Jan. 4, 1938. E. G. TOUCEDA 2,104,380

CENTRIFUGAL CASTING MACHINE

Filed May 5, 1934 2 Sheets-Sheet 1

Fig. 1.

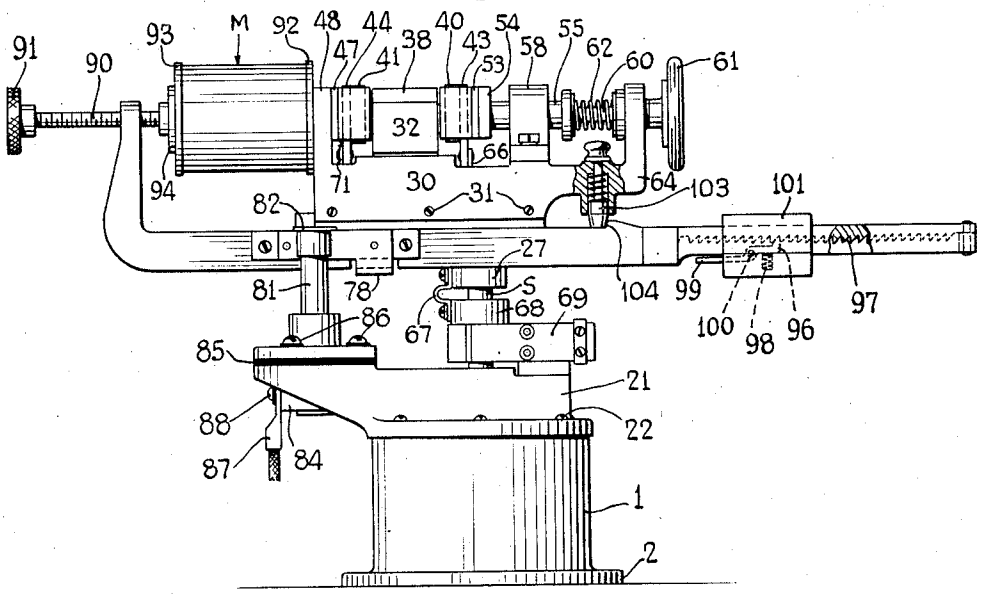
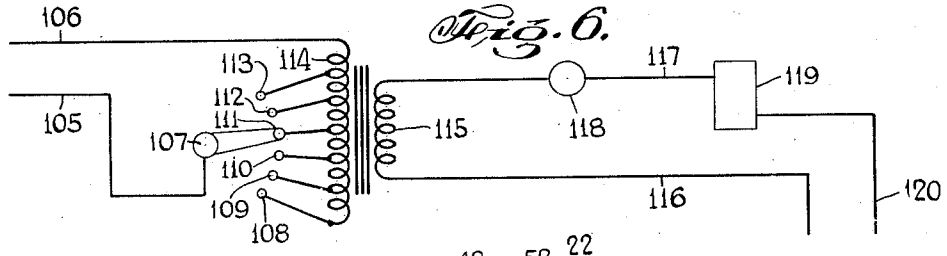


Fig. 6.



