Feb. 22, 1949. J. FREI, JR 2,462,259

CRUCIBLE HOLDER AND CRUCIBLE

Filed Jan. 20, 1945

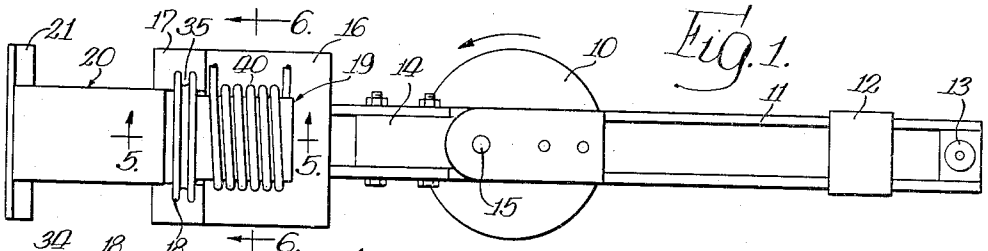


Fig. 1.

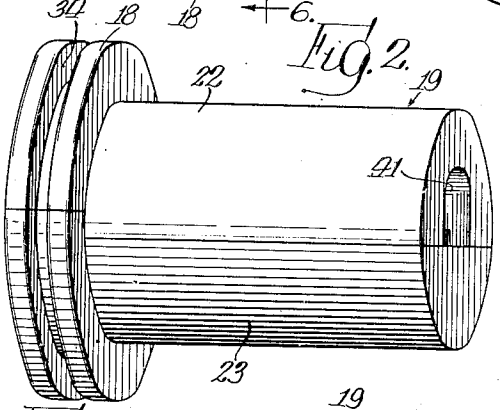


Fig. 2.

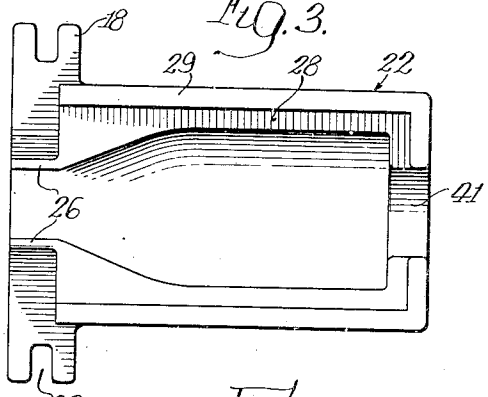


Fig. 3.

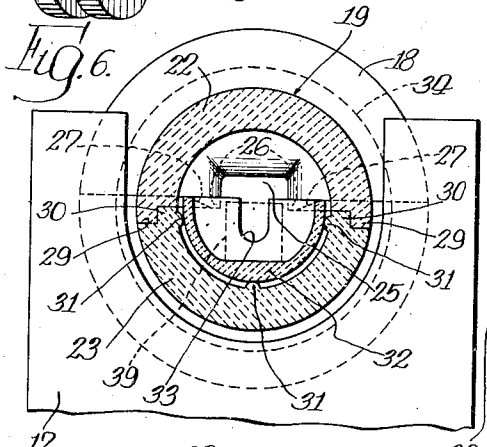


Fig. 6.

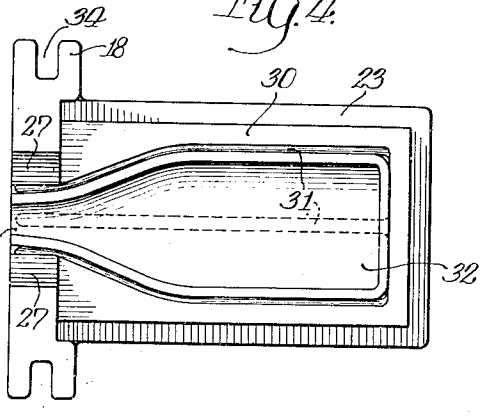


Fig. 4.

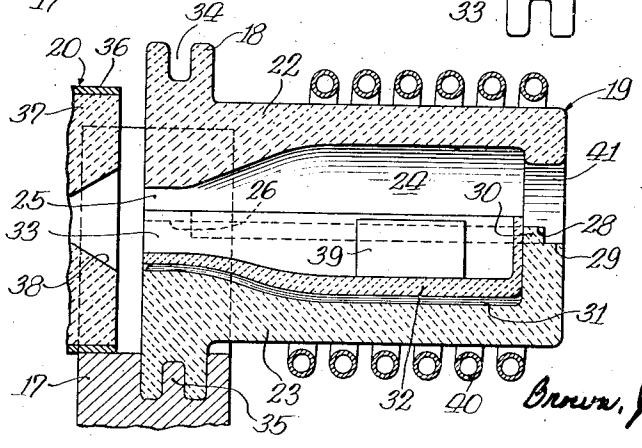


Fig. 5.

