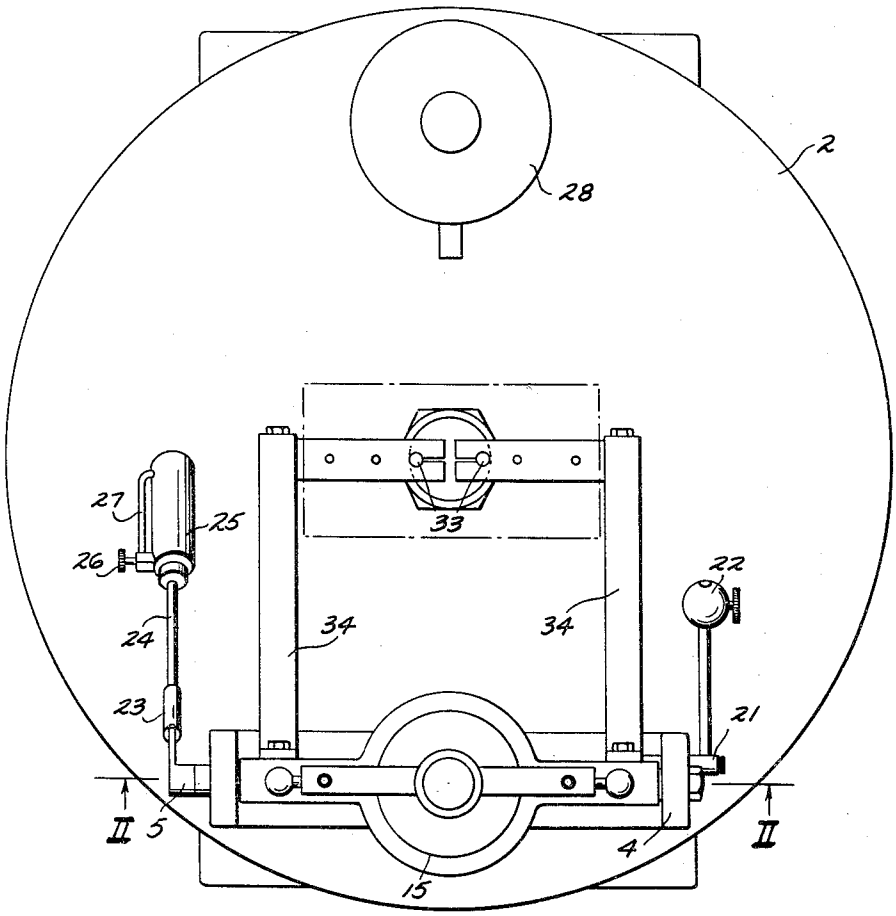
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METHOD AND APPARATUS FOR SMELTING AND CASTING METALS OR THE LIKE

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FIG. 1.