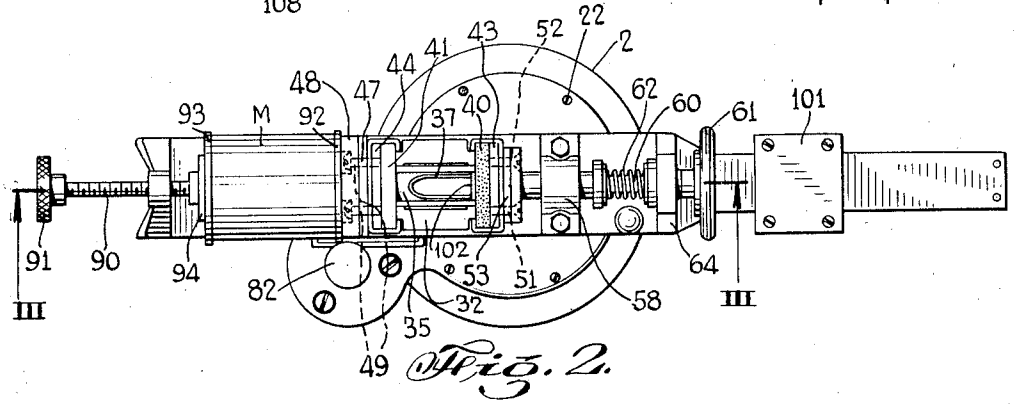


Fig. 2.

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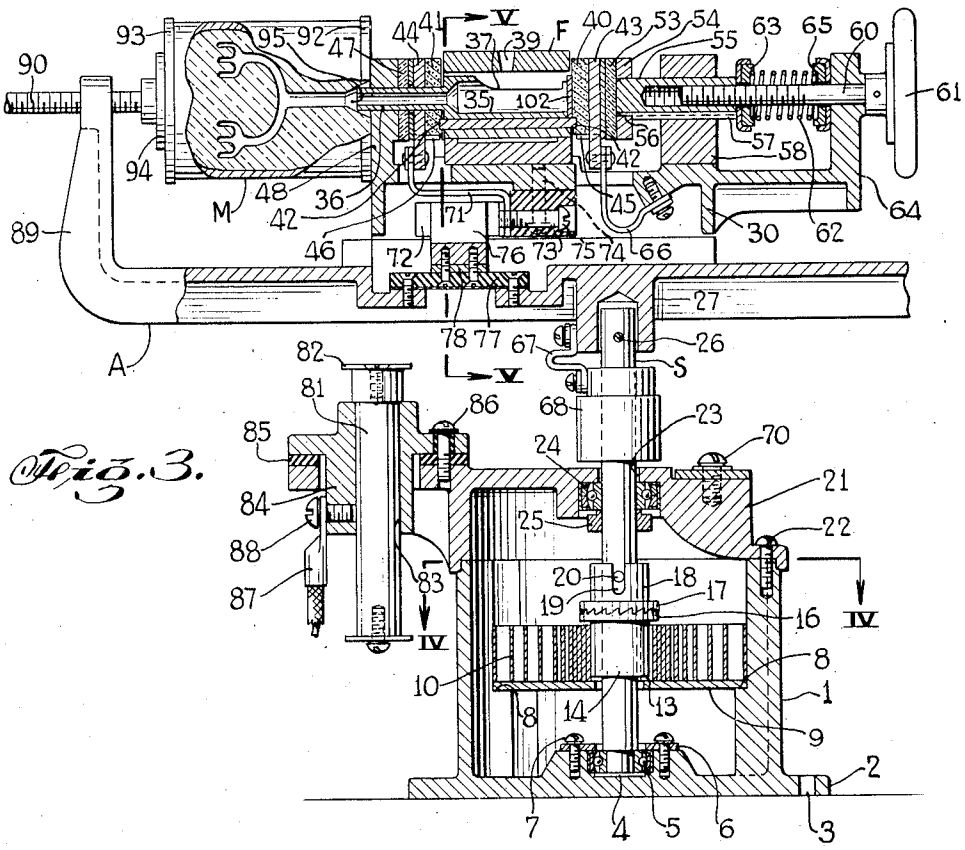


Fig. 3.

Fig. 4.

