Nov. 15, 1938.

O. RIEG

2,137,217

SLUSH CASTING MACHINE

Filed Jan. 9, 1937

3 Sheets-Sheet 1

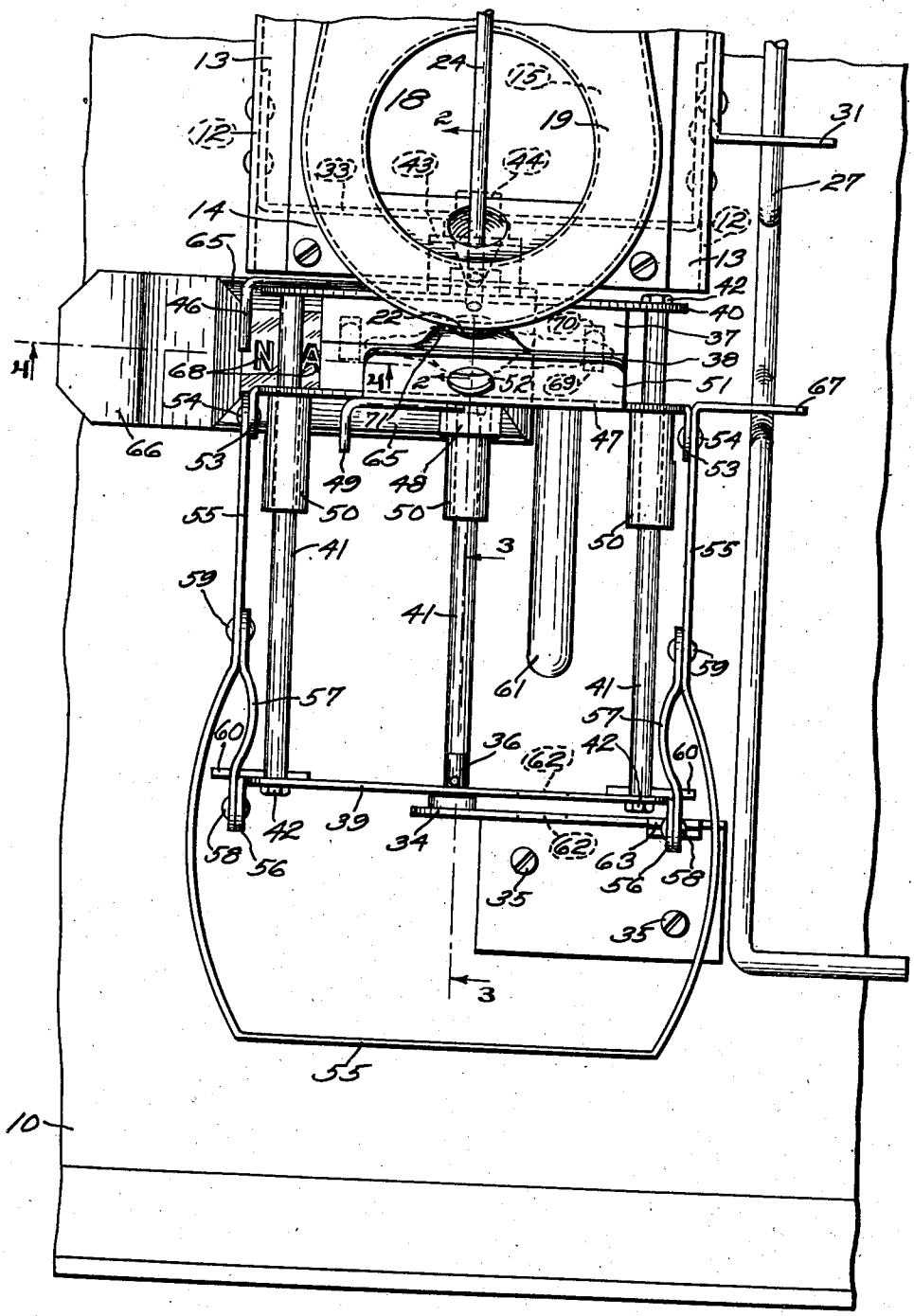


Fig. 1

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Fig. 2

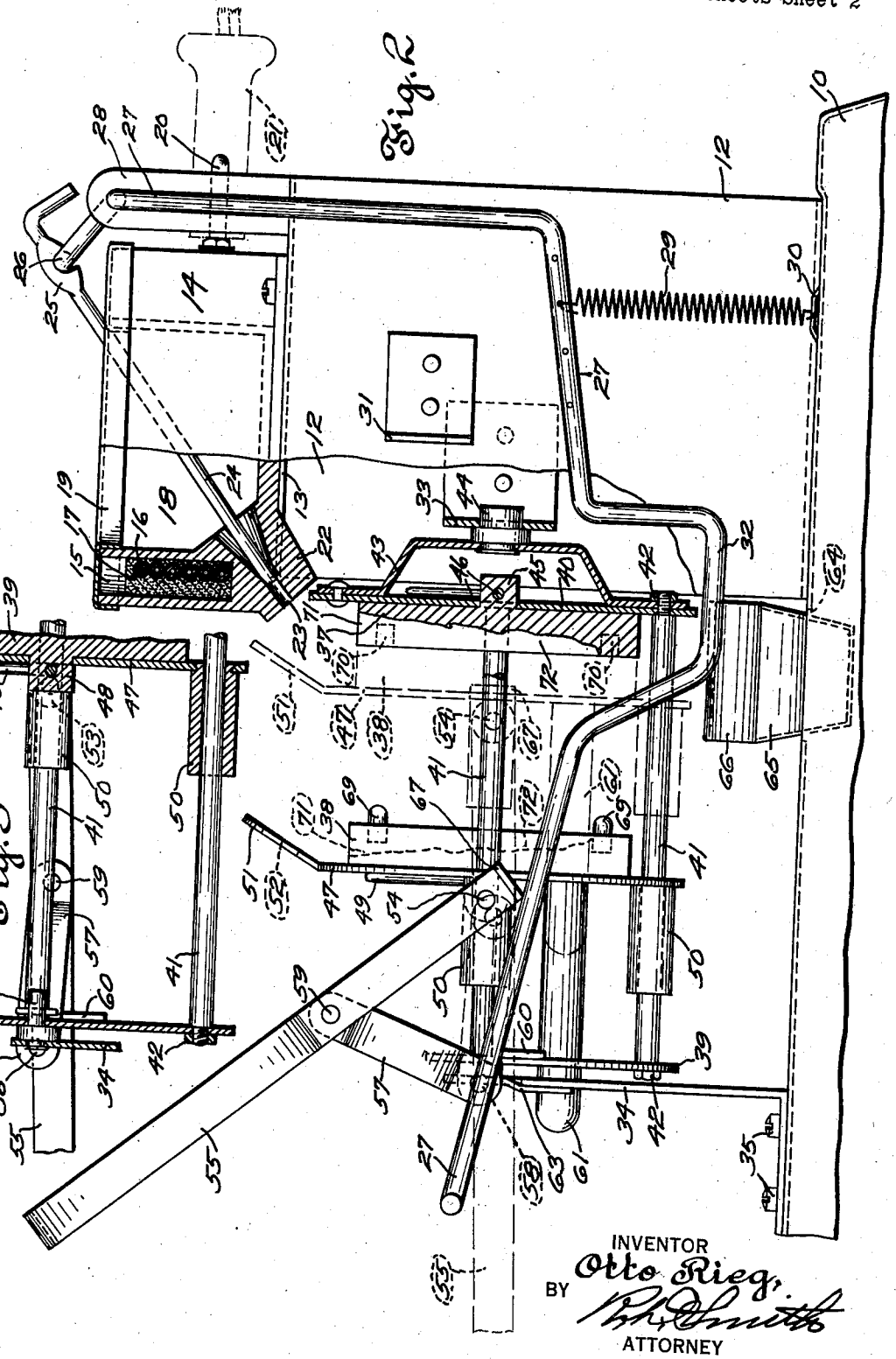


Fig. 3

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Fig. 4

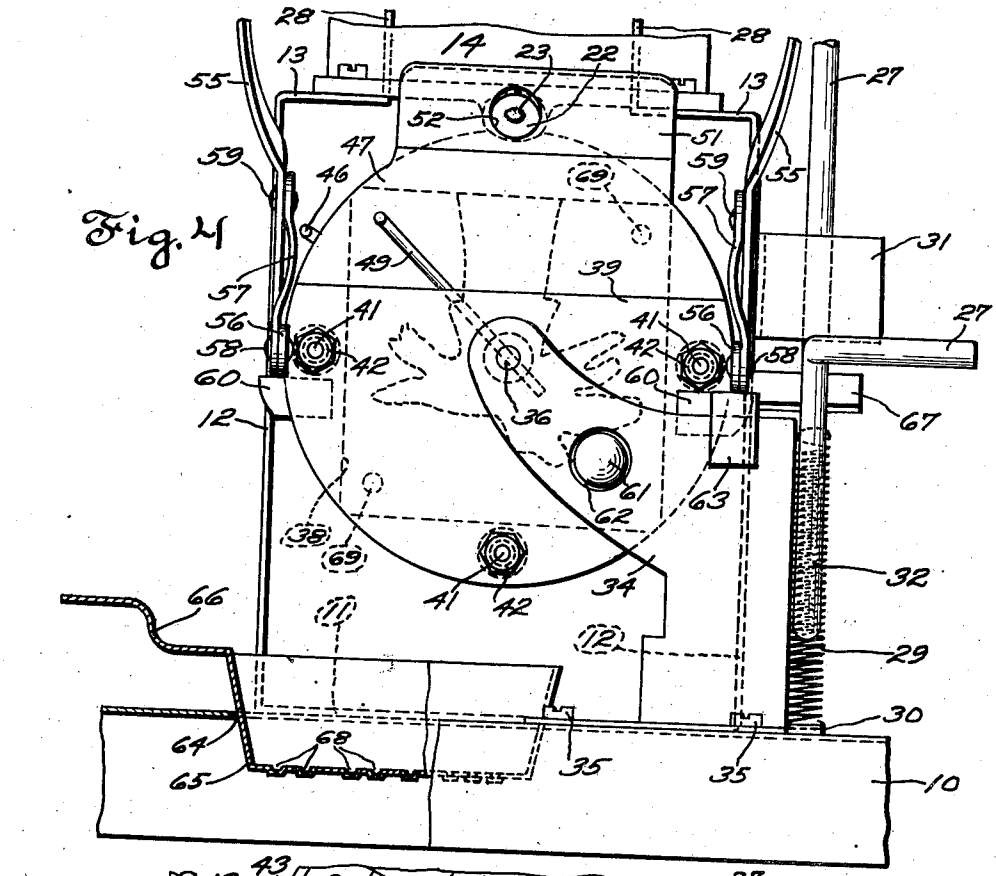
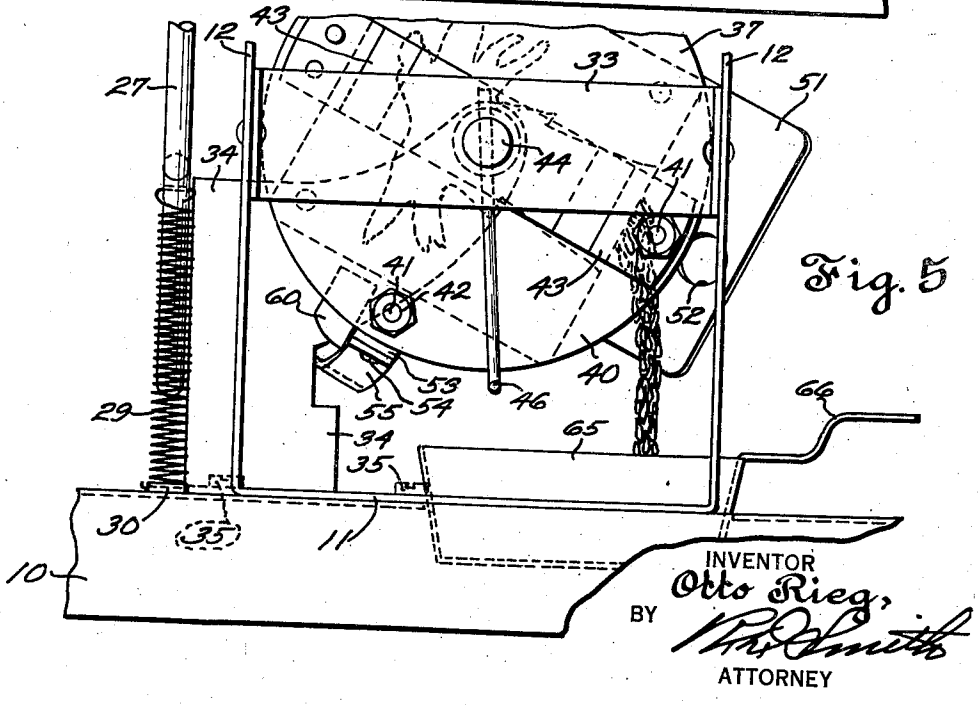


Fig. 5



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UNITED STATES PATENT OFFICE

2,137,217

SLUSH CASTING MACHINE

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Application January 9, 1937, Serial No. 119,762

15 Claims. (Cl. 22—57)

This invention relates to apparatus for making castings particularly of metals or other moldable materials having a low melting point and which are therefore quick to solidify within a mold. Such metals or materials are most suitable for use by an unskilled operator in the making of toy castings and other small articles.

It is an object of the present invention to provide an apparatus which shall facilitate the making of castings of this nature by persons who have little or no knowledge of the founding art and an apparatus which may safely be used, even by children, in the home.

