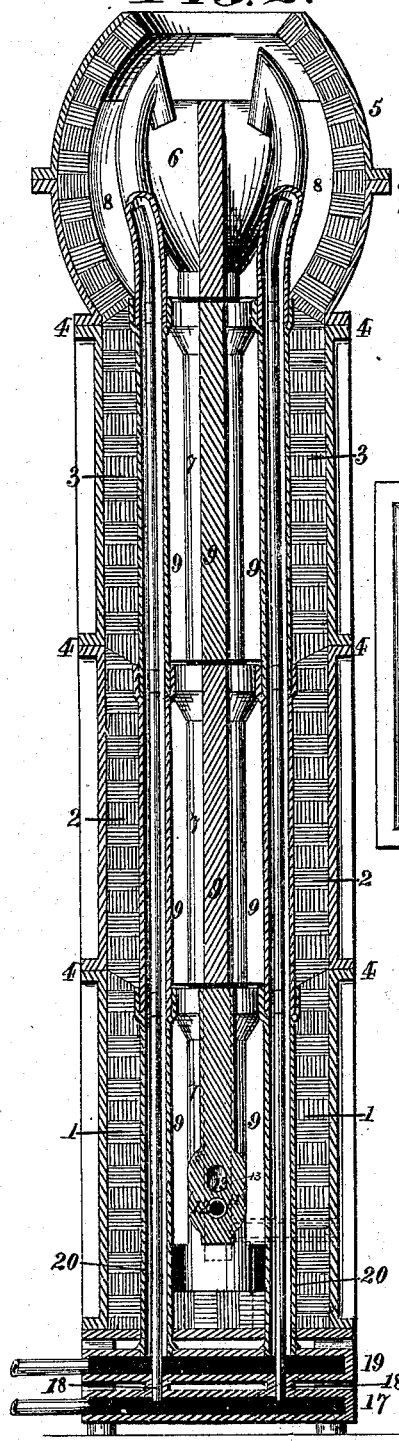


FIG. 4.

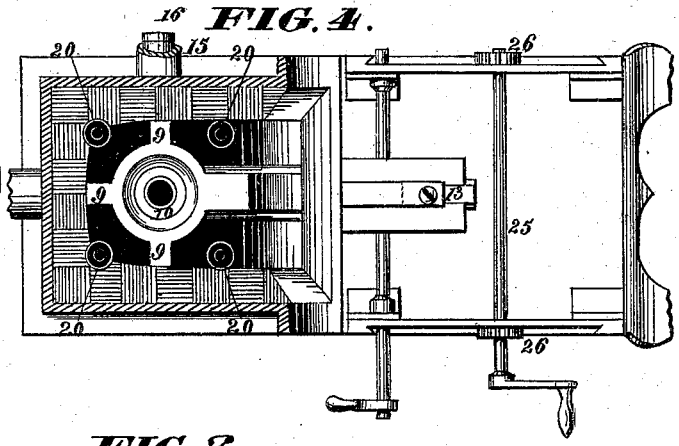


FIG. 3.

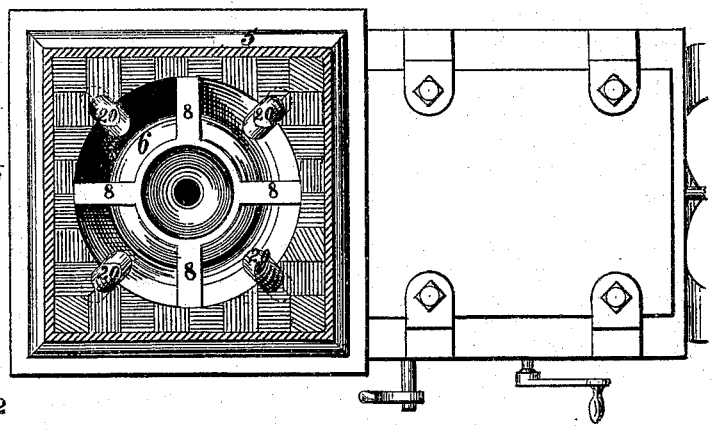
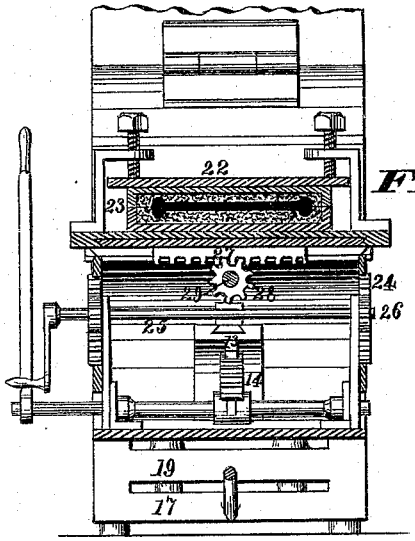


FIG. 5.