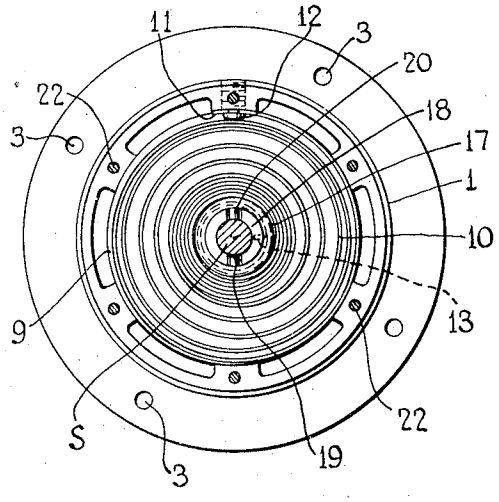
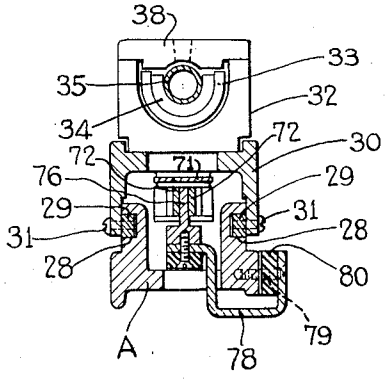


Fig. 5.



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UNITED STATES PATENT OFFICE

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CENTRIFUGAL CASTING MACHINE

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Application May 5, 1934, Serial No. 724,005

5 Claims. (Cl. 22—65.1)

This invention relates to casting, especially to metal casting, and more particularly to centrifugal casting.

A principal object of this invention is the production of a device, especially adapted for the centrifugal casting of prosthetic articles, such as dentures, in which the necessary heat for melting the metal required is produced electrically.

A further object of the invention is the production of a device of the type specified in which the mold to be filled with molten metal is mounted upon the same rotatable member as the device for melting the necessary metal.

A further object of the invention is the production of a device of the type described which includes an electric resistance furnace in which the resistance element serves as a crucible for the molten metal, either with or without a lining.

Other objects and advantages will appear as the description of the particular physical embodiment selected to illustrate the invention progresses, and the novel features will be particularly pointed out in the appended claims.

In describing the invention in detail and the particular physical embodiment selected to illustrate the invention, reference will be had to the accompanying drawings and the several views thereon, in which like characters of reference designate like parts throughout the several views, and in which:

Figure 1 is a side elevational view of a device embodying my invention; Fig. 2 is a top plan view of the device as shown by Fig. 1; Fig. 3 is a vertical sectional view of the device on the plane indicated by the line III—III of Fig. 2, viewed in the direction of the arrows at the ends of the line; Fig. 4 is a horizontal sectional view on the plane indicated by the line IV—IV of Fig. 3, viewed in the direction of the arrows at the ends of the line; Fig. 5 is a vertical sectional view on the plane indicated by the line V—V of Fig. 3, viewed in the direction of the arrows at the ends of the line; Fig. 6 is a diagrammatic view illustrating a method of controlling electrical energy for the device of Fig. 1.

The device, in general, includes an electric furnace designated, generally by F, mounted so as to communicate with the inlet of a mold M so that metal melted within the furnace F may flow into the mold M when both mold and furnace are rotated about a center. In order to secure the desired rotation, both the furnace F and the mold M are mounted upon an arm A which in turn is mounted upon the rotatable spindle S. When the spindle S is caused to rotate, the arm A is rotated with it so swinging the furnace F and mold M about the longitudinal axis of the spindle S whereby melted metal in the furnace F is thrown by centrifugal force into the mold M.

The particular specific embodiment of applicant's invention shown in the drawings includes a substantially hollow, preferably cylindrical base member 1. This base member 1 is preferably provided with a flange 2 apertured, as at 3, for the reception of bolts or screws whereby the base may be secured to a suitable support.

Preferably within the base member 1, an end bearing is provided for the spindle S. This end bearing preferably includes an end plate 4 of appropriate material to take the end thrust of the spindle S and a ball bearing 5 of usual or appropriate form held in place by the annulus 6 and screws 7 to provide anti-friction means for allowing the rotation of the spindle S and for appropriately maintaining a fixed position for the lower end of the spindle S.

