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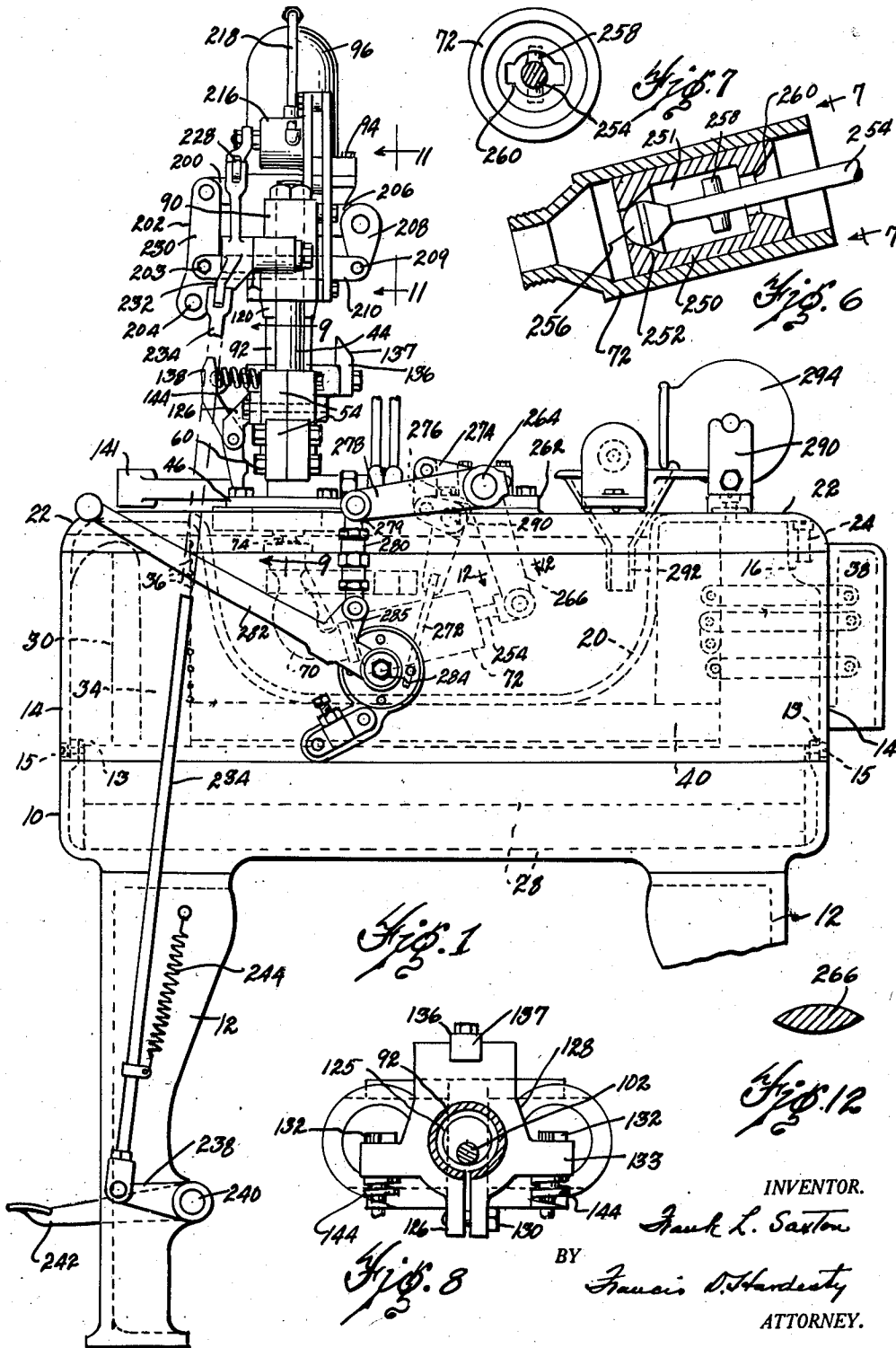
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1,769,394