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UNITED STATES PATENT OFFICE.

CHARLES GRASSER AND JACOB STEPP, OF SOMERVILLE, MASSACHUSETTS, ASSIGNORS, BY MESNE ASSIGNMENTS, TO AMERICAN ART FOUNDRY, OF SAME PLACE.

IMPROVEMENT IN APPARATUS FOR CASTING METALS.

Specification forming part of Letters Patent No. **165,164**, dated July 6, 1875; application filed August 22, 1874.

To all whom it may concern:

Be it known that we, CHARLES GRASSER and JACOB STEPP, both of Somerville, in the county of Middlesex and State of Massachusetts, have invented a new and Improved Apparatus for Casting Metals, of which the following is a specification:

Our apparatus constitutes a furnace, and is constructed so as to serve also as a standpipe or fountain, by which molten metal is delivered in large or small quantities, with any desirable pressure, under control of valves, which, together with the mouth-piece and all parts of the apparatus which require accurate fitting, or are subjected to wear, and at the same time have to withstand a high degree of heat, we construct of porcelain. The apparatus is made in sections, so that its height and the consequent height of the vertical column of molten metal may be varied according to the pressure which it is desired to apply to the metal within the molds. The invention also relates to a construction of furnace by which molten metal may be delivered in successive quantities, as desired, with promptness and certainty, without danger of chilling, and cut off instantaneously; also, to a device for withdrawing the surplus metal from the furnace when required. The invention further relates to a mode of supporting the molds upon an adjustable table and readily centering them in relation to the mouth-piece. The heating of the apparatus is effected by gas and air introduced through concentric pipes passing upward inside the furnace, in order to pre-heat the said gas and air, as hereinafter described.

In the accompanying drawings, Figure 1 is a vertical section of a casting apparatus illustrating our invention. Fig. 2 is a vertical section on the line 2 2, Fig. 1. Fig. 3 is a horizontal section on the line 3 3, Fig. 1. Fig. 4 is a horizontal section on the line 4 4, Fig. 1. Fig. 5 is a vertical section on the line 5 5, Fig. 1.

The external walls of the furnace are constructed in annular sections 1 2 3, of any desired number, placed one upon another, and each consisting of an inner body of fire-brick and an outer casing of metal, with flanges 4 for coupling or connecting the sections. The top 5 of the cupola is formed in like manner of fire-brick surrounded by metallic plates, and is enlarged in its internal capacity sufficiently to inclose the crucible 6, which surmounts the sectional pipes 7, said pipes being coupled together and the sections thereof corresponding in number to the sections 1 2 3 of the casing of the furnace. The melting-pot 6 at the top of the furnace is constructed of crucible stuff, and may be made of any capacity, to contain from fifty to five hundred pounds of metal, according to the purpose of the apparatus and the extent of the operations for which it is desired. It is constructed with radial flanges 8, extending outward to the inner walls of the casing 5, in order to support the crucible or melting-pot firmly in a central position. The pipes 7, which receive the molten metal from the crucible, are also constructed of crucible stuff, and with similar radial flanges 9 for the same purpose. These flanges may be formed upon the crucible and the pipes respectively, or upon the casing surrounding the same, as preferred. The joint between the upper pipe and crucible, and between the successive sections of the pipe, are formed of coupling-tubes 10, of porcelain.

The lower section of the vertical pipe communicates with a horizontal pipe, 11, of porcelain, within which works a porcelain valve or plug, 12, for the purpose of opening and closing the discharge-aperture for the molten metal. When this plug-valve is retracted or opened the metal is permitted to flow through a duct, 13, which has an upward inclination and communicates with a mouth-piece, 14, also constructed of porcelain.

