Feb. 18, 1930. A. D. LUND 1,747,552

GRID CASTING MACHINE

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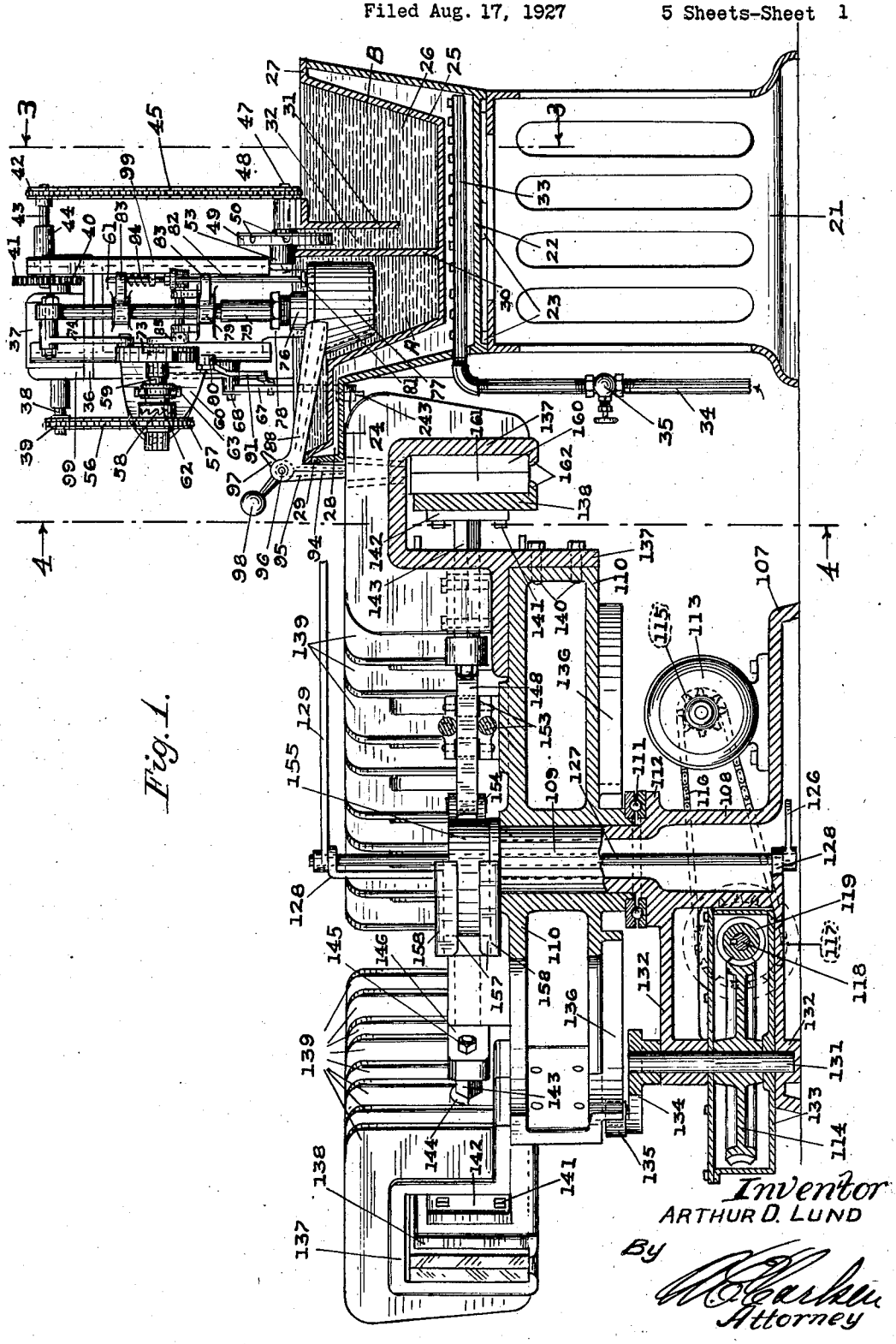


Fig. 1.