BABBITTING MACHINE

Filed April 20, 1928

4 Sheets-Sheet 1



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BABBITTING MACHINE

4 Sheets-Sheet 2



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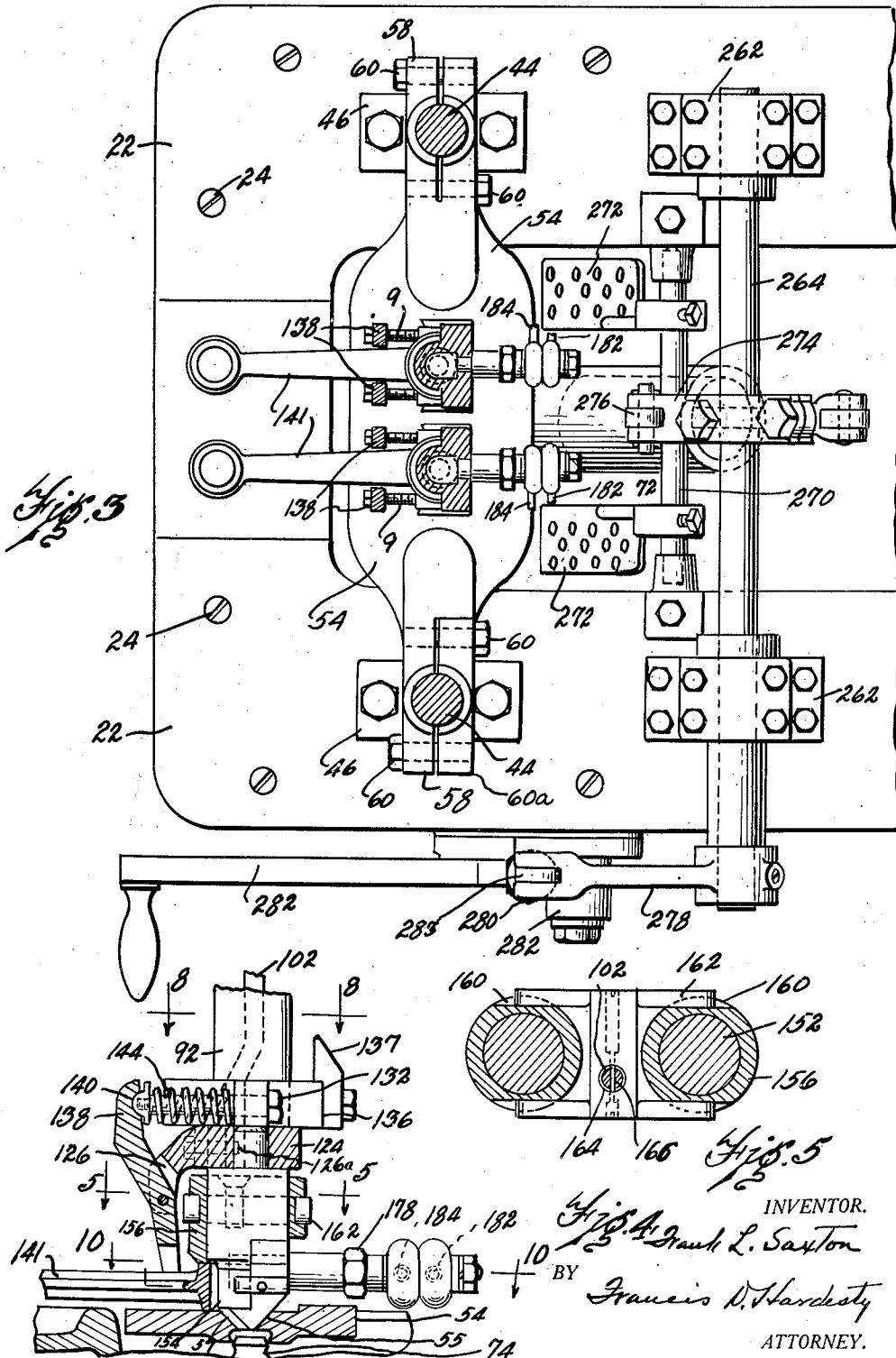
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BABBITTING MACHINE