INVENTOR.
John Frei, Jr.,
BY
Brown, Jackson, Boettcher & Dixon
Attys.
37.

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CRUCIBLE HOLDER AND CRUCIBLE

John Frei, Jr., Chicago, Ill.

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5 Claims. (Cl. 263—11)

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This invention relates to casting apparatus, and has to do with crucibles intended particularly for use in centrifugal casting.

It is known, particularly in the dental and jewelry fields, to cast articles centrifugally by melting the metal in a crucible and projecting the molten metal, by centrifugal force, from the crucible into a suitable mold. The crucibles commonly used for melting the metal are rather expensive and subject to cracking and breaking after being in use for a short time and are not well adapted for industrial uses, in that the metal or other material from which the articles are to be cast has to be placed within the crucible with some care, often incurring considerable delay. My invention is directed to a crucible of simple construction such that the metal or other material may be placed within the crucible with expedition and facility, of importance in quantity production, this crucible comprising an outer body or holder, which may be termed the secondary crucible, and an inner member in the nature of a liner, which constitutes the primary crucible in which the metal or other material is melted. The secondary crucible or body is formed in two sections the lower of which contains the inner crucible, the two sections being provided with grooved flanges whereby the assembled crucible may readily be mounted upon supporting and aligning flanges of a supporting structure of the centrifugal machine. The inner or primary crucible is open at its top, so that by removing the upper section of the outer crucible or holder, the metal or other material may be quickly placed within the primary crucible and the upper section of the outer crucible or holder may as quickly be replaced. The two sections of the outer structure have cooperating shoulders or projections providing a closure about the primary crucible to guard against spillage of metal therefrom, and the primary crucible preferably is supported in the lower section of the outer crucible or holder in such manner as to be out of contact therewith for the major area of its exterior surface, which assists in preventing excessive heating of the outer crucible and resultant cracking thereof, the spacing of the inner crucible from the outer crucible also rendering possible the functioning of the latter for projecting the molten metal into the mold in the event of breaking or cracking of the inner crucible. Further objects and advantages of my invention will appear from the detail description.

In the drawings:

Figure 1 is a diagrammatic plan view of a centrifugal casting machine with a crucible structure embodying my invention applied thereto;

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Figure 2 is an isometric side view, on an enlarged scale, of the crucible structure of Figure 1;

Figure 3 is an underneath view of the upper section of the structure of Figure 2;

Figure 4 is a plan view of the lower section of the structure of Figure 2 with the inner or primary crucible therein;

Figure 5 is a sectional view, on an enlarged scale, taken substantially on line 5—5 of Figure 1; and

Figure 6 is a sectional view, on an enlarged scale, taken substantially on line 6—6 of Figure 1.

In Figure 1 I have shown, more or less diagrammatically, a centrifugal casting machine of known type comprising disc 10 having associated means for rotating it at high speed about a vertical axis, to which disc is secured an arm 11 carrying an adjustable weight 12 and provided at its outer end with a handle 13. A second arm 14 is pivoted at 15 to arm 11, and has adjustably mounted thereon a suitable carriage 16 provided with a holder 17 appropriately formed to receive and retain a circumferentially grooved flange 18 of a cylindrical crucible 19 formed of suitable refractory material. The crucible 19, to be described more in detail presently, is provided at its outer end with an opening disposed to deliver the charge of molten metal to a mold 20, which will also be described more fully presently, mounted at its outer end in a support 21 carried by arm 14 and resting, at its inner end, in support 17, spaced a short distance from the outer end of crucible 19. Assuming that there is a proper charge of molten metal in the crucible 19, by rotating disc 10 in the direction indicated by the arrow, and with it the arms 11 and 14, the molten metal is projected by centrifugal force from the crucible 19 into the mold 20, in which the metal is permitted to set for producing the desired article, as is known in the centrifugal casting art.