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METHOD AND APPARATUS FOR SMELTING AND CASTING METALS OR THE LIKE

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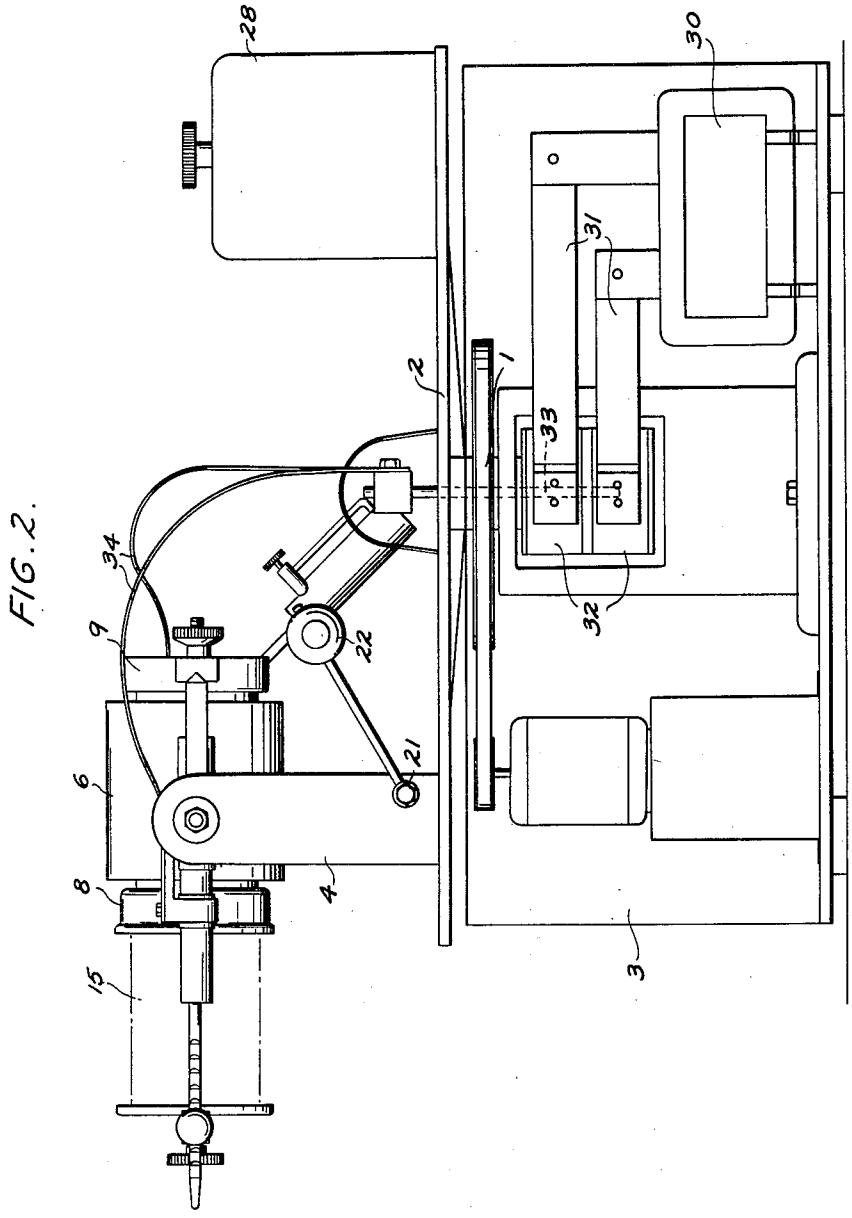


FIG. 2.

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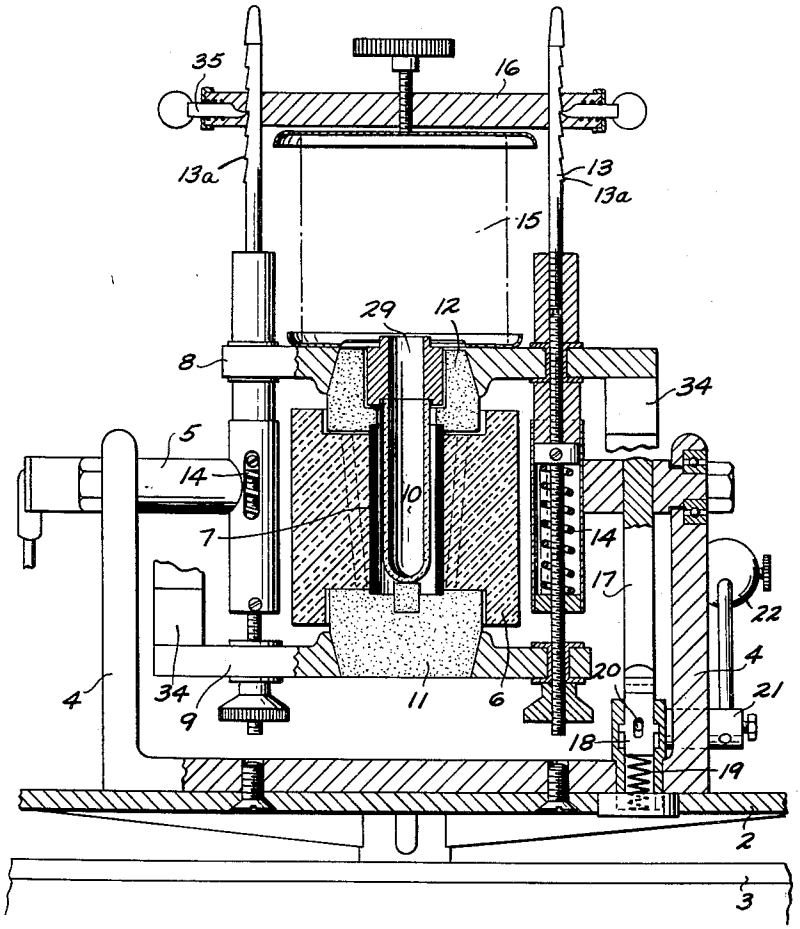
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METHOD AND APPARATUS FOR SMELTING AND CASTING METALS OR THE LIKE

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FIG. 3.



