Jan. 4, 1944. H. G. YARUSS 2,338,560

CENTRIFUGAL CASTING APPARATUS

Filed Dec. 2, 1942 2 Sheets-Sheet 1

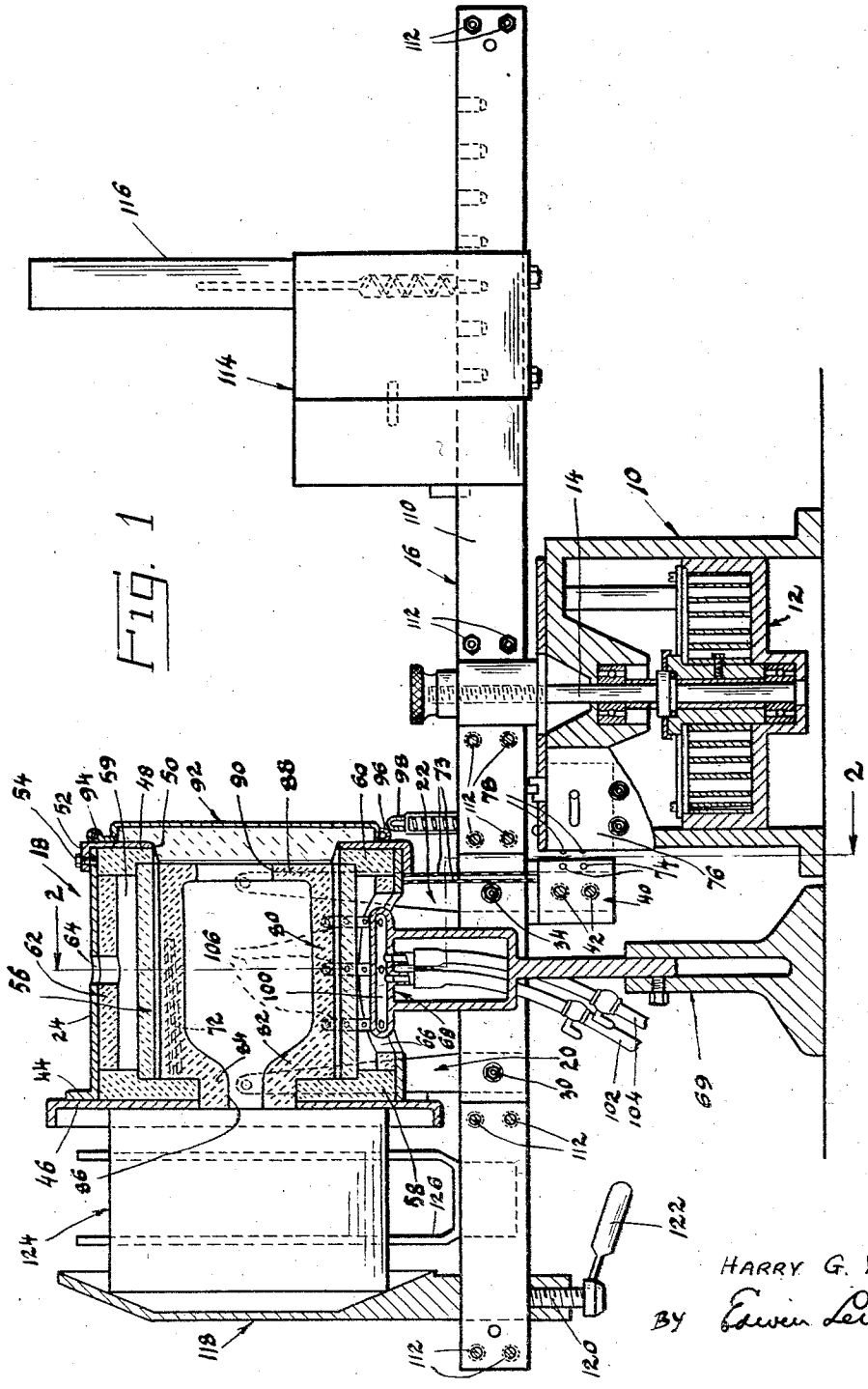


FIG. 1

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Fig. 4

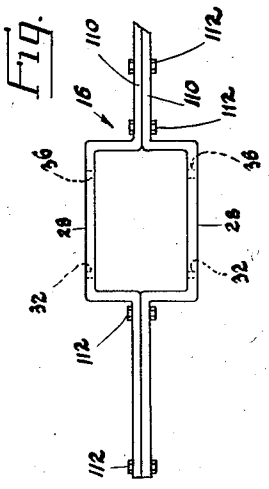


Fig. 3

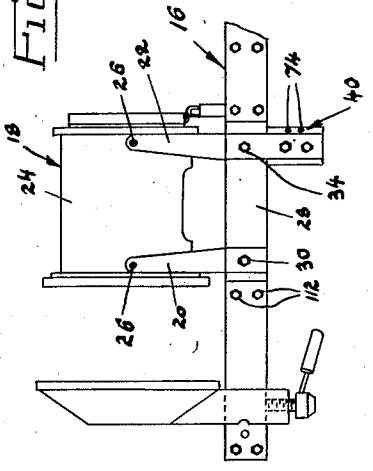
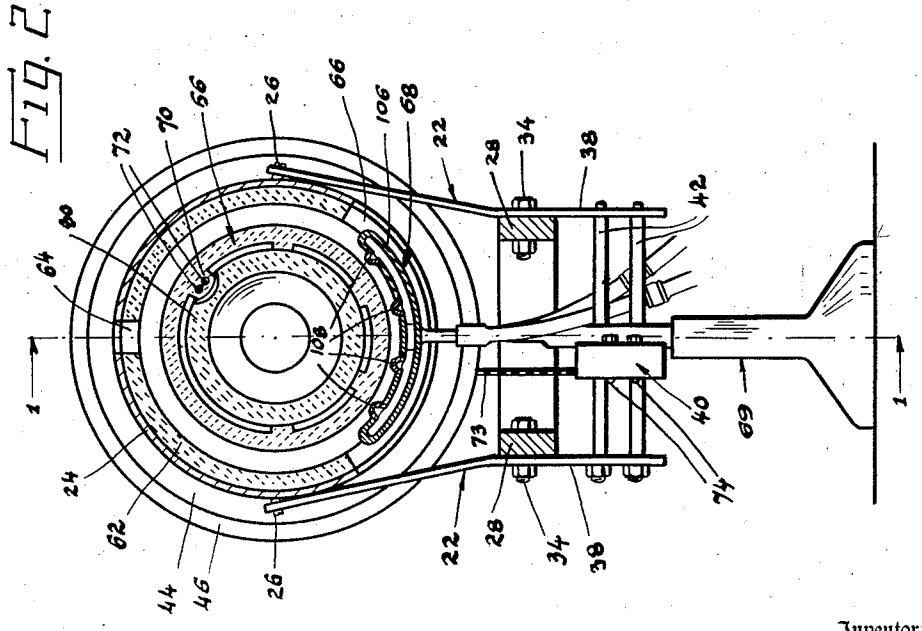


Fig. 2



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UNITED STATES PATENT OFFICE

2,338,560

CENTRIFUGAL CASTING APPARATUS

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Application December 2, 1942, Serial No. 467,589

9 Claims. (Cl. 22—65.1)

This invention relates to centrifugal casting apparatus of the type intended primarily for use in dental, jewelry or similar arts or, more generally, for use in casting comparatively small articles or small parts of various articles.

The primary object of the present invention is the provision of a centrifugal casting apparatus having a furnace heated by a gaseous or other fuel burner in such manner that the interior of the crucible positioned in the furnace is out of communication with the flame of the burner or the combustion products thereof, whereby to prevent any impairment of the metal which is melted in the crucible preliminary to the casting thereof. Heretofore, when gases were utilized for melting metal in the crucible of a centrifugal casting apparatus, the heating flame, for example the flame of a blow pipe or the like, was applied to said metal in the crucible, with undesirable results, at least in most cases, because of the oxidizing or other harmful effect of the flame on the metal. This objection and disadvantage are eliminated by the present invention.

Another object of the invention is to provide a centrifugal casting apparatus having a furnace in which steel and steel alloys can be melted preliminary to the casting thereof.

The above and other objects, features and advantages of the invention will be more fully understood from the following description, considered in connection with the accompanying illustrative drawings:

In the drawings:

Fig. 1 is a side view in elevation, and partly in section, of a centrifugal casting apparatus embodying the present invention;

Fig. 2 is a sectional view on the line 2—2 of Fig. 1;

Fig. 3 is a side view in elevation of part of the casting apparatus illustrated in Fig. 1;

Fig. 4 is a plan view of part of the bar on which the furnace of the casting apparatus is mounted for rotation.