It will be observed that the parts 10, 11, 12, and 14, which are constructed of porcelain, are completely surrounded by a body of crucible stuff or other non-conducting material to protect them against too rapid heating and consequent danger of cracking.

In constructing the tubes 10, valve 12, sleeve 11, mouth-piece 14, and such other parts as are made of porcelain, we adopt the following mode of treatment, in order to effect the necessary accuracy in shaping and fitting and pre-

vent distortion in the operation of burning: Taking the material of which the porcelain is to be made, we mold or otherwise shape the articles in approximately the form they are to have, and then subject them to a preliminary baking process for, say, two hours at a temperature not exceeding 1,500° Fahrenheit, by which the material is brought to such a degree of hardness and consistency as to prevent any considerable subsequent distortion, while it is still soft enough to be worked with steel tools. We then shape the articles with more accuracy, cutting any screw-threads that may be required and finishing up all parts, excepting such as are required to fit together air-tight, for which purpose grinding is necessary. The final baking or burning is then given, after which the articles can only be cut by the use of diamond tools or ground with emery.

A peculiar porcelain composition, which may be used in carrying out our invention, will be made the subject of a separate application for Letters Patent.

The plug-valve 11 is operated by a rack and sector, 13 14. 15 represents a discharge-aperture closed by a plug, 16, and employed for drawing off the surplus metal when the furnace is to be completely emptied thereof. The heating of the furnace is effected by means of gas introduced in a chamber, 17, and forced upward through pipes 18, of which there may be four, more or less, the air to support combustion being introduced in similar manner from a chamber, 19, through pipes 20, surrounding the gas-pipes 18. These concentric pipes are arranged around the pipes 7, which contain the molten metal, and are surrounded by the fire-brick sections 1 2 3, in order to confine the heat. The gas and air are discharged together at and around the top of the crucible 6, the flame coming in contact with and passing outward completely around the crucible, and the heated products of combustion being carried downward by the force of the blast to the bottom of the furnace, where they are discharged through the flue-pipe 21. The flask 22, containing the mold 23, is fitted to slide upward and laterally and forward and backward, as may be required. The vertical adjustment of the flask is effected by means of racks 24 and a crank-shaft, 25, carrying pinions 26, the racks being attached to the sides of a frame, within which the flask receives its forward and backward motion to present it to and withdraw it from the mouth-piece of the furnace. The lateral adjustment of the flask is effected by means of a rack, 27, and pinion 28, operated by a crank-shaft, 29. 30 represents a sprue-tube or conducting-pipe for leading the molten metal from the mouth-piece 14 to the sprue of the mold.

In setting up the apparatus, any necessary number of the sections 1 2 3, with their contained tubes 7, are set one upon another to reach to the necessary height to impart such pressure as may be desired to the outflowing metal when the whole is in a fused state and the apparatus is in operation. The metal to be fused is placed in the crucible 6, and gas and air being forced in through the concentric pipes 18 and 20, the gas is ignited at the outlets of the pipes 18 and its combustion maintained by the air forced through the pipes 20. The flame being thus injected at the top of the furnace, and carried around the crucible and down in contact with the pipes 7 and 20, fuses the entire body of metal and keeps it in a constantly melted condition, and at the same time imparts a high degree of heat to the inflowing gas and air within the pipes 18 and 20. When it is desired to run the metal into the mold the latter is adjusted in position in front of the mouth-piece 14 by the means already described, the conducting-pipe 30 being placed in position. The valve 12 is then retracted, permitting the molten metal to flow up through the duct 13, mouth-piece 14, and tube 30 into the mold 23, within which it is compressed with all the force exerted by the column of molten metal in stand-pipe 7. As soon as the casting is completed the valve 12 is again closed, when the flask 22 and the tube may be removed.

It will now be seen that the molten metal will stand within the upwardly-inclined duct 13 and mouth-piece 14 in readiness for instantaneous ejection whenever the valve 12 is again retracted; and as the said ducts 13 and mouth-piece 14 are inclosed within the fire-brick and subjected to the full heating effect of the fuel, the metal is kept in a melted state in readiness for immediate use.