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METHOD AND APPARATUS FOR SMELTING AND CASTING METALS OR THE LIKE

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6 Claims. (Cl. 22—65)

The present invention relates to a method and apparatus for smelting and casting of metals and other materials such as used in dental and jewelry work and contemplates the use of a furnace or smelting apparatus which is combined with a casting mold.

More in particular the invention is concerned with a method and apparatus whereby the smelting apparatus is first moved about an axis of rotation while in upright position and is then placed into a slanted or horizontal position for casting.

It is an object of the invention to render the charge first into a molten condition while the smelting device containing the crucible is in upright position where it can be subjected to proper observation. Then the apparatus is moved about the axis of rotation while in an upright position and is finally brought into an inclined or horizontal position by a tilting or rocking movement after the centrifugal forces involved have reached the conditions which safeguard the proper performance of the casting process.

This type of working procedure insures that the form can be completely filled preparatory to the casting operation and that the forces which develop are not excessive. It is possible to achieve this in accordance with a further object of the invention in that the smelting device is subjected, for the actual casting, to a brake controlled tilting movement.

It is known to cast metals or steels in centrifugal casting operations by using a crucible which is combined with a mold and is rotatably arranged about an axis of rotation. Casting arrangements of this type are used especially in laboratory work for molding fine or precious metals. In a casting apparatus of this type known heretofore, the furnace or crucible was arranged together with the mold in horizontal position upon an arm of the axis of rotation and the casting proceeded in such a manner that the charge in the crucible was first brought to the required temperature by electric heating and then the crucible and mold were turned by means of a spring driven mechanism about the axis of rotation so that the charge in the crucible was cast under the effect of the centrifugal force into the mold. This known manner of operation had the disadvantage that the charge could not be sufficiently observed during the smelting operation and besides the casting step proper during its course and the attendant forces applied during its performance were not completely under control.

The method in accordance with the invention is advantageously carried out in such a manner that the current supply to the furnace is maintained until completion of the centrifugal casting step. In this manner it is avoided that the melted charge loses heat prior to the casting operation and during the casting operation, which might result in defective casts. This is particularly of importance in connection with metals, alloys and other materials which it is difficult to cast and which have a high melting point such as silicates. The initiation and release of the tilting movement of the smelting device from the vertical position into an inclined or horizontal position is here advantageously effected by centrifugal force while using mechanical, electrical, hydraulic or pneumatic means. This insures that the tilting operation is first initiated

after the rotating tilting device and the charge in the crucible have attained sufficient potential energy from the centrifugal effects applied thereto and when the path for the charge into the casting form is opened by the tilting of the smelting device.

In accordance with further objects of the invention different embodiments of the structural details of apparatus are provided for carrying out the method on which the invention is based. The invention relies in the first place on such a known centrifugal machine where a smelting device combined with a mold is arranged for rotation around an axis and the invention provides for constructing the smelting device and casting form for tilting toward the axis of rotation. For this purpose, the smelting device can be arranged advantageously upon a tilting axle which is suitably provided with a release device which normally prevents a tilting movement of the smelting device. The release device is furthermore suitably restrained by a control device which, depending on the centrifugal force, operates the release mechanism and thus frees the smelting device for the tilting movement. The course of the tilting movement and its speed can be controlled by an adjustable braking device which is preferably a hydraulic means.

In accordance with the invention, the furnace of the smelting device is made in the form of a transformer heater in which a carbon heater tube or a crucible of graphite carbon or other electrically conductive metal is connected in an electric circuit particularly into the secondary circuit of a transformer. The contacts of the heater are resiliently supported in accordance with the invention while the current supply to the contacts of the furnace is effected by way of movable leads. The method and the arrangement in accordance with the invention are particularly of importance for metals and steel or steel alloys and metal alloys as well as silicates which have a high melting point, particularly in the range of temperatures from 2000 to 3000° C. For temperatures above 1500° C. it is suitable to use a crucible of corundum or magnesium oxide.

Further advantages, objects and details of the invention will become apparent from the drawing in which the invention is illustrated in connection with one embodiment and where,

FIG. 1 is a plan view of the apparatus showing one embodiment of the invention.

FIG. 2 is a side elevation showing the apparatus with the casting device in tilted position, and

FIG. 3 is a cross section taken on an enlarged scale along line II—II in FIG. 1.