The centrifugal casting apparatus embodying the present invention comprises a base 10 in which the motor 12, here shown as a spring motor, but which can be any other type of motor, is mounted for actuating the rotary shaft 14. A horizontal bar 16, hereinafter to be more specifically described, is removably secured to the upper end of shaft 14 to rotate therewith. The furnace 18 is releasably secured to bar 16 at a point between shaft 14 or the axis of rotation of bar 16 and one end of said bar. The support for furnace 18 comprises a pair of arms 20 and a pair of arms 22 secured at their upper ends to the outer casing 24 of the furnace by screws 26. The lower ends of supporting arms 20 are secured to the laterally spaced parts 28 of bar 16 by bolts 30 projected through holes 32 formed in bar portions 28. The lower end portions of arms 22 are similarly secured to bar portions 28 by bolts 34 passing through holes 36 in bar portions 28. Supporting arms 22 are provided with integral extensions 38 which project below bar 16. A contact carrying block 40 is removably secured between arm extensions 38 by suitable bolts 42.

The outer wall 24 of furnace 18 is preferably formed of sheet metal and is cylindrical. One end of said cylindrical wall is provided with a peripheral flange 44 to which the rear wall 46 of the furnace is secured in any suitable way, for example by being welded thereto. A front metal wall 48 provided with a central opening 50 is secured to the opposite end of cylindrical wall 24 in any suitable way, preferably by securing the peripheral flange 52 of said front wall to the adjacent edge of the cylindrical wall, for example by screws 54.

A cylindrical refractory muffle 56, preferably of alundum, is positioned internally of the furnace and forms the inner peripheral wall of the heating chamber. The opposite ends of the cylindrical muffle 56 are embedded in the end refractory walls 58 and 60 which form the opposite end walls of the heating chamber, said end walls also being preferably formed of alundum. The peripheral wall of the furnace is provided on its inner surface with a refractory lining wall 62 which is spaced radially from the outer surface of cylindrical muffle 56 forming an annular space 59 between said muffle 56 and said lining 62. The top of the furnace is provided with an outlet opening 64 for the products of combustion, and the bottom of said furnace is provided with an opening 66 in which a fuel burner 68 is removably positioned as will hereinafter be described in further detail.

The muffle 56 has an inwardly projecting portion 70 within which a thermocouple 72 is positioned, said thermocouple being connected by suitable wiring 73 to the terminal contacts 74 on contact block 40. A movable contact holder 76 is mounted on base 10 and carries contact members 78, which engage the contact members on said block when said holder is projected outwardly. Contacts 78 are connected to a pyrometer (not shown) for indicating the temperature within the crucible 80. Holder 76 is mounted for sliding movement on base 10 from a retracted position in which said holder is out of engagement with block 40 and the contacts carried by said block to a projected position in which said holder engages said block and the holder carried contacts engage the block carried contacts. It will be understood that when holder 76 is moved outwardly so that the contacts 78 engage contacts 74, rotation of bar 16 and of the parts carried thereby is prevented and that upon completion of the heating operation, as indicated by the pyrometer, the movement of holder 76 inwardly to disengage the same from block 40 allows rotation of bar 16 by motor 12 through shaft 14.

Crucible 80 is of cylindrical shape and fits re-

movably within the heating chamber of the furnace, and more particularly within muffle 56. Crucible 80 is preferably formed of carbon. Said crucible has a rear wall 82 terminating in a sprue 84 which projects through an opening 86 in rear wall 46 of the furnace. The front wall 88 of the crucible is provided with an inlet opening 90 through which the metal to be melted can be placed in the crucible. The furnace is provided with an insulated door 92 pivoted to front wall 48 as indicated at 94 and provided at its lower end with a catch 96 which releasably engages a spring projected latch 98 carried by bar 16 whereby to prevent accidental opening of said door.

The burner 68 which is utilized, in accordance with the present invention, for heating the muffle 56 for applying heat to the metal within crucible 80 will now be more particularly described. Said burner comprises a chamber 100 supplied with the gaseous or other fluids through valve-controlled supply pipes 102 and 104. For example, illuminating gas may be supplied through pipe 102 and air under pressure may be supplied through pipe 104, when a temperature of about 2300° F. is required, or other gases may be supplied through said pipes 102 and 104 when higher temperatures are desired. For example, oxygen and acetylene may be supplied to chamber 100 through pipes 102 and 104, respectively, or hydrogen and acetylene may be supplied through said pipes, respectively, when the required heating temperature is about 3800° F. Chamber 100 is provided with a plurality of branches 106 preferably of arcuate form (Fig. 2), said branches being of arcuate form to conform to the cylindrical contour of muffle 56. Said branches 106 carry the burner nozzles 108 for directing the flames of said burner nozzles against the outer surface of muffle 56. It will be understood that the products of combustion pass upwardly through the annular space 59 around muffle 56 and out of the furnace through outlet opening 64. It will be understood that upon the completion of the heating operation as indicated by the pyrometer connected to the thermocouple 72, burner 68 is removed in order to permit rotation of bar 16 and of the parts carried thereby during the casting operation. As here shown, burner 68 is mounted for vertical adjustment on a standard or other suitable support or base 69. It will be understood that the supply of fuel and air or other gases to the burner can be controlled automatically by the pyrometer in a manner which is well known and need not be described as it does not per se form part of the present invention.