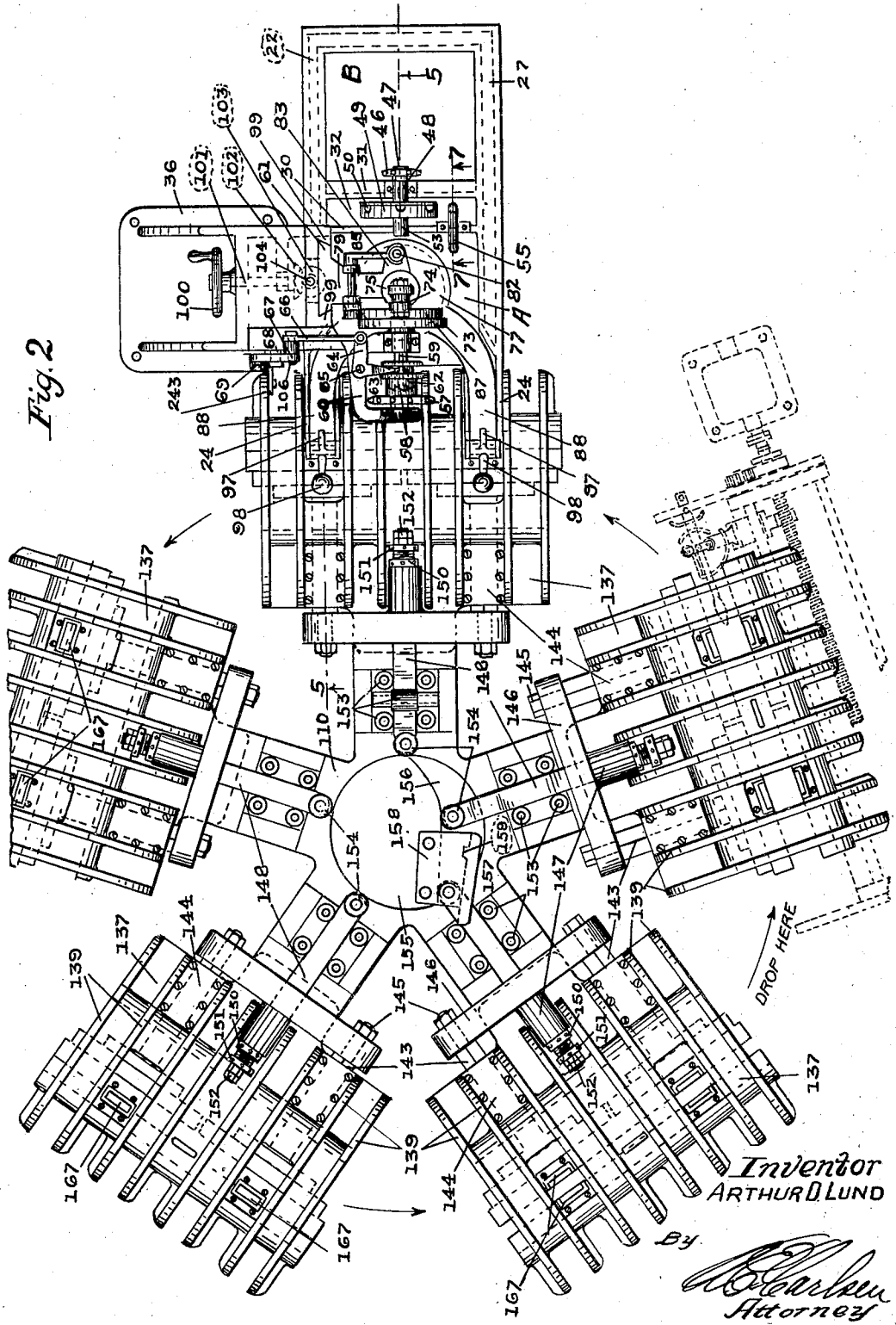
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Fig. 2



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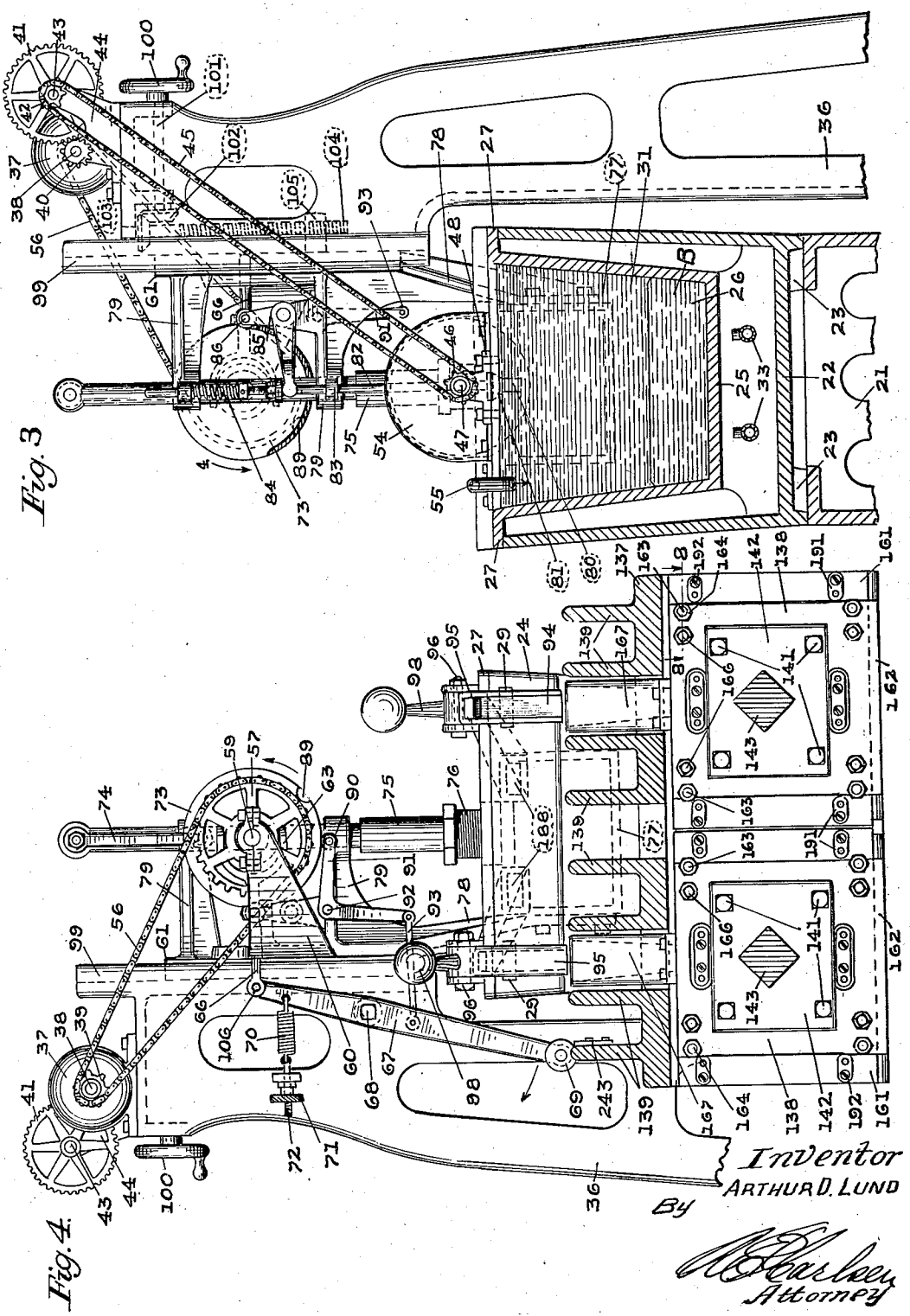