When the furnace is to be emptied, the plug 16 is taken out, permitting the entire body of metal which may remain within the furnace to run off. To maintain heat within and around the mouth-piece, charcoal or other fuel may be added at that point, if desired. The construction of the mouth-piece and valve of porcelain is a feature of great value when the apparatus is to be used for casting refractory metals, the heat required for which rendering the use of a metallic mouth-piece or valve impracticable, while most substances adapted to resist the necessary degree of heat lack the strength, cohesion, durability, and capacity for nice fitting which are requisite for the mouth-piece and valve under our invention. For casting soft metals, however, a metallic mouth-piece and valve may, in some cases, be used. The upward delivery of the metal is of great utility in preventing any drip, and in connection with the valve and the hydrostatic column in the stand-pipe, affords a full and instantaneous delivery, which may be regulated in rapidity and quantity with the greatest nicety. The table 32, which supports the flask 22, may be constructed in any suitable manner to adapt it for the flasks with which it is to be used, and to receive the vertical and lateral adjustment by the respective racks and pinions hereinbefore described; or, with small molds, these mechanical devices for raising and adjusting the table, by which the mold is

supported, may be dispensed with, as the mold can readily be adjusted by hand.

We are aware that founders, in certain instances, use a sort of stand-pipe to obtain a higher pressure on the metal in the mold; but such stand-pipe is built up for each article to be cast, and only on large castings, and has one great disadvantage, namely: the body of metal in such a temporary stand-pipe is liable to chill and harden sooner than the casting, which is of a greater mass. We are also aware that at times a receptacle or ladle, provided at the bottom with an outlet, closed with a plug, is employed by placing such ladle on the top of the mold, and in communication with the sprue of the same. When the casting is to take place, all the metal required to fill the mold is first poured into such ladle, the plug in the bottom of the ladle preventing the flow of metal into the mold until said plug is removed by withdrawing it from the top of the ladle through the fluid metal. This mode of casting is adopted in order to obtain a uniform and rapid inflow of the metal and a certain degree of pressure; but it is a slow and expensive operation, as the plug must be removed at every operation, being made of a moist clay fastened to the end of a rod of iron and rendered dry in its place. It is only employed for large castings, and the metal is exposed, as in the ordinary mode, to the detrimental oxidizing influence of the atmosphere. By means of our apparatus and furnace we can regulate the pressure required to inject the metal into the molds to a great and uniform nicety, so as to obtain just such a pressure as may be required to perfectly fill molds made of material of greater density than ordinary molding-sand or loam. Furthermore, our apparatus is a ready fountain from which fluid metal may be drawn off at pleasure when required, no long and laborious preparation being necessary. The metal is kept entirely from contact with the air, and an injurious and wasteful oxidation of it is thus prevented. By the use of our furnace or apparatus all sizes of castings, small or large, may be made with the greatest facility, and with the great and indisputable advantage of having a high column of perfectly fluid metal in connection with the casting to be made.

The following is claimed as new:

1. A crucible or metal receptacle, inclosed in a furnace, and provided at bottom with an outlet communicating with a stand-pipe surrounded and inclosed by the furnace-walls, and of sufficient vertical length to compress the molten metal within the molds with a uniform force, as the metal is drawn off.

2. The combination of a valve, 12, with a stand-pipe, 7, and ascending duct 13, operating substantially as set forth.

3. In an apparatus for casting refractory metals, the valve 12, constructed of porcelain and working, within a suitable sleeve or casing, in contact with the molten metal, the whole surrounded by a protecting body of crucible stuff or other non-conducting material to prevent the too rapid heating of the porcelain, substantially as set forth.

4. The porcelain coupling-tubes 10, employed substantially as set forth, in combination with the sectional stand-pipe 7, and a surrounding body of crucible stuff, or other non-conducting material to protect the porcelain in an apparatus for casting refractory metal.

5. The porcelain mouth-piece 14, constructed and applied as herein set forth, surrounded by a protecting body of crucible stuff or other non-conducting material within the furnace-walls.

6. The flanges 8 and 9, employed to center and support the crucible 6 and pipes 7, respectively, substantially as set forth.

7. The combination of the crucible 6, stand-pipe 7, valve 12, duct 13, and mouth-piece 14 within a suitable furnace, constituting a self-acting fountain for the delivery of molten metal for casting purposes.

8. The adjustable table 32, operated by racks and pinions 24, 26, 27, 28, substantially as described, for the purpose set forth.

CHARLES GRASSER.
JACOB STEPP.

Witnesses:
J. J. C. SMITH,
MICHAEL SMITH.