Shoulders 8 are provided on the interior of the wall of the base 1. A plate 9 is supported by these shoulders 8 and in turn serves to support a spiral spring 10, one end 11 of which is attached, as by screw 12, to the base 1, and the other end 13, of which is attached to the sleeve 14 which is free on spindle S so that spindle S may rotate independently of sleeve 14 although sleeve 14 does not move longitudinally of spindle S being supported by spring 10 and prevented from too great movement downwardly by plate 9.

The sleeve 14 has its upper end, as viewed in Fig. 3, formed into ratchet teeth 16 mating with ratchet teeth 17 formed in the lower end of a sleeve 18 about the spindle S. This sleeve 18 is freely movable longitudinally of the spindle S, but is rotatable therewith by reason of the longitudinal slot 19 in the collar 18 and the pin 20 in the spindle S.

The construction heretofore described is such that if the spindle S is rotated in a clockwise direction, the pin 20 causes the sleeve 18 to turn thereby causing the teeth 17 to engage with the teeth 16 on the sleeve 14 thereby causing sleeve 14 to rotate in a clockwise direction which causes the spring 10 to be tensioned or wound up. If the spindle S is then freed, it will rotate in a counter-clockwise direction being driven by the spring 10 through the sleeve 14 and its teeth 16 meshing with teeth 17 of sleeve 18 which bearing against pin 20 causes the spindle S to rotate in

a counter-clockwise direction. If the spindle S or any parts attached thereto have considerable inertia therein after the spring 10 has been completely unwound there will be a tendency for the spindle S to continue its rotation. This may be done without winding the spring in the opposite direction, that is, in a counter-clockwise direction because when the spring has become completely unwound and the spindle S still continues to turn, the teeth 17 of the sleeve 18 will ride up over the teeth 16 of the sleeve 14, being permitted by the slot 19 of the sleeve 18, so that spindle S can continue to turn until stopped by friction without winding the spring 10 in a counter-clockwise direction.

In order to suitably journal the upper end of the spindle S applicant provides a base cap 21 attached to the base 1 as by screws 22. This base cap is provided with an orifice 23 through which the spindle extends and properly supports a ball bearing 24, the inner race of which is attached to the spindle S so that the spindle S is suitably supported in an anti-friction manner enabling it to rotate freely, but is prevented from longitudinal movement by the base plate 4 and the collar 25 fixedly attached thereto and bearing against the ball bearing 24.

At the upper end of the spindle S, a pin 26 is passed through the spindle and through the hub 27 of arm A. This binds the arm A to the spindle S so that the arm A must turn with the spindle S but the fit between the spindle S and the hub 27 is such that the arm A can pivot slightly at the pin 26 so that if the arm A is heavier at one end than it is at the other it will be shown by the slight pivoting, and, as will hereinafter be shown, may be corrected by a weight adjustment.

The arm A is provided on each side with trackways 28 for receiving slides 29 held to carriage 30 by appropriate means such as screw 31. This trackway 28 extends longitudinally of the arm A and so allows the furnace carriage 30 to move longitudinally of arm A.

The furnace carriage 30 supports heat insulation material 32 which in turn supports what I term, an outer crucible cover 33, which is preferably made of a refractory material which can withstand a very intense heat without melting. Within the covering 33 is a trough-like member 34 which is the resistance element of an electric resistance furnace and to the ends of which the terminals of a source of electrical energy are connected. This trough-like member 34 is made preferably of recrystallized silicon carbide, which is a material having a negative resistance characteristic upon heating, and is at the same time infusible at the temperatures at which it is desired to operate, and is also quite fairly stable when heated in the presence of air. This trough-like member 34 may be formed in a variety of ways but applicant has found that an appropriate way is to grind out, into the form of a trough, one of the ordinary refractory recrystallized silicon carbon rods now sold as an article of commerce, although direct moulding thereof may be preferable.