Fig. 3

Fig. 4

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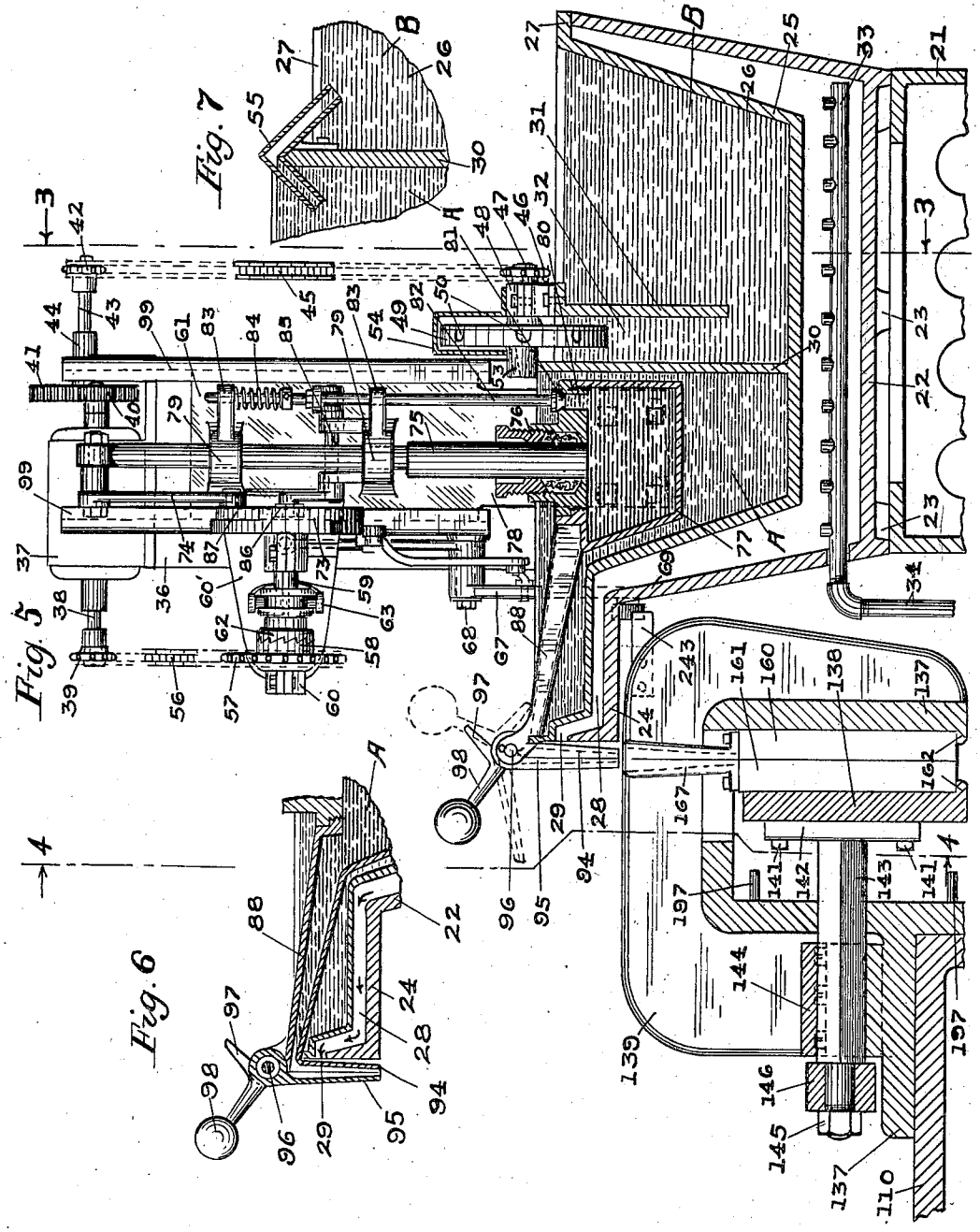