The crucible structure 19 comprises a crucible holder, which may also be utilized as a crucible under certain conditions and, therefore, may be termed a secondary crucible, and a primary crucible mounted in the crucible holder. The crucible holder is formed in two semi-cylindrical sections, an upper section 22 and a lower section 23. The sections 22 and 23 are interiorly recessed, to provide a melting chamber 24 the outer portion of which tapers to discharge opening 25 defined by

registering notches in the outer ends of the sections 22 and 23, the upper section being provided with downwardly extending inclined projections 26 at opposite sides of the notch therein seating upon inclined shoulders 27 at opposite sides of the notch in the lower section, to assist in proper registering of the two sections when assembled. The upper section 22 is further provided at its under face with a rabbet 28 and a downwardly projecting flange 29, the rabbet 28 receiving a shoulder 30 projecting upward from the upper face of lower section 23 and extending about the recess therein, flange 29 providing with shoulder 30 a closure about the melting chamber 24 and in cooperation with shoulder 30 restraining the upper section 22 against outward endwise movement relative to the lower section 23.

The lower section 23 is provided interiorly with spaced lengthwise ribs 31 defining between them spaces or channels which open into the outer end of the recess of this section. An inner or primary crucible 32 seats upon ribs 31, within the recess of lower section 23, and is spaced by the ribs 31 from the surrounding wall of section 23. The primary crucible 32 is open at its top, as shown, and tapers at its outer portion to a discharge neck 33 extending through discharge opening 25, this neck being spaced a short distance above the bottom of the opening. The outward taper of crucible 32 and the outward taper of the recess in lower section 23 of the secondary crucible provides cooperating shoulders which restrain the primary crucible 32 against outward movement relative to section 23, as will be understood. The primary crucible 32 is formed of suitable refractory material which may be either electrical conducting or non-conducting as conditions require. It may be rather thin, compared to the secondary crucible or holder, and comparatively inexpensive. Under ordinary conditions the primary crucible may be used a considerable number of times, and in event of cracking or breakage thereof, or when an objectionable amount of slag accumulates therein, this primary crucible may be discarded and replaced by an unused crucible. The ribs 31 provide small area of contact between the primary crucible 31 and section 23 of the secondary crucible, reducing heat flow from the primary crucible to the secondary crucible and thereby avoiding excessive heating and resultant cracking or breakage of the secondary crucible. That is of importance in quantity production of articles by centrifugal casting, since the secondary crucible is rather expensive and necessity for frequent replacement thereof would render the centrifugal casting of articles objectionably expensive. The primary crucible 32, on the other hand, is comparatively inexpensive and may be replaced without incurring objectionable expense in the casting of the articles.

The flange 18 of the crucible 19 is formed in two semi-circular sections each carried by one of the sections 22 and 23 of the secondary crucible, the sections of flange 18 being in accurate register when the sections of the secondary crucible are about properly assembled. Flange 18 is provided with a circumferential groove 34 which snugly receives flange 35 of holder 17, by means of which the sections 22 and 23 of the secondary crucible are accurately aligned and the crucible 19, as a whole, is mounted on the holder 17 with its outer end spaced a short distance from the inner end of mold 20.

The mold 20 comprises a flask 36 of a suitable heat resistant metal or alloy, such as stainless steel, within which there is a body 37 of refractory having formed therein a gate 38 opening through the inner end of the mold, this gate communicating with a casting cavity (not shown) formed in body 37. Preferably the mold 20 is produced in the manner disclosed in my copending application for Investing means and method, filed November 9, 1944, Serial No. 562,707, though it may be produced in any other suitable manner.

In the use of the crucible of my invention in centrifugal casting, the primary crucible 32 is placed within lower section 23 of the secondary crucible and the metal from which the article is to be cast is placed in the primary crucible, conveniently in the form of a cube or block 39 of proper mass. Conveniently that operation is performed after the lower section 23 of the secondary crucible has been mounted in the holder 17. Since the primary crucible 32 is open and unobstructed at its top the metal may be placed therein with facility, as will be clear. After the metal has been placed in the primary crucible, the upper section 22 of the secondary crucible is positioned upon the lower section 23 thereof, enclosing the primary crucible within the secondary crucible in the manner above stated, the flange 18 of the crucible 19 cooperating with flange 35 of holder 17 to align the crucible sections 22 and 23, while restraining them against relative endwise movement and mounting the crucible as a whole upon the holder 17. After the crucible 19 has been charged with metal and properly mounted upon the holder 17, as above described, the metal within the crucible structure, preferably within the primary crucible 32, is melted preliminary to the casting operation. This metal may be melted in any suitable manner, though I preferably provide a high frequency induction coil 40 positionable about the crucible structure 19 and removable therefrom to a position clear of the crucible structure and of the centrifugal casting machine parts which move during operation of the machine. The manner in which the induction coil 40 is positioned about and removed from the crucible 19 is not of the essence of my instant invention and that result may be accomplished in any suitable manner, though I preferably employ the means disclosed in my copending application for Centrifugal casting machine, filed January 20, 1945, Serial No. 573,745. Any means other than the induction coil 40 may be utilized for melting the metal in the crucible structure. Where the induction coil 40 is employed, upper section 22 of the secondary crucible is provided with an opening 41 through its inner end permitting observation of the melting chamber 24 and the metal therein, so as to determine when the metal is in proper condition for casting. When the metal within the crucible is in proper condition for casting, the induction coil 40 is moved from its position about crucible 19 into a position in which it will clear the moving parts of the centrifugal casting machine, and the machine is then set into operation. In the operation of the centrifugal casting machine, the molten metal is projected from the primary crucible 32 into gate 38 of mold 20 and thence into the casting cavity of the mold, as is known in the centrifugal casting art. The outwardly tapering outer end portion of the melting chamber 24 of the crucible structure assures that any metal which may be discharged from the primary crucible 32 before it reaches the outer end of neck 33, such