Another object of the invention is to provide an apparatus of this nature capable of producing hollow or slush castings of lighter weight than solid castings, this feature being desirable in toy soldiers, ornamental statuettes and various other articles not required to have an accurate configuration of their hollow interiors. Also a greater number of hollow or slush castings can be produced from a given supply of molding metal or material, than is the case where only solid castings can be produced.

A further object is to provide an apparatus for operating separable and rotatable mold sections by the use of a single hand so that the other hand of the operator may be free to control the pouring of the liquid material to be cast in conjunction with the opening, closing, and dumping action of the mold sections for making hollow castings. By the speed of operation thus made possible, I avoid the slowness of in and out pouring operations inherent in apparatus for producing slush castings as heretofore known, and am able to work with more quickly solidifying materials and produce a greater variety of more perfect and uniform castings.

A further object is to provide mechanism whereby the mold sections may be opened, closed, and turned to dump out the unsolidified content of the mold for producing a slush casting, all by the manipulation of a single operating handle.

A further object is to provide mechanism adapted automatically to maintain the mold sections in closed relationship while they are being turned to dump out unsolidified casting material from the mold cavity.

A further object is to provide safety devices cooperative between the mold operating mechanism and certain mechanism which controls the pouring or feeding of casting material from a crucible into the mold, to insure that no molten metal or material shall be poured or fed from the crucible when the mold sections are open.

A further object is to provide interlocking devices which shall hold the mold sections against turning movement while the sections are separated for removing an article which has been cast therewithin, and which shall cooperate with the aforesaid safety devices to preclude discharge of molten material from the crucible at that time.

A further object is to provide stops for limiting the movements of various parts of the apparatus when shifted to their respective stations for carrying out the casting operations above described.

A further object is to provide a removable receptacle to receive the unsolidified casting material when it is dumped out of the mold cavity and to equip such receptacle with sloping walls adapted to cause the liquid material discharged from the mold cavity to solidify within the receptacle in the general shape of an ingot whereby the ingot may easily be removed from the receptacle by overturning the latter and redeposited in the crucible for repeated delivery to the mold cavity in liquid form.

A still further object is to provide means disposed to come in contact with the liquid casting material received from the mold cavity by the receptacle, which shall cause to be formed on the surface of the ingot, depressed or raised markings constituting a name, figures or the like, or a symbol of any kind which may be useful in later identifying the ingots formed by a given kind of casting material or for propagating the trademark or advertising marks of the manufacturer.

A still further object is to provide in a toggle linkage mechanism employed for pressing together cooperative mold sections, parts capable of resiliently yielding to a limited extent for opposing the overcentering action of the toggle mechanism and holding the mold sections together.

A still further object is to construct an apparatus of the type described with parts of sufficient ruggedness to withstand hard and constant usage so that the apparatus may be used as a machine for the rapid production of uniform slush castings in the commercial production of same, if desired.

The foregoing and other objects will appear in greater particular from the following detailed description which has reference to the appended drawings, wherein:

Fig. 1 is a plan view showing in suitable actual size one possible embodiment of the present improvements in casting apparatus, the rear extremity of the machine being broken away and the actual width of the base or platform being

condensed. The complementary mold sections are shown in closed relationship beneath the pouring spout of the crucible.

Fig. 2 is a side elevation looking from the right at Fig. 1 and showing the complete length of the apparatus with a portion of its base or platform broken away. Certain of the parts are shown in central vertical section on the plane 2—2 in Fig. 1 and the mold sections are shown in separated position with the crucible valve locked closed.

Fig. 3 is a fragmentary view of the operating mechanism for the slidable mold section taken in vertical section on the plane 3—3 in Fig. 1 looking in the direction of the arrows and showing such mold section locked in its position abutting with the complementary mold section, by overcentering action of the toggle mechanism.

Fig. 4 is a front view of the apparatus showing the parts positioned as in Fig. 2 and showing a portion of the base and side wall of the receptacle cup broken away to expose their construction, the upper part of the crucible being omitted.

Fig. 5 is a view looking at the rear end of the machine, portions of which are omitted, and shows the mold turned about its horizontal axis for discharging unsolidified portions of the casting material from the mold cavity to produce a slush casting.

The working parts of the apparatus are mounted upon a hollow base 10 which may be made of sheet metal with down-turned edges and of sufficient area to form an underlying platform extending well beyond the lateral range of movement of the moving parts so as to provide a stable foundation having no tendency to shift position or overturn when the parts of the apparatus are manipulated.