Fig. 7

Fig. 5

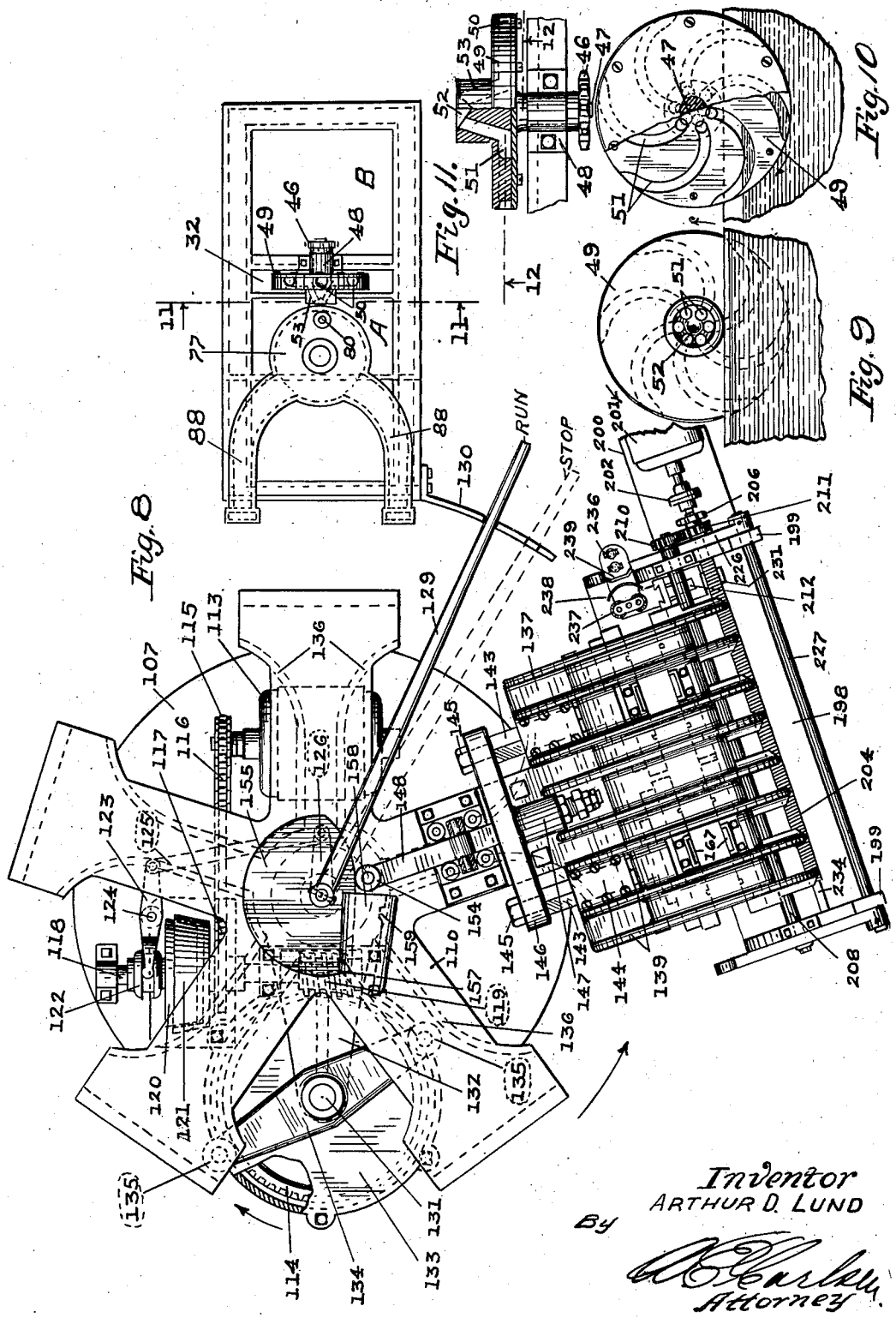
Fig. 6

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Patented Feb. 18, 1930 1,747,552

UNITED STATES PATENT OFFICE

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GRID-CASTING MACHINE

Application filed August 17, 1927. Serial No. 213,575.

This invention relates to casting machinery and the primary object is to provide a machine which is especially designed for the purpose of casting battery grids; which is practical and efficient, in construction and operation, when compared with methods and means heretofore employed for this purpose; and which will produce large quantities of grids in a limited space of time, thus cheapening the cost of producing completed and marketable grids. A further object is to provide an improved type of die or mold carrier, and means for operating the same. Another object is to provide a highly novel and efficient construction of lead melting and feeding mechanism, and means for synchronously actuating the same in conjunction with the mold carrier. Still further and more specific objects will be disclosed in the course of the following specification, reference being had to the accompanying drawings, wherein:

Fig. 1 is a sectional elevation of the machine, as seen substantially on a central longitudinal plane therethrough, and with some parts in full and others removed, for purpose of illustration.

Fig. 2 is a plan view of the machine, with some parts broken away.

Fig. 3 is a sectional elevation of the machine, as on the line 3—3 in Fig. 5.

Fig. 4 is a sectional elevation of the machine, as on the irregular line 4—4 in Fig. 5.

Fig. 5 is an enlarged sectional elevation about as on the line 5—5 in Fig. 2.

Fig. 6 is a detail sectional view of the preferred form of nozzle construction.

Fig. 7 is an enlarged detail section on the line 7—7 in Fig. 2.

Fig. 8 is a skeleton plan view of the machine with various parts removed, for the purpose of illustrating certain substructure, and which also shows the application of the die smoking device.

Fig. 9 is an enlarged detail section on the line 11—11 in Fig. 8.

Fig. 10 is a detail elevation, similar to Fig. 9, but as seen from the opposite side, and partly in section as on the line 12—12 in Fig. 11.

Fig. 11 is a plan view of the device substantially as seen, from above in Fig. 10.