The element 34 is the element which is heated by the passage of electric current and may well serve, in many cases, as the direct receptacle for the material to be melted so that the element 34 may well be called a crucible and may actually be used as a crucible. In some cases, however, applicant prefers to place a lining within the trough-like member or resistance element 34 to act as the direct receptacle for the material to be melted. In case such inner lining is used, such as 35, it would be made of highly refractory material so as to withstand the great heat to which it is subjected and would preferably be formed as best shown in Fig. 3, that is, with a prolonged neck 36 serving as an outlet duct, and would be open at 37 so that the material to be melted could be placed therein from above. In order to facilitate the placing of material within the crucible, applicant provides a removable cover 38 which may be taken away from in place, as shown in the drawings, while metal is being placed within the crucible or within the inner lining 35 thereof, and applicant further provides a peep-hole 39 through which the metal being heated may be viewed and through which any gases which may be generated may issue.

In order to transmit the electric current to the crucible 34, applicant preferably provides a conducting block abutting each end. As shown in Fig. 3, one abutting block 40 is at one end and a similar abutting block 41 is at the other end. These blocks are made preferably of conducting carbon and are preferably formed with grooves 42 therein in which the end of the crucible 34 rests. In order to make a more perfect electrical union between the crucible 34 and the end blocks 40 and 41, applicant prefers to place a conducting cement such as an electric graphite cement between the several parts.

The current is conducted to the carbon blocks by means of copper plates such as 43 and 44 abutting the carbon blocks 40 and 41 respectively. These copper plates 43 and 44 and the blocks 40 and 41 are held in copper stirrups 45 and 46.

The copper stirrup 46 is insulated from the frame 30 by a mica plate 47, and the parts 41, 44, 46, 47 and the abutment plate 48 of carriage 30 are all held firmly and rigidly together by bolts as 49, best shown in Fig. 2. These bolts have insulation under their heads and surrounding them so as to prevent an electrical connection to the carriage 30.

The members 40, 43, and 45 are held together by bolts, as 51 and 52, together with a mica plate 53 and an apertured steel plate 54. The form of construction adopted is such that all of the parts are held together and the apertured metal plate 54 is positioned to receive the end of a plunger 55 against the mica plate and within the aperture 56 of the steel plate 54. The mica also serves as a heat insulator to prevent too great heating of 55.

The plunger 55 has a feather 57 therein which works in a keyway within the plunger shoulder 58 so that the plunger 55 is movable longitudinally but cannot rotate upon its own axis.

The plunger 55 is provided with an internal screw thread and a screw threaded rod 60 attached to a hand wheel 61 cooperates therewith. When the hand wheel 61 is rotated in a clockwise direction the plunger 55 is withdrawn, taking with it a metal plate 54, mica plate 53, stirrup 45, connector plate 43 and carbon contact 40, as 54 fits tightly on 55 and is preferably silver soldered thereto. When the hand wheel 61 is rotated counter-clockwise the plunger 55 is in effect merely spring pressed by the spring 62, that is the rotation of the hand wheel 61 cannot force plunger 55 into engagement with mica plate 53, but it can, in effect, release plunger 55 so that the spring 62 will press it into contact with mica plate 53. In order to have plunger 55 so act, spring 62 surrounds rod 60 and at one end presses against plunger 55 through the intermediary of spring seat 63 and at the other end presses against

standard 64 through the intermediary of spring seat 65.

The effect of the construction described, is that the several parts at each end of the crucible and the crucible 34 are tensioned to an extent depending upon the force exertable by the spring 62 so that the danger of crushing crucible and the associated parts is avoided, and if during heating the several parts expand, then expansion may be taken up by the spring 62.

In order to conduct current to the copper plate 43, a jumper 66 made of conducting material is connected from the copper plate to the carriage 30. The carriage 30 is in good electrical and mechanical contact with arm A through the bars 29. The arm A is connected by conducting jumper 67 to copper sleeve 68 positioned on spindle S and a conducting brush 69 bears upon the sleeve 68 and is supported by and attached insulatingly to the member 21 by means of the screw 70 by which the electrical conductor from one side of a source of potential may be connected to the device.