At the rear of base 10 a superstructure 11 is fixed to the top surface of the base by welding or any suitable means, consisting of a wide U-shaped sheet of metal having side walls 12 and in-turned flanges 13 respectively at their tops affording an elevated support for a crucible 14.

The crucible employed may have sundry forms but as here shown comprises a cast metal body incorporating an annular chamber 15 containing electrical resistance 16 preferably embedded in refractory material 17 for heating the crucible chamber 18. A ring-like cap 19 covers the annular chamber 15 and exposes the crucible chamber 18. The electrical resistance 16 terminates at the rear of the machine in side-by-side prongs 20 adapted to receive an electrical attachment cord terminal 21 for connection to a source of electric current. The crucible may be heated by gas flame or in any other suitable way. At the lower front edge of the crucible a spout 22 containing a delivery orifice 23 is provided for discharging molten metal or other material from the crucible under the control of a valve rod 24 whose lower end operates to control the passage of the casting material outwardly through orifice 23. Rod 24 extends diagonally upward through and out of the crucible chamber 18 and has a flatted notched portion 25 which hooks over a crank 26.

Crank 26 forms a portion of a long, bent handle 27 and together with the same is pivotally supported at the top of a standard 28 fixed to the top flange 13 of the superstructure 11. A standard similar to 28 is preferably employed at the opposite side of the machine to provide a double pivotal support for crank handle 27 which construction, together with other details of the crucible and its outlet control, will be found illustrated and described as to one possible form in United States Patent 2,025,069 granted December 24, 1935, to W. G. Newton. A vertical extension spring 29 is stretched between one point in the crank handle 27 and an anchorage 30 on base 10 so as to urge the crank 26 counterclockwise into valve closing position. The degree to which the crank handle 27 may be lifted is determined by a stop bracket 31 protruding laterally from the side wall 12 of the superstructure. Crank handle 27 extends to the frontmost part of the machine to be manipulated by the right hand of the operator and contains a downwardly offset bent portion 32 to clear certain parts of the mechanism as will hereinafter be more fully explained.

The side walls 12 support therebetween a horizontally disposed bearing bracket 33 giving pivotal support to the rear end of a rotatable cradle-like mold supporting structure next to be described and which at its front end derives pivotal support from the upstanding bearing bracket 34 secured to base 10 by screws 35 on which is mounted a bearing stud 36 axially aligned with the bearing hole in bracket 33. All of the parts for supporting and operating the mold sections 37, 38 comprise a movable structure which as a whole is pivotally suspended between brackets 33 and 34, which structure will now be described.

A front plate 39 of less than full circular area is rigidly secured to a rear plate 40 by three horizontally disposed rods 41 each of whose end portions may be reduced and threaded to penetrate plates 39 and 40 and to receive the retaining nuts 42. Front plate 39 is centrally apertured to receive and be pivotally supported by bearing stud 36 on bracket 34. Rear plate 40 has fixedly secured thereto a straddle bar 43 carrying the trunnion stud 44 which is pivotally supported in bearing bracket 33. Rear plate 40 further has a central aperture which may comprise a square or rectangular or irregularly shaped hole adapted to receive the mounting projection 45 of corresponding cross sectional shape which is integral with mold section 37. Mounting projection 45 has a crosswise hole adapted to receive the retaining pin 46 which by removal permits mold section 37 to be demounted from plate 40 and replaced by a different mold section.

The three rods 41 are utilized as ways for slidably mounting a third plate 47 adapted to carry the cooperative mold section 38 whose mounting projection 48 may penetrate sliding plate 47 and be retained therein by pin 49 all as described in connection with the mold section 37 and plate 40. To give stability to the sliding constraint or plate 47 by the rods 41, the plate is provided with three hollow posts 50 made rigid therewith and having a free sliding fit, respectively, upon the rods 41. At its top, the carrier plate 47 is extended to form a splash guard 51 containing the aperture 52 whose purpose will appear hereinafter.

At its lateral opposite edges, the sliding plate 47 carries ears 53 bent forwardly and to which are respectively pivoted by suitable studs 54, the ends of a bail handle 55. At corresponding edges of the front plate 39 similar ears 56 are bent forwardly to each of which is pivoted a toggle link 57 by suitable studs 58. The opposite end of each of toggle links 57 is pivoted to a mid por-

tion of the bail handle 55 by suitable studs 59 which are in axial alignment. The toggle links 57 are bowed to permit of a resilient yielding action whose purpose will appear hereinafter. The pivoted end 67 of bail handle 55 at the right side of the machine is bent outwardly and extends into the vertical plane of movement of the valve handle 27 for reasons which will later appear. Front plate 39 further carries in rigid relation thereto stop brackets 60 positioned to engage with toggle links 57 respectively and to be cleared by the bail handle 55 in its swinging movement about pivots 54.