A turntable 2 is arranged for rotation about an axle 1 above a housing 3 in which a transformer for supplying the current to the crucible is mounted and a transmission for driving the turntable 2. Two standards 4 are secured upon turntable 2 proximate the outer border in which the pivotal support or tilting axle 5 of the crucible 6 is journaled. The furnace 6 may be constituted of an outer insulating shell in the interior of which a carbon heater tube 7 is provided between the upper contact head 8 and the lower contact head 9 and which surrounds a ceramic crucible 10. The contact heads 8 and 9 are preferably made of red brass or bronze and the lower contact 11 and the upper carbon contact 12 are received therein and are adjustably mounted upon common standards 13 presenting ratchet teeth 13*a* for example by means of spring biased catch bolts 35 adapted to engage teeth 13*a*, and are elastically supported by springs 14 which, among other things, prevent that the carbon heater tube 7 is strained too much if the contact head 8 is placed under tension. Above contact head 8 a mold box 15 is provided, the mold cavity of which communi-

cates with the interior of the crucible 10 and which is secured upon standard 13 by means of cross head 16. The pivotal support or tilting axle 5 is provided with a downwardly extending hook 17 which is engaged by the detent 18 which is constituted essentially by a plunger which is movable against the spring 19 and which engages the hook 17 with its upper end in such a manner that the tilting axle 5 is retained in a position which corresponds to the upright position of the crucible 6.

A set screw 20 engages the detent 18 which is connected to a weight 22 by way of a movable axle 21.

As the disc 2 is rotated the centrifugal force acts upon weight 22 which becomes so great upon attaining a pre-determined adjustable number of rotations that the detent 18 is shifted downwardly thus releasing the hook 17.

As shown in FIGS. 1 and 2 the tilting axle or pivotal support 5 may be extended at one of the outer sides and provided with a lever joint 23 which is engaged by the piston rod 24 of a hydraulic brake cylinder 25, the resistance of which is adjustable by the operation of the throttle bolt 26 which, by more or less deeper insertion changes the cross section of the channel 27 leading from one side of the piston to the other in the cylinder 25. A counter weight 28 is arranged to be radially movable upon the turntable 2.

A special intermediate member 29 for extending the length of the crucible 10 is shown in FIG. 3. As shown in FIG. 2 a transformer 30 is arranged inside the housing 3 besides the driving means for disc 2 as well as the current contacts and the brushes 31 which rest upon slip rings 32. Current conductor bars 33 and movable current supply leads 34 are provided which conduct the current from the transformer 30 by way of brushes 31 and slip rings 32 to the contact heads 8 and 9.

The method of operation in accordance with the invention can be effected with the illustrated embodiment as follows:

With the smelting furnace in upright position the crucible 10 together with the charge is moved into the furnace and the contact heads 8 and 9 are connected by applying the current clamps in the secondary current circuit of the transformer which is provided in housing 3 so that the carbon heater tube 7 raises the charge in the crucible to the required casting temperature. This permits observing the charge through the upper opening in the crucible 10. When the required condition of the charge is obtained the mold box 15 is placed on top and is secured thereon by means of the cross head 16 and the turntable 2 is started to rotate by means of the motor. Upon attaining sufficient peripheral speed the lever 22 is operated by centrifugal force so that the catch 18 is pressed downwardly and releases the arm or hook 17 and the furnace 6 together with the mold box 15 is enabled to tilt into horizontal position. Under the influence of the centrifugal force the charge in the crucible 10 now shoots into the cavity of the mold box 15 and fills the same in the desired manner.

The course and the velocity of the tilting movement is retarded by means of the brake cylinder 25 and this to an extent which can be accurately controlled by means of the adjusting screw 26. Upon completion of the casting, turntable 2 is stopped, the furnace 6, together with the mold box 15 is tilted upwardly and the parts are separated from one another.

The invention is not limited to the embodiment described and illustrated and is not restricted to the structural details of the drawing. For example, it is possible to use a carbon or graphite crucible in lieu of the carbon heater tube 7. Furthermore, the release of the tilting movement of the furnace 6 need not be effected mechanically but can also take place in any other desired manner, for example, by electro-magnetic means. It is also possible to carry out the initiation or release of the tilting movement of the crucible or of the entire smelting device by hydraulic or pneumatic means. Also the braking of the tilting movement upon initiation of the tilting operation may be effected by hydraulic means or with pneumatic or electrical or mechanical means.

Dividing the crucible into an actual crucible portion 10 and an intermediate member 29 serves the important purpose of intercepting thermal stresses in the dense ceramic material of the crucible and thus preventing destruction of the crucible wall by such thermal stresses.

Having now described my invention with reference to the embodiments illustrated in the drawings I do not wish to be limited thereto, but what I desire to protect by Letters Patent is set forth in the appended claims.