The copper plate 44 is connected through the conducting jumper 71 to the conducting plates 72 insulatingly supported by insulation 73 upon the carriage 30 by means of bolts, as 74 and 75. Cooperating with the plates 72 is the conducting plow or wedge 76 insulatingly supported by insulation 77 bolted to the carriage 30 and having connected thereto a conducting jumper 78 passing down under and up as shown in Fig. 5 and attached by bolts, as 79, and insulation as 80, to the face of the arm A in position to be engaged by a reciprocating plunger 81.

The reciprocating plunger 81 is made of conducting material and is preferably constructed with its upper end having an overhanging shoulder, as 82, which may rest on the top of the member 78. The plunger 81 passes through a bore 83 of a plunger carrier 84 supported on the member 21 but insulated therefrom as by insulation 85 and bolted thereto, as by bolts 86, insulated from the plunger carrier 84. The plunger carrier 84 is further provided with any suitable means, such as contact clip 87 held by screw 88, by which a conductor from one side of the source of potential may be connected thereto.

For the purpose of properly holding a mold into which metal is to be poured applicant provides the mold standard 89 forming part of the arm A. This mold standard 89 is apertured at its upper end and provided with a screw thread with which cooperates the threaded rod 90 operable by the hand wheel 91. The mold M, with a plate 92, usually at one end and a plate 93 at the other end, is mounted between the standard 48 and the end plate 94 of the mold screw. By tightening the screw rod 90, the mold M is held firmly in position with its inlet 95 communicating with the interior of the extension 36 of the crucible lining 35.

In making use of the device the mold M is put in place and secured by turning the screw rod 90 and the crucible 34 with its associated and surrounding parts are positioned as shown in Fig. 3 and the hand wheel 61 is turned counterclockwise, until the full force of the spring 62 is exerted upon the parts so as to properly hold them together. The metal to be melted is placed in the crucible, or crucible lining, as the case may be, after removing the cover 38. The cover 38 is then replaced and observation is made to see whether or not the arm is balanced. If it is not balanced then the ratchet 96 is moved out of the teeth of the rack 97 against the spring 98 by pressing upwardly, as shown in Fig. 1, on the arm 99 of the two arm lever pivoted at 100 on the weight member 101, and the weight 101 is moved along until the arm A is in balance and then the ratchet freed to re-engage the rack 97. Terminals from a source of potential are connected one to 70 and the other to 87. The plunger 81 is moved upwardly so that its overhanging shoulder 82 engages the top of the member 78 after the spring 10 has been wound up by a clockwise movement of the arm A. The plunger 81 prevents the spring from unwinding and also conducts the current to the wedge or plow 76. The passage of current through the crucible 34 generates heat sufficient to melt the metal within the crucible or the lining 35. When the lining is used the metal does not come in contact in any way with carbon or carbide, as the end wall 102 of refractory material such as alundum is placed in the end of the lining 35. The melting of the metal may be observed through the peep hole 39, and when the metal is melted and of the proper heat the plunger 81 is manipulated so as to be dropped to its position as shown in Fig. 3 and the arm A released, whereupon, the arm A rotates about with the spindle S so as to throw the melted metal into the inlet 95 of the mold M and so fill the impression in the mold to give the desired article.

In order to prevent the carriage 30 from moving when the mold M is pushed up against it the spring catch 103 is positioned on the carriage 30 to engage with a shoulder 104 on the arm A.