The sliding plate 47 carries a forwardly projecting post 61 in rigid relation thereto and the front plate 39 together with bearing bracket 34 are each apertured at 62 in line with post 61 to receive the post when the mold sections are opened thereby to lock plates 39, 47, and the entire structure supporting the mold sections against rotative movement relative to bracket 34. Bracket 34 further carries the upwardly projecting stop 63 for limiting rotation of the parts when they have been turned to mold filling position.

The top wall of base 10 is apertured at 64 to receive and fit a receptacle cup 65 having sloping sides and a projecting handle 66. This cup is positioned to receive unsolidified metal or casting material when it is dumped out of the mold by rotating the mold sections.

It will be noted that the sloping sides of cup 65 enable the casting material deposited therein to solidify in the shape characteristic of an ingot which may therefore readily be removed from the cup when the latter is removed from the base 10 and overturned. This is conveniently done by use of the cup handle 66 by means of which, if desired, the ingot may be redeposited in the crucible for replenishing the supply of molten casting material. Handle 66 may conveniently be formed by an extension of the sheet-like material of the cap walls to provide a large area of heat dissipating surface tending to keep the cup handle cool enough to be grasped by the hand of the operator. Indentations 68 stamped or otherwise produced in the floor wall of receptacle 65 may be provided for causing a corresponding embossed marking to appear on the surface of the ingot, by which means the trade-mark of a manufacturer or some identifying mark for the kind of casting material being used will be propagated. If preferred, a separate indented or embossed ingot marking plate may be inserted into the bottom of the cup so that the characters 68 comprising the mark may be varied at will and without requiring a separate cup to be used for changing the marking.

The operation of my improved apparatus is as follows. Starting with the parts positioned as in Figs. 1 and 3 and as represented by broken lines in Fig. 2, it will be clear that the locking projection 67 carried by bail 55 is positioned to free the handle 27 and its crank portion 26 for swinging movement clockwise in Fig. 2 about its pivot at the top of frame standard 28 because of the downwardly offset portion 32 of the long bent rod which comprises handle 27. While grasping the frontmost span of the bail or mold operating handle 55 with his left hand, the operator will raise the valve control handle 27 with his right hand against the resistance of spring 29 to an easily controlled extent so that swinging of crank 26 in a clockwise direction will withdraw the lower end of valve rod 24 a corresponding extent from its sealing position in relation to the pouring orifice 23 if crucible 14 is sufficiently heated to liquify the casting material in crucible chamber 18.

Thereupon, an accurately controlled supply of the molten casting material will be delivered by gravity into the mouth or gate 71 of the mold cavity 72 formed by the abutting mold sections 37 and 38 whose correct register is assured by the dowels 69 on mold section 38 engaging the dowel holes 70 in mold section 37. The rate of delivery of the casting material to the mold is conveniently observed by the operator through the aperture 52 in the splash guard 51 which also gives a view of the mold gate 71 so that the operator may know when the mold cavity is full and thereupon drop handle 27 to cut off the discharge of casting material from the crucible.

Immediately, or when a suitably brief time has elapsed, the operator will twist the wrist of his left hand to turn the mold sections, and the entire structure by which they are supported and operated, counterclockwise in Fig. 4, or clockwise in Fig. 5, about the pivotal supports 36 and 44 until an arm of the bail 55 strikes the edge of frame bracket 34 as shown in Fig. 5. In this position of the parts, the mold gate 71 has been shifted from its upwardly disposed position in Figs. 1 to 4 inclusive, to its downwardly disposed position in Fig. 5, whereupon unsolidified portions of the casting material within the mold cavity will be poured out through the mold gate 71 into receptacle cup 65. The angle at which the gate 71 shall be downwardly disposed may differ from that shown in Fig. 5 to suit the shape and disposition of the mold cavity, the kind of casting material being used, or any other factor determining the abruptness with which the unsolidified content of the mold should be discharged to produce the characteristic of slush casting desired. It is preferable that some limit be provided to the turning movement of the mold, of which the abutment of bail 55 against bracket 34 will be understood to be an illustrative example.