I claim:

1. Method of centrifugally casting metals or other smeltable materials where the charge is cast by centrifugal force from a smelting device into a casting mold, said method comprising the steps of smelting a charge of material in the smelting device by supplying electric current thereto, rotating the smelting device together with the casting mold in upright position along a circular path about an axis of rotation while supporting the mold above said smelting device, tilting said device and said mold outwardly for casting the molten charge under centrifugal force into the mold, and checking the tilting movement of said device and said mold by a braking action.

2. Method of centrifugally casting metals or other smeltable materials where the charge is cast by centrifugal force from a smelting device into a casting mold, said method comprising the steps of smelting a charge of material in the smelting device by supplying electric current thereto, rotating the smelting device together with the casting mold in upright position along a circular path about an axis of rotation while supporting the mold above said smelting device, tilting said device and said mold outwardly for casting the molten charge under centrifugal force into the mold, continuing the supply of current to said device during tilting and checking the tilting movement of said device and said mold by a braking action.

3. A casting apparatus comprising a turntable in the form of a disk presenting a flat upper surface area and including a motor means therefor, a smelting furnace and a casting box disposed in inverted position on top of said smelting furnace and connected therewith, said furnace and said casting box being pivotally supported in upright position on said turntable for centrifugally induced tilting movement downwardly and outwardly and means associated with said turntable adapted to control the tilting movement of said furnace and said casting box in a manner to tilt said furnace and said casting box into horizontal position upon heating and melting the charge in said furnace.

4. A casting apparatus comprising in combination a turntable in the form of a disk presenting a flat upper surface area and including a motive means therefor, a smelting furnace and a casting box disposed in inverted position on top of said smelting furnace and connected therewith, said furnace and said casting box being mounted upright on said turntable for tilting movement outwardly and supporting means tiltably supporting said furnace and said casting box on said turntable; said motive means comprising an electric motor and a transformer being connected to supply power to said furnace by way of sliding contact means including brushes and slip rings associated with said turntable and conductor means connected to said slip rings, said furnace supporting means comprising supporting standards on said turntable and a tilting axle carrying said furnace and said casting box and said turntable having a central shaft supporting said slip rings adjacent said brushes, said apparatus further comprising a detent mechanism in operative engagement with a member of said furnace supporting means normally restraining said furnace and

box against tilting and a release device in operative engagement with said detent including centrifugally operated means adapted to release said detent upon imparting thereto a predetermined centrifugal force.

5. A casting apparatus comprising in combination a turntable in the form of a disk presenting a flat upper surface area and including a motive means therefore, a smelting furnace and a casting box disposed in inverted position on top of said smelting furnace and connected therewith, said furnace and said casting box being mounted upright on said turntable for tilting movement outwardly and supporting means tiltably supporting said furnace and said casting box on said turntable; said motive means comprising an electric motor and a transformer being connected to supply power to said furnace by way of sliding contact means including brushes and slip rings associated with said turntable and conductor means connected to said slip rings, said furnace supporting means comprising supporting standards on said turntable and a tilting axle carrying said furnace and said casting box and said turntable having a central shaft supporting said slip rings adjacent said brushes, said apparatus further comprising a detent mechanism in operative engagement with a member of said furnace supporting means normally restraining said furnace and box against tilting and a release device in operative engagement with said detent including centrifugally operated means adapted to release said detent upon imparting thereto a predetermined centrifugal force and an adjustable braking means adapted to check the tilting movement of said furnace and said casting box.

6. A casting apparatus comprising in combination a turntable in the form of a disk presenting a flat upper surface area and including a motive means therefor, a smelting furnace and a casting box disposed in inverted

position on top of said smelting furnace and connected therewith, said furnace and said casting box being mounted upright on said turntable for tilting movement outwardly and supporting means tiltably supporting said furnace and said casting box on said turntable; said motive means comprising an electric motor and a transformer being connected to supply power to said furnace by way of sliding contact means including brushes and slip rings associated with said turntable and conductor means connected to said slip rings, said furnace supporting means comprising supporting standards on said turntable and a tilting axle carrying said furnace and said casting box and said turntable having a central shaft supporting said slip rings adjacent said brushes, said apparatus further comprising a detent mechanism in operative engagement with a member of said furnace supporting means normally restraining said furnace and box against tilting and a release device in operative engagement with said detent including centrifugally operated means adapted to release said detent upon imparting thereto a predetermined centrifugal force, and an adjustable braking means adapted to check the tilting movement of said furnace and said casting box, said braking means comprising a hydraulic cylinder and piston operatively connected to said axle.

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