Referring now more particularly to bar 16, it will be noted that the laterally spaced portions 28 of said bar permit the burner 68 to be inserted in operative position within the furnace and to be removed from the furnace to allow rotation of bar 16 and of said furnace during the casting operation. In order to provide bar 16 with said laterally spaced portions 28, said bar is formed in sections. More particularly, said bar comprises two lengths 110 having the laterally spaced portions 28 formed therein, said two sections 110 being rigidly secured together in any suitable way as by bolts 112 secured at suitable points spaced longitudinally of the bar. An adjustable counterweight 114 is mounted on bar 16 and is adjustable longitudinally of the latter. Said counterweight is provided with an upwardly extending handle 116 for the purpose of facilitating the winding of the spring motor 12 between operations of the casting apparatus. A flask holder 118 is slidably mounted on bar 16 for movement to adjusted positions toward and away from the outlet opening of the furnace, a clamping screw 120 operable by a handle 122 being provided for releasably clamping the holder 118 in adjusted position. A flask or mold 124 is mounted between the furnace and the flask holder 118 and is supported on a cradle 126 which is slidably mounted on bar 16. Cradle 126 supports mold 124 at the proper height in position to be engaged by the flask holder 118 which holds the forward end of said mold 124 against the outer surface of rear wall 46, with the sprue opening of the crucible in registry with the opening of the mold.

In using the apparatus of the present invention, the spring motor is first wound up by grasping handle 116 and rotating bar 16, the contact-carrying holder 76 being in its retracted position out of contact with the contact members on block 40 and out of engagement with said block. When the spring motor is sufficiently wound, holding member 76 is projected into the path of block 40, thereby preventing rotation of bar 16 and making electrical connection between contacts 74 and 78 of the thermocouple to the pyrometer. The metal to be melted in the furnace is then placed in the crucible 80 and the door 92 is closed. Burner 68 is then placed in position for heating the furnace. Then, after the operation of the burner for a suitable length of time, so that the metal in the crucible is melted and the proper temperature is reached, as indicated by the pyrometer which is connected to the thermocouple as indicated above, the burner is removed and holder 76 is retracted, thereby releasing bar 16 for rotation. Preferably, just before the metal is heated to the desired temperature, the mold is clamped in position in the apparatus. It will be understood that when holder 76 is retracted, bar 16 and the furnace 18 carried thereby are rotated by spring motor 12, and that the centrifugal force thereby generated causes the molten metal to flow from the crucible through sprue 84 into the mold 124.

It will be noted that during the heating of the molten metal in crucible 80, the heating flames are out of contact with the metal in the crucible and that the interior of said crucible is out of communication with the products of combustion, whereby the metal in the crucible is unimpaired by the flame of the burner or by the products of combustion. Crucible 80 is preferably formed of carbon, as stated above, for avoiding or counteracting oxidizing action on the metal within the crucible during the melting operation. It will be understood, however, that when the metal to be melted in the crucible is steel or a steel alloy and it is not desired to add carbon thereto, the crucible will be formed of a suitable refractory material, which will not materially alter the composition of the particular type of steel or an alloy thereof. Any refractory material heretofore used in melting steel or its alloys can be used, many of such materials being well known to those skilled in the art. Further, it will be understood that the crucible is preferably formed of carbon when it is desired to add carbon to the steel or steel alloy which is melted in the crucible preliminary to the centrifugal casting thereof.

It will be understood that various changes may be made in the casting apparatus embodying the

present invention, and it will be understood also that the burner may be of a different construction than that illustrated. Accordingly, in view of the fact that various changes may be made without departing from the underlying idea of the present invention, I do not wish to be limited to the construction herein specifically shown or described except to the extent which may be required by the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a centrifugal casting machine having a furnace adapted to be heated by a fuel burner, said furnace having an outer peripheral wall, a muffle positioned within said outer wall, means supporting said furnace at one side of a vertical axis for rotation about said axis in the casting operation, means releasably engaging a part of said furnace for holding the latter stationary, said furnace having an opening through which said fuel burner may be removably projected for applying heat to said muffle externally thereof while said furnace is stationary, and means for rotating said furnace when said holding means is disengaged from said part of the furnace.