When all of the liquid casting material has been dumped out of the mold, there will remain a solidified shell of the casting material within the mold cavity conforming to its contours and a hollow or slush casting thereby produced. By means of his left hand the operator then turns the mold back to its original position as in Figs. 1 to 4 inclusive, and lifts upwardly upon the bail handle 55 to move the parts into their positions shown in full lines in Fig. 2. While the mold section 38 is capable of further movement to the left than is indicated in Fig. 2, enough separation of the mold section 38 from mold section 37 has been effected to expose the slush casting and enable its removal from the mold section to which it most strongly adheres. Also in Fig. 2 the projection 67 has cammed downwardly and forwardly against the top of valve control handle 27 so that the latter cannot be accidentally lifted and the pouring orifice 23 can discharge no hot casting material to burn the hands of the operator while the casting is being removed from the mold section. Also in Figs. 2 and 4 the locking post 61 has entered apertures 62 in the plate 39 and in the frame bracket 34 thus holding the mold sections and the entire rotatable structure which supports them, against turning movement. Thus projections 67 and posts 61 cooperate not only to hold down the valve handle 27 but also to keep all of the movable parts rigidly positioned as shown in Fig. 2 until the operat-

ing handle 55 is again manipulated for repeating the casting operation.

When a new casting is to be made, the operating or bail handle 55 is swung downwardly from its position in Fig. 2 to its position in Fig. 3. Toward the last end of this motion the link pivots 59 slightly pass a dead center relationship to a straight line connecting the centers of pivots 54 and 58, and by this overcentering action, permitted by resilient yielding of the bowed links 57, firmly and automatically press and hold mold sections 37 and 38 tightly together until bail handle 55 is subsequently swung upwardly about its pivots 54.

When sufficient casting material has been discharged into the receptacle cup 65, the latter may be removed from its seat in the base 10 by means of its relatively cool handle 66 which is remote from the path of discharge of casting material both from the crucible and from the mold, and the solidified ingot formed within the receptacle dumped out by overturning the cup and if desired deposited in this manner within the crucible chamber 18 for remelting without requiring the relatively hot ingot to be touched by the hand of the operator.

While various ways of producing hollow or slush castings are old and well known, I am not aware that any apparatus has heretofore existed for the purpose which is capable of the speed, safety and uniformity of production of such castings made possible by my present improvements. If it is preferred that solid castings be produced, many of the advantages of the improvements likewise apply. The operation of dumping out the unsolidified casting material is merely omitted.

By the appended claims, therefore, I do not intend to limit the invention to any particular construction herein employed for illustrative purposes, but intend by said claims to cover all equivalents and substitutions which may come within the terms of the claims and the principles of the invention.

I claim:

1. A self stable appliance for making slush castings while the appliance rests unattached on a table top, embodying in combination, an underlying platform-like base, spaced front and rear frame members upstanding from said base, a cradle-like structure adapted to hold a mold section and pivotally supported by and between said frame members in a manner to be swung relative to said base for overturning said mold section while the latter is positioned over said base, a carrier equipped to hold a complementary mold section and slidably mounted on said cradle-like structure in a manner to swing rotatively in unison therewith relative to said base and also to shuttle relative to said cradle-like structure away from either of said frame members and simultaneously toward the other frame member thereby to open or close said mold sections while the latter remain in constant rotative register, and an operating handle connected in common to said carrier and to said cradle-like structure in a manner selectively to swing said carrier and structure in unison or to slide said carrier relative to said structure.

2. In apparatus for movably supporting complementary mold sections and operating them single handedly in a manner to produce slush castings, the combination with spaced rear and front frame abutments, of a turnable structure intermediate and pivotally supported by said abutments including a mold section holding member at the rear end of said structure and a carrier for a complementary mold section slidably mounted on said structure in a location to travel away from said front frame abutment toward said holding member for closing the mold sections and to travel away from said holding member toward said front frame abutment for opening said mold sections, together with an operating lever extending past said front frame abutment connected at the rear thereof to said carrier in a manner selectively to slide said carrier and/or to swing said structure.

3. In apparatus as defined in claim 2 the combination therein defined in which the said mold section holding member comprises an apertured plate adapted to accommodate in the aperture thereof a portion of a removable mold section which penetrates said plate and projects to the rear thereof, together with a bearing bracket rigid with and offset rearwardly from said plate in a manner to make room for and give access to said projecting portion of the mold section.

4. Apparatus as described in claim 2 in which the said operating lever includes a bail portion disposed to straddle the said turnable structure and having its arms pivotally connected at their ends to opposite edges respectively of the said carrier thereby to be swingable in relation to said structure and rotatable in unison with said structure.

5. Apparatus as described in claim 2 in which the said operating lever includes a bail portion disposed to straddle a portion of the said front frame abutment and having arms pivotally connected to opposite edges respectively of the said carrier.

6. In apparatus as defined in claim 2 the combination therein defined together with a toggle link having one end pivotally connected to the said turnable structure at a point intermediate the said frame abutments and extending away from the said front frame abutment toward the said rear frame abutment and pivoted at its opposite end to said operating lever.