The drawings will now be described in detail by reference characters, like characters designating like parts throughout the various views.

Referring first to Figs. 1, 2, 3, 4, 5, 6 and 8, wherein are shown the lead receptacles and melting unit, 21 designates a base or frame, preferably of cast metal, and which supports a large outer receptacle 22, also preferably of cast metal, having short legs or feet 23, and a shallow extension 24. A receptacle 25, for holding the molten lead 26, is spaced within the receptacle 22, and has a flange 27 which rests upon the upper edge of the latter. The receptacle 25 also has an extension, similar to 24, and spaced therefrom so as to form a flue 28 therewith, said flue terminating in escape holes 29. The receptacle 25 is further provided with an integral partition 30, which completely divides it into two chambers A and B, while a second integral partition 31, extending partway down into the chamber B creates a separate well 32. The receptacle 25, as a whole, is heated by any suitable means, such as a gas burner 33. which is spaced between the receptacles 22 and 25, and is supplied with fuel as by a pipe 34 having a valve 35. The heat from this burner will entirely surround the receptacle 25, thus melting the lead therein and keeping it in a fluid state, and as this heat escapes through the restricted flue 28 it will also keep the lead in the extension of 25 hot.

Consideration will now be given to the lead feeding and handling unit, which conveys the lead from the melter and feeds it into the molds, later to be described. This unit comprises, in part, a tall and relatively heavy frame or standard 36. This standard is not moved with respect to the base frame 21, and may, if desired, be cast integral therewith, but for convenience in manufacture may be made separate, as shown. Upon the top of the standard 36 we mount a motor 37, having a shaft 38, which at one end is provided with a sprocket pinion 39, which in turn operates the primary feeding mechanism. The other end of the shaft 38 has

a pinion 40 meshing with a gear 41, which, with a sprocket pinion 42 is keyed, or otherwise suitably secured, to a shaft 43 journaled in a bearing 44 on the standard 36.

The pinion 42 is connected by a sprocket chain 45 to a pinion 46 which is carried on and rotates a short stub shaft 47 journaled to rotate in a bearing 48 mounted on the partition 31. The other end of the shaft carries a feed wheel 49 the purpose of which is to feed or convey the molten lead from the well 32 into the chamber A. To this end the wheel 49 is so mounted that a considerable lower portion of it is submerged in the metal of the well, and its peripheral surface is provided with a series of orifices 50 which are the terminals of radially curved passageways 51, all of which converge to a common center or recess 52 in the end of the hub 53 of the wheel. It will thus be seen that as the wheel 49 is rotated by the motor 37, through the mechanism 38, 40, 41, 43, 42, 45, 46, 47, the channels 51 will each pick up a limited amount of molten lead and conduct it to the end of the hub 53, and as this hub extends well over the partition 30 the lead will be dropped into the chamber A. In order to preserve the temperature of the lead thus being transferred, as much as possible, and also for the purpose of keeping out foreign matter, I provide it with a guard or case 54, as shown in Figs. 3 and 5. It may also here be noted that the primary function of the partition wall 31 is to keep the sludge and dross away from the wheel 49 and thus also prevent it from getting into the molds. The crude or raw lead is of course dumped into the vat B, and as it becomes heated the dross can be skimmed off from the exposed surface of the metal in the chamber B, but such foreign matter need never get into the well 32 at all as long as the normal lead level is kept above the lower edge of the partition 31. Carried by the partition 30 is a gooseneck or elbow 55 (see Figs. 2, 3 and 7) which is so arranged that it will return the lead from the chamber A to the chamber B, when it reaches a certain level in the former. As this member 55 is tubular it will be seen that the restricted passage thus formed will not permit the atmosphere to cool the returning lead stream. As the wheel 49 is continuously revolving it will, of course, continually feed lead into the chamber A, but this chamber will not overflow even if the lead is not normally removed by the feeding mechanism at the same rate, because of the escape or return permitted by the duct 55. Thus we are enabled to retain the lead in chamber A at a constant, predetermined level, the importance of which will be explained hereinafter.

The sprocket pinion 39, through a sprocket chain 56, drives the sprocket gear 57, of a clutch hub 58, rotatably carried on a shaft 59. This shaft is journaled in a bearing extension or bracket arm 60 of a slide plate 61, and has a clutch hub 62 which is splined on the shaft for selective engagement and disengagement with the clutch hub 58. Thus when the clutch 58, 62 is locked or closed the chain 56 will drive the shaft 59, and when the clutch is open, then the clutch hub 58 will merely rotate on the shaft 59. The clutch hub 62 is reciprocated by a fork arm 63 of a bell crank lever 64 which is pivoted, as at 65 to the bracket arm 60', and which is connected by a link 66 to the upper end of a tripper lever 67, pivoted as at 68 to the standard 36. The lower end of the lever 67 has a roller 69 which is engaged and actuated by the mold carrying turret, later to be described. It may here be noted that a spring 70 (see Fig. 4) the tension of which may be adjusted by a nut 71 engaging a spring bolt 72, normally holds the clutch 58, 62 out of engagement, and the roller end of the lever 67 in an initial position with respect to the advancing turret sections.

The inner end of the shaft 59 has a wheel 73, connected by a connecting rod 74 to the upper end of a plunger 75, the lower end of which operates in a packing box 76 of a pot 77. This pot is rigidly carried on a depending, integral extension 78 of the slide plate 61. The plunger or piston 75 guides in a pair of lugs 79 which are also integral with the slide plate 61.