2. In a centrifugal casting machine having a furnace adapted to be heated by a fuel burner, said furnace having an outer peripheral wall, a muffle positioned within said outer wall, means supporting said furnace at one side of a vertical axis for rotation about said axis in the casting operation, means releasably engaging a part of said furnace for holding the latter stationary, said furnace and said supporting means having registering openings through which said fuel burner may be removably projected for applying heat to said muffle externally thereof while said furnace is stationary, and means for rotating said furnace when said holding means is disengaged from said part of the furnace.

3. In a centrifugal casting machine having a furnace adapted to be heated by a fuel burner, said furnace having an outer peripheral wall, a muffle positioned within said outer wall, means supporting said furnace at one side of a vertical axis for rotation about said axis in the casting operation means releasably engaging a part of said furnace for holding the latter stationary, said furnace having a bottom opening through which said fuel burner may be removably projected for applying heat to said muffle externally thereof while said furnace is stationary, and a top opening for the escape of the products of combustion, and means for rotating said furnace when said holding means is disengaged from said part of the furnace.

4. In a centrifugal casting machine having a furnace adapted to be heated by a fuel burner, said furnace having an outer peripheral wall, a muffle positioned within said outer wall, means supporting said furnace at one side of a vertical axis for rotation about said axis in the casting operation, means releasably engaging a part of said furnace for holding the latter stationary, said furnace having an opening through which said fuel burner may be removably projected for applying heat to said muffle externally thereof while said furnace is stationary, and a crucible in said muffle heated thereby, said muffle being peripherally continuous and imperforate and completely surrounding said crucible for preventing access of the flame or products of combustion of the burner to the interior of the crucible.

5. In a centrifugal casting machine having a furnace adapted to be heated by a fuel burner, said furnace having an outer peripheral wall, a muffle positioned within said outer wall, means supporting said furnace at one side of a vertical axis for rotation about said axis in the casting operation, said muffle being heated externally by said burner, and a crucible in said muffle heated thereby, said muffle being peripherally continuous and imperforate and completely surrounding said crucible for preventing access of the flame or products of combustion of the burner to the interior of the crucible.

6. In a centrifugal casting machine having a furnace adapted to be heated by a fuel burner and supported at one side of a vertical axis for rotation about said axis in the casting operation, a muffle in said furnace adapted to be heated externally thereof by the fuel burner while the furnace is stationary, and a crucible in said muffle heated thereby, said muffle being peripherally continuous and imperforate and completely surrounding said crucible for preventing access of the flame or products of combustion of the burner to the interior of the crucible.

7. In a centrifugal casting machine having a furnace adapted to be heated by a fuel burner, a bar mounted for rotation about a vertical axis, said bar having laterally spaced portions, said furnace being mounted on said bar in position over said laterally spaced portions and having a bottom opening in registry with the space between said laterally spaced portions of the bar, and a muffle in said furnace in position to be heated by said fuel burner, said spaced bar portions permitting the burner to be removably positioned in heating relation to said muffle when said bar and the furnace mounted thereon are stationary.

8. In a centrifugal casting machine having a furnace adapted to be heated by a fuel burner, a bar mounted for rotation about a vertical axis, said bar having laterally spaced portions, said furnace being mounted on said bar in position over said laterally spaced portions and having a bottom opening in registry with the space between said laterally spaced portions of the bar, and a muffle in said furnace in position to be heated by said fuel burner, said spaced bar portions permitting the burner to be removably positioned in heating relation to said muffle when said bar and the furnace mounted thereon are stationary and a crucible in said muffle heated thereby, said muffle being peripherally continuous and imperforate and completely surrounding said crucible for preventing access of the flame or products of combustion of the burner to the interior of the crucible.

9. In a centrifugal casting machine having a horizontal bar mounted for rotation about a vertical axis, a furnace carried by said bar at one side of said axis and rotatable with said bar about asid axis, a muffle having a continuous peripheral wall disposed in said furnace, said furnace having a wall spaced radially from the outer surface of said peripheral wall providing a space for the passage of hot products of combustion in heat exchange relation with said wall of the muffle, said furnace having an outlet for said products of combustion, and a crucible in said muffle heated thereby, said muffle being peripherally continuous and imperforate and completely surrounding said crucible for preventing access of the flame or products of combustion of the burner to the interior of the crucible.

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