7. In apparatus as defined in claim 2 the combination therein defined together with a toggle link having one end pivotally connected to the said turnable structure at a point intermediate the said frame abutments and extending away from the said front frame abutment toward the said rear frame abutment and pivoted at its opposite end to said operating lever, the said ends of said link falling in substantially a common plane aligned with the direction of their travel and the intermediate body of said link being normally bowed out of alignment with said direction of travel and comprised of sufficiently thin and resilient material to spring into more abruptly bowed shape thereby to exert a yielding resilient thrust against said carrier after the mold sections have been forced together in a manner to permit overcentering of the said toggle link and operating lever for automatically retaining them in overcentered position.

8. In combination with apparatus as described in claim 2, a locking device cooperative between said turnable structure and the said frame to prevent movement of the former relative to the latter and arranged to be impelled into locking position by the movement of said carrier which causes the mold sections to separate.

9. In casting apparatus, in combination with a structure including spaced and rigidly related front and rear end members, a longitudinal guide

extending from one of said members toward the other member, a mold section mounted on the rear member, a carrier slidably mounted on said guide between said members, a complementary mold section mounted on said carrier, a handle for operating the carrier, and mechanism including toggle connections cooperative with said handle, said front end member, and said carrier and arranged to transmit force for moving the mold sections into contact when said handle is moved, together with yieldable resilient means forming a part of said mechanism constructed and arranged to yield to the force transmitted by said mechanism in a manner to permit said toggle connections to overcenter while forcing the mold sections into contact.

10. In combination with an appliance as defined in claim 1, a crucible stationed on the said rear frame member at a higher level than the said cradle-like structure above the said base and having a discharge spout leading from a low point in said crucible to a position above the rear end portion of said cradle-like structure between the said front and rear frame members for directing molten casting metal into the mouth of the said mold sections when closed, and a receptacle constrained on said base under said cradle-like structure between said frame members in a position to receive sprue dumped from the mouth of the closed mold sections when they are overturned.

11. In an apparatus of portable type for supporting complementary mold sections and operating them single-handedly to make slush castings, in combination with a portable apparatus frame including spaced front and rear standards and a platform-like base extending between and supporting said standards, a cradle-like structure equipped and arranged to carry the mold sections in a manner to permit them to be opened and closed said structure being turnably supported above said base by said standards in a manner to swing relative to said base and having one of its ends positioned nearest one of said standards and its opposite end positioned nearest the other of said standards, and an operating lever connected to said cradle-like structure in a manner to turn in unison therewith and also to swing relative thereto said lever being operatively related to one of said mold sections for imparting respectively different characteristics of movement thereto while both mold sections are carried by the cradle-like structure between frame standards.

12. In apparatus as described in claim 11, the combination defined in claim 11 in which the said operating lever comprises a bail having arms straddling the said cradle-like structure constructed and arranged to be swingable relatively thereto in planes flanking the sides thereof for opening and closing the mold sections.

13. In apparatus as described in claim 11, the combination defined in claim 11 in which the said operating lever comprises a bail having arms straddling the said cradle-like structure constructed and arranged to be swingable relatively thereto in planes flanking the sides thereof for opening and closing the mold sections, together with separate toggle links each pivotally connected at one end to laterally spaced portions respectively of said cradle-like structure and extending rearwardly in flanking relation thereto and pivotally connected at their opposite end to each of said bail arms respectively in a manner to enable said links to swing to a position paralleling the sides of the cradle-like structure between the said frame standards.

14. In apparatus of the character described, in combination with a stationary apparatus frame, stationary abutments held in spaced relation by a length of said frame, a movable guide way structure supported between said abutments in side by side relation to said length of the frame in a manner to be turnable in relation thereto, separable mold sections carried by said structure in a manner to turn in unison therewith one of said mold sections being also movable relative to said structure along said guide way toward and away from the other mold section, and an operating handle connected to actuate said movable mold section in a manner to impel the latter along said guide way and also to turn said guide way structure relative to said frame and abutments, for overturning said mold sections to empty them of their contents.

15. In apparatus of the character described, a frame of light sheet metal construction including a base with a relatively high rear standard and a relatively low front standard spaced apart thereon, a movable mold carrying structure supported for turning movement between said frame standards in superimposed relation to said base, a crucible mounted on said high rear standard having a stationary discharge spout spaced above said turnable mold carrying structure, and a mold operating bail handle pivotally connected to said carrying structure at a point between said frame standards in a manner to turn in unison with said carrier structure and also to move relative to said carrier structure for selectively imparting movements to the mold in respectively different paths of travel in relation to said crucible spout and frame standards.

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