The pot 77 is normally submerged in the lead of the chamber A, and the lead is conducted into the pot through a port 80 closed by the valve head 81 of a valve stem 82. This valve stem 82 is slidable in extension bearings 83 of the lugs 79, and a spring 84 tends to keep the valve yieldingly closed. The valve is opened, to admit the molten lead, by the forked end of a bell-crank-lever 85, pivotally carried by the lower lug 79, and the other end of the lever has a roller 86 which constantly travels on the peripheral surface of the wheel 73. This surface has an arcuate or peripheral recess 87, into which the roller 86 drops, under the action of spring 84. Thus, as the wheel 73 rotates it will have a cam acting influence on the rocker lever 85, and by so doing will effect an intermittent opening and closing of the valve port 80. The parts are so co-ordinated that the valve 80 will be closed while the piston 75 moves downward, and will be opened during the greater part of the upward travel of the piston. The valve does not open, however, until the piston has first started to move upwardly, the object being to cause the piston to first exert a slight suction, and thereby partly clear the mold filling spouts 88, to prevent dripping while the molds are being moved away, before the pot is again permitted to fill.

In one edge of the peripheral surface of

the wheel 73, not engageable by the roller 86, is a notch 89 (see Figs. 3 and 4), adapted to receive a roller 90 (which travels on the circular periphery), carried at the end of a bell crank lever 91, which is pivoted, as at 92, to the lower lug 79, and is connected by a link 93 to the lever 67, below the pivot bolt 68. The roller 90 by engaging the notch 89 serves to check the momentum of the wheel 73, and acts as a stop therefor during the turret moving action. When the next empty mold is brought into filling position the action upon the roller 69 (to the left, as in Fig. 4) causes the lever 67, by pulling on the link 93, to disengage the roller 90 from the notch 89, thus leaving the wheel 73 free to rotate. This same action, by the lever 67, causes the clutch 58, 62 to close, thus setting the lead feeding mechanism in operation.

The inclined lead conducting spouts 88 are filled with the lead disharged from the pot 77 by the displacement piston 75, and are so arranged that they will, when in operation, be practically submerged in and surrounded by the hot lead in the extension neck of the chamber A. Thus the spouts 88, and the lead within them, will not be permitted to cool, but will always be kept hot enough so that the lead will freely pour into the molds. The discharge ends of the spouts 88 are provided with downwardly directed beaks, each of which comprises an inner, integral member 94 and an outer complementing member 95, which is pivoted, as at 96, so that it can be lifted up, when necessary, to permit access to the interior of the spout for cleaning purposes. A horn 97 is integral with and serves as a stop for the member 95 when the latter is swung open, while a weighted arm 98, serves to hold the beak member 95 down in its closed position. In Fig. 4, of the drawings, the beak at the left is shown as closed, while the one at the right is shown as open.

The entire mechanism thus far described as being carried by the plate extensions and lugs 78, 60, 79 and 83, is supported by the plate 61, and this plate is dovetailed into, and vertically movable in a race formed by a pair of integral rails 99 of the standard 36. The carriage or plate 61 is vertically adjusted by a hand wheel 100, mounted on one end of a horizontally journaled shaft 101, having a bevel pinion 102 which meshes with the bevel pinion 103 of a vertically disposed screw 104, which, in turn is threaded in a rear lug 105 of the carriage plate 61. Thus when the wheel 100 is turned it will cause the lug 105 and the plate 61, which it supports, to travel up and down as may be desired. When the carriage is down, it is in its operating position, and the chain 56 is sufficiently taut to be operative, but when the carriage is moved up, which is done when the machine is to be left idle for some time, so as to get the pot 77 out of the chamber A, then the chain 56 will be greatly slackened. In order to permit a free lift of the carriage it is also necessary to temporarily remove the bolt or pin 106 (Figs. 2 and 4) which connects the members 66 and 67, and when this is done the lever 67 has sufficient freedom for movement so that it is probably unnecessary to disconnect any of the parts 91—93, 67, but one of the pivot pins in such mechanism may easily be temporarily removed, if necessary.

Having described the lead melting and feeding mechanism, attention is now called to the grid dies, and the mold carrying unit, as disclosed in Figs. 1, 2, 4, 5, 8, and 9.

Spaced at a proper distance from the stand 21, and also resting on the floor, is a relatively broad base 107 having an integral, centrally arranged post or standard 108, the upper end of which is reduced to form an arbor or trunnion 109 for a large turret 110. This turret is preferably mounted to rotate on roller bearings 111, carried on a shoulder 112 of the standard (see Fig. 1). The turret has a number (in the present case, five) of radial arms, each of which carries a grid molding unit.