as metal being crowded out of the open top of neck **33**, will be projected into the mold. In the event of cracking or breaking of the primary crucible **32** during the casting operation, molten metal leaking therefrom will pass into the recess in lower section **23** of the secondary crucible and will be discharged therefrom between ribs **31** to discharge opening **25**, and thence projected into the gate **38** of mold **20**. That guards against loss of metal or interruption of the casting operation in the event of breakage or cracking of the primary crucible, and the flange **29** and shoulder **30**, previously referred to, further guard against loss or spillage from the crucible structure **19** of molten metal which may leak or be discharged from the primary crucible during the casting operation. The primary crucible and the secondary crucible thus cooperate to provide a crucible structure which guards against excessive heating and cracking of the secondary crucible, while assuring proper discharge of the molten metal from the crucible structure into the mold and providing an inexpensive primary crucible which may readily be replaced without incurring objectionable expense.

I claim:

1. In a crucible structure for use in centrifugal casting, a refractory body formed in two separate superposed interiorly recessed sections defining a melting chamber, said body having a restricted opening leading through its outer end from said chamber, and an open top crucible seating in the recess of the lower one of said sections having a restricted discharge neck extending through said opening, said body having integral inwardly projecting end walls restraining said crucible against endwise movement relative to said body.

2. In a crucible structure for use in centrifugal casting, a refractory body comprising a lower substantially semi-cylindrical section recessed from its upper face and a removable substantially semi-cylindrical upper section seating on said lower section, said body having a restricted opening leading through its outer end from the recess of said lower section, and an open top crucible removably seating in the recess of said lower section having a restricted discharge neck extending through said opening, said sections of said body having integral inwardly projecting end walls restraining said crucible against endwise movement relative to said body.

3. In a crucible structure, a refractory body comprising a lower substantially semi-cylindrical section recessed from its upper face and an upper substantially semi-cylindrical section seating on said lower section, said body being disposed with its axis substantially horizontal and having a restricted opening leading through its outer end from the recess of said lower section and the latter section having interior spaced ribs extending generally lengthwise of the recess thereof, and an open top crucible in the recess of said lower section seating on said ribs spaced thereby from the surrounding wall of said lower section, said crucible having a restricted discharge neck extending through said opening and spaced from the bottom thereof, said sections of said body having integral inwardly projecting end walls restraining said crucible against endwise movement relative to said body.

4. In a crucible structure, a refractory body formed in two separate superposed substantially semi-cylindrical interfitting interiorly recessed sections defining a melting chamber and a discharge opening leading therefrom through the outer end of said body adapted for reception of an open top crucible seating in said chamber having a restricted discharge neck extending through said opening, said sections having interfitting elements at their opposed faces restraining them against relative transverse and lengthwise movement and being provided at their outer ends with registering exterior elements adapted for interengagement with aligning and supporting flanges of a supporting structure effective in cooperation therewith for restraining said sections against relative endwise movement.

5. In a crucible structure, a refractory body comprising a lower substantially semi-cylindrical section defining an upwardly-opening substantially semi-cylindrical recess tapering upward and laterally inward at its outer end portion providing a restricted opening through its outer end, said lower section having interior lengthwise ribs extending into said outer tapered portion thereof, an upper substantially semi-cylindrical section removably seating on said upper section, and an open top crucible substantially conforming to the interior of said lower section disposed within the latter seating on said ribs and extending into the outer tapered portion of said recess and open at its outer end, said body having integral end walls extending radially inward thereof restraining said crucible against endwise movement relative to said body.

JOHN FREI, JR.

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