A suitable method of supplying current to the device is shown by Fig. 6 in which the connections from a source of potential are indicated as 105 and 106. One of these, 105, is connected to the center 107 of an ordinary switch arm which is mounted to turn to contact successively the contact points 108, 109, 110, 111, 112, and 113 respectively which are tapped into the primary 114 of a transformer of which the secondary is 115. By this arrangement various voltages may be generated at the terminals of the secondary 115 as desired. The secondary 115 has one terminal 116 connected to 70 of Fig. 3 and the other terminal 117 is connected through an ammeter 118 to any suitable form of overload circuit breaker 119 and then by wire 120 to the terminal 87 as shown in Fig. 3. By this arrangement the desired flexibility and desired energy supply to the crucible is obtained.

Although I have particularly described one particular physical embodiment of my invention and explained the operation, construction and principle thereof, nevertheless, I desire to have it understood that the form selected is merely illustrative, but does not exhaust the possible physical embodiments of the idea of means underlying my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In an electric furnace, in combination: a crucible formed as an elongated trough, open at each end and formed of refractory electrical conducting material; refractory electrical conducting blocks, one applied removably to either end of the trough and serving to close the same at one end while the other block has an orifice to permit discharge of fused material endwise from the trough; metallic conducting plates, one bearing against each block; and means for applying a difference of potential to the metallic conducting plates.

2. In a centrifugal casting machine, in com-

bination: an arm mounted for rotation and supported intermediate its ends; an electric furnace mounted on the arm, said electric furnace including a somewhat elongated trough-like member formed of refractory electrical conducting material; means for mounting a mold upon the arm, said mold formed with an inlet positionable to communicate with the trough of the crucible; means for applying a difference of potential to the ends of the crucible whereby material therein may be melted; and means for rotating the arm whereby the melted material in the crucible is moved by centrifugal force into the mold, said instrumentalities being arranged in approximately balanced position relatively to the axis of rotation of said arm, so that the moment of centrifugal force is exerted chiefly upon said melted material.

3. In a centrifugal casting device, in combination: an arm mounted for rotation; an electric furnace mounted on the arm and formed with an outlet and terminals; a mold mounted upon the arm and formed with an inlet aligning with the outlet of the furnace; a carriage upon which the furnace is mounted; means for sliding the carriage longitudinally of the arm and for securing it in an adjusted position; means for rotating the arm; means for preventing rotation of the arm also serving to conduct electricity to one terminal of the furnace; and means for conducting electricity to the other terminal of the furnace, said instrumentalities being adjustable into approximately balanced position relatively to the axis of rotation of said arm, so that the moment of centrifugal force may be exerted chiefly upon the molten material.

4. In a centrifugal casting device, in combination: an arm; a spindle pivotally supporting the arm intermediate its ends; means for supporting a mold formed with an inlet on the arm; a furnace carriage; cooperating slides and slideways on the carriage and the arm whereby the carriage may be slid longitudinally of the arm; a somewhat elongated trough-like crucible formed of refractory electrical conducting material supported by the carriage; means for connecting one side of a source of potential to one end of the trough-like crucible including a refractory electrical conducting block bearing against one end of the crucible, a metal conducting plate bearing against the refractory block, spaced plates supported by the carriage and electrically connected to the metal plate, a wedge positioned on the arm to engage between the plates, and a conductor extending from the wedge to a side face of the arm, and an electrical connection from the said side plate to one side of a source of potential; means for connecting the other end of the crucible to the other side of the source of potential; and means for rotating the arm whereby material placed in the crucible may be melted and thrown by centrifugal force into the mold.

5. In a centrifugal casting device, in combination: a rotatable member, an electric resistance furnace mounted on the rotatable member and including a resistance element formed into substantially an elongated hollow trough; a mold formed with an inlet communicating with the hollow trough; resilient means to bias said trough and mold into cooperative relation; means for applying electric energy flow through the resistance element; means for at times rotating the rotatable member whereby metal may be melted within the trough and then thrown by centrifugal force into the mold, a movable abutment for said resilient means, and a quick-acting manually operable device to shift said abutment, so that said mold and said trough are respectively and independently readily demountable.

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