In order that the turret may be properly started, moved, and stopped, in coordination with the operation of the lead feeding mechanism (above described), it is necessary that the mold units be successively brought into receiving position with respect to the filler beaks 94—95, held stationary while the lead is being poured, and then be advanced to make room for the next empty mold unit. In other words it becomes necessary to convert the continuous rotary motion of a power motor 113, into an intermittent rotary motion of the turret. This I accomplish, as follows:

The motor 113 (see Figs. 1 and 8) is mounted on the base 107, and drives a worm wheel 114, through the medium of a sprocket pinion 115, a sprocket chain 116, and a sprocket gear 117 which drives a shaft 118 having a worm 119 meshing with the worm gear 114. A driving connection between the shaft 118 and the gear 117 consists of a friction clutch having a male member 120, splined on the shaft 118, and a female member 121 driven by the sprocket gear 117. The clutch member 120 has a peripherally grooved collar 122, engaged by a shipper lever 123, pivoted as at 124, and connected by a link rod 125 to a crank arm 126 of a vertical shaft 127, which extends up through and is journaled in suitable bearing extensions 128 of the post 108. The upper end of the shaft 127 is provided with a hand lever 129, which may rest in either of two positions on a bracket arm 130, carried by the melting and feeding unit. When the arm 129 is in one of these positions the clutch 120—121 is closed, so that the motor 113 will drive the worm gear 114, and when in its other position, the clutch is open and the gear 114 is idle even though the motor is running. The gear 114 is fixed on a shaft 131, journaled in bearings

132, of the standard 108; and the worm members 114 and 119 are preferably inclosed in a housing 133 which may contain a lubricant and also covers the members 114 and 119, as a safety measure. The upper end of the shaft 131 is provided with a cross head lever 134, having rollers 135, at its ends, for operating engagement with flanges 136, depending from the turret arms. The inner end portions of these flanges 136 are substantially radial, with the post 108 as a center, but the outer ends of each pair of these flanges diverge, and are curved in arcs, the arcs of two opposed flange sections being concentric and having radii which are common to the operating radius of the cross head 134, whereby the roller 135 can roll on two opposite flange arcs, and when so moving will not rotate the turret at all. It is during this motion or time that the mold filling operation takes place. But as the cross head 134 continues to rotate (in a direction contrary to the direction of movement of the turret) the outwardly moving roller 135 disengages the flange arc it has been in contact with, while the inwardly moving roller meets the straight section of the flange it engages, and starts to move the turret. As the last mentioned roller approaches the center of the turret, the other roller swings out and then in to engage the near flange of the next advancing turret arm (as in Fig. 8), at which time the first flange has moved out to the arc section of the preceding turret arm, and the turret is again stationary for another interval of time. This operation continues as long as the machine is functioning.

The outer end of each turret arm carries a vise, consisting of an outer jaw 137 and an inner jaw 138. The jaw 137 is substantially U-shaped, in cross section (Figs. 1 and 5) and is inverted so as to open downwardly. It is also heavily ribbed, as at 139, primarily to give the strength required. Its inner end rests on and is secured to the turret arm by bolts 140. The inner jaw 138 of each vise, is integrally formed with or secured by bolts 141, to a plate 142, which, in turn, is carried at the outer ends of a pair of shafts 143. As shown in Fig. 4, there are in reality two members 138 and 142 for each inner jaw but as they operate in unison they are here considered as unit members. The shafts or bars 143 are preferably square, in cross section, and extend through the inner jaw legs of 138, and also through guides or bearings 144, carried on the jaw members 137. The inner ends, i. e., the ends of the bars 143 nearest the post 108, are secured, as at 145, in the ends of cross bars 146, each of which has a center bearing extension 147 (see especially Fig. 9).

A rod 148 extends into each of the members 146—147 and is mounted for a limited reciprocating movement therein, such movement being limited by a spring 149, in 147, and the tension of this spring is adjusted, as may be found necessary, by an adjusting nut 150, the position of which is locked by a lock nut 151. The bar or rod 148 is retained against retraction, by suitable nuts 152. The object of the spring 149 is to absorb and lend a slightly yielding response to the closing action of the molds, and also to insure their complete closing, thus taking up any play that might otherwise permit an uneven closing or a slight opening which would, of course, be fatal to the production of usable grids.

The rods 148 extend between series of vertical and horizontal rollers 153, carried on the turret arms, and are thus firmly held so that they can move longitudinally only. The inner ends of the rods 148 are provided with rollers 154 which guide against the periphery of a head 155 on the post 108. Said periphery is arc shaped, in part, and is recessed or cam shaped, in part, so that the vises will be closed from the time they leave the mold filling mechanism until they successively come into the position of the vise at the lower left hand corner, as shown in Fig. 2. As the turret continues to revolve, the rollers 154 then drop into the recess 156, and as they do so they also strike the flanges 157 of a pair of guide plates 158, secured on the head 155. These flanges serve to pull in the rods 148, and thus insure the separation of the molds so that the grids may drop out, and to assist in this separation it is found desirable to provide the flanges with bosses 159 which tend to give a quicker or grid releasing action to the bars 148 as will later be noted. As each of the rollers 154 leaves the member 158, and the grids have been dropped, it begins an outward movement which continues until the vise which it operates reaches its closed or filling position at the mold filling unit.

The grid molds 160 and 161 are respectively carried by the vise jaws 137 and 138, and are positioned and held, in part, by opposed lips 162 at the lower ends of the jaws proper, as in Figs. 1, 4 and 5. The mold members 161 are further secured by bolts 163 (Figs. 4 and 8) which are anchored in the molds, but have adjusting nuts 164 by which they may be regulated so as to give them a trifle of freedom for play, and which play is compensated for or taken up by cushioning springs 165 which are regulated, as to tension, by bolts 166.

Each vise carries two sets of molds 160—161, each of which has a funnel 167, and the two funnels of each unit are so spaced that they will stop in receiving positions directly below the filler beaks 94—95, as shown in Fig. 4. The funnels project up through suitable apertures between the ribs 139, and are vertically divisible so that each half is carried by a corresponding mold section (160—161) and moves with it.

From the foregoing description and explanation it will be seen that with a sufficient

amount of lead melted up in the pots A and B, the motor 37 is energized, thus giving a conitnuous rotary motion to the feed wheel 49, with a result that the metal level in the chamber A is always retained at a constant predetermined level. It may here be noted that this level is above the chamber 77, but is below the top of the packing box 76, with a result that no part of the surface of the piston 73 can alternately contact with the lead at one moment and with the atmosphere at the next moment. This is an important feature, because of the fact that under such circumstances it is impossible for the piston to accumulate a litharge coating, as results in a pump structure otherwise constructed. When the motor 113 is now started an intermittent rotary motion is imparted to the turret 110 and as the turret 110 and as the mold carrying arms of the turret approach the feeding mechanism the molds thereof close together and the roller 69 is engaged to close the clutch 58 which in turn starts the feed mechanism in motion to inject charges of lead into the empty molds. The necessary interval of time for this operation having elapsed, the turret turns another fifth of a rotation, whereupon the succeeding molds are successively filled. As soon as the grid plates have sufficiently cooled the molds of each arm open, under the action of the cam acting members 157, thus releasing the completed grid plates, whereupon the molds are successively cleaned and smoked while each preceding mold is again being filled, in the manner hereinabove described.

From the foregoing description of the machine and its operation it is believed that the construction, advantages and merits of this invention will be apparent, especially to those skilled in the art to which the invention pertains. It is understood, however, that suitable modifications may be made in the general design and structural details of the invention as herein disclosed, provided, however, that such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described my invention, what I claim to be new is:

1. A molten metal-feeding mechanism comprising, a pot adapted to confine a predetermined amount of molten metal, a plunger adapted to reciprocate in the pot and upon an inward movement to displace a predetermined amount of metal, means for actuating the piston, a valve in the pot to admit metal thereto for replenishing the pot to compensate for the metal previously displaced, and means independent of the piston and connected with the piston actuating means to open the valve at predetermined intervals.

2. In a machine of the character described, a primary chamber in which the metal is melted, a second chamber adjacent the primary chamber and adapted to be heated together therewith, means for transferring molten metal from the primary chamber to the second chamber, a pot contained within the second chamber for receiving metal therefrom, and means for delivering the metal from the pot.

3. In a casting machine, a primary chamber in which the metal is melted, a second chamber adjacent the primary chamber and adapted to be heated together therewith, means for transferring molten metal from the primary chamber to the second chamber, a feed pot contained within the second chamber for receiving metal therefrom, and means for maintaining the metal in the second chamber at a constant predetermined level.

4. In a casting machine a metal feeding mechanism comprising a chamber for containing molten metal, a pot arranged within the chamber so as to be submerged in the metal, a spout leading from said pot, means for displacing a predetermined amount of metal in the pot whereby the overflow will be conducted to the spout, and a mechanism incorporated in the machine for lifting said pot and metal displacing means from the chamber and for replacing them in predetermined positions in the chamber.

5. In a molten metal feeding mechanism, a pot adapted to confine a predetermined amount of molten metal, a spout extending from the pot, a valve to admit metal to the pot, a piston adapted to move in and out of the pot and upon an inward stroke to displace a predetermined amount of metal therein whereby such displaced metal may be conducted out through the spout, and positively actuated means, operatively associated with the piston, and rendered operative at a predetermined interval after the piston has started its outward stroke, to open the valve, whereby a slight retraction of the metal in the spout will be effected by the piston prior to refilling of the pot through the valve.

6. In a molten metal feeding mechanism, a chamber for containing the molten metal, a pot arranged within the chamber below the normal metal level thereof and having a spout through which the metal is to be fed, a piston operative to reciprocate in the pot to displace metal therein which metal is then conducted out through the spout, a valve in the pot through which the metal from the chamber may be run into the pot, and means, independent of the piston, but positively actuated in co-operation therewith, for opening the valve at a brief interval immediately after the piston starts to move outwardly, whereby to effect a slight retraction of the metal in the spout by the piston.

7. In a casting machine, a metal melting chamber, a metal feeding mechanism, including a feed pot adapted to be submerged in the metal in the chamber, and a mechanism forming a part of the machine for lifting the pot out of the chamber and for replacing the pot

in a predetermined position in the chamber.

8. In a casting machine, a metal melting chamber, a metal feeding mechanism, including a feed pot adapted to be submerged in the metal in the chamber, and means incorporated in the machine for raising the entire feeding mechanism to lift the pot out of the molten metal and for replacing the pot in a predetermined position in the chamber.

9. In a casting machine a metal and feeding mechanism comprising a furnace, a melting chamber depending into the furnace and having its walls spaced therefrom, said furnace having an elevated shallow portion, and said chamber having a reduced portion extending over but spaced from said shallow portion, and a feed pot in the chamber having a spout positioned in said reduced chamber portion.

10. In a casting machine, a metal melting and feed mechanism comprising a chamber in which the metal is melted, a pot in the chamber, a discharge spout extending from the pot in a goose neck extension over the edge of the chamber, means for forcing metal from the pot into and out through the spout, said spout having an openable section whereby the spout and its extension may be cleaned.

In testimony whereof I affix my signature.

ARTHUR D. LUND.