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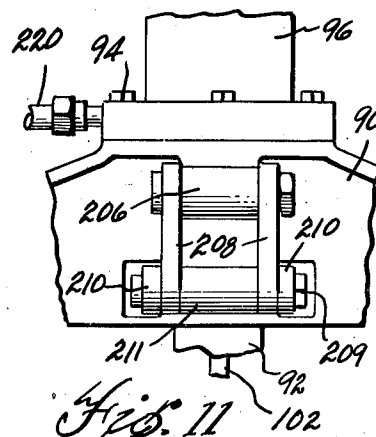
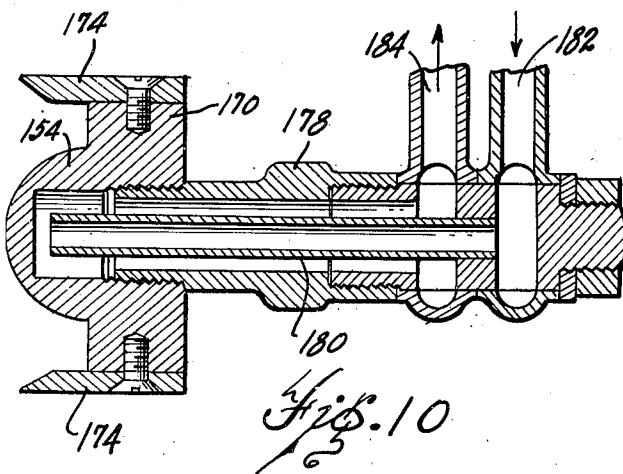
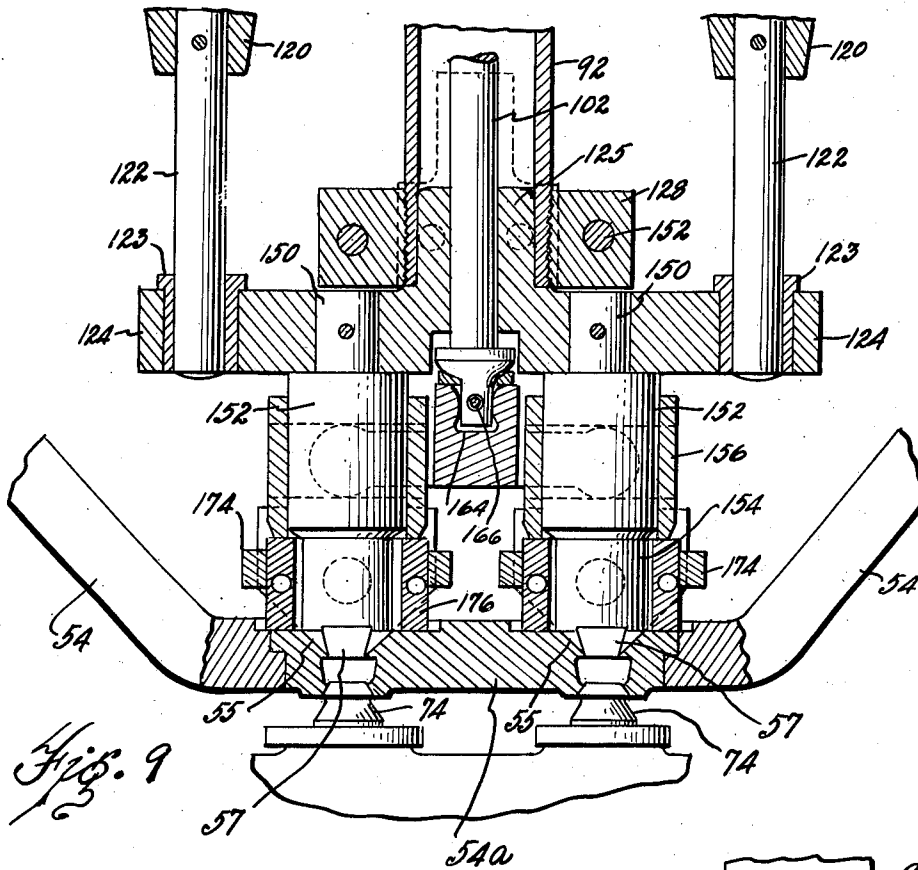
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4 Sheets-Sheet 4



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## UNITED STATES PATENT OFFICE

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## BABBITTING MACHINE

Application filed April 20, 1928. Serial No. 271,437.

This invention relates to die-casting and has to do with a machine which may be used for babbitting crankshaft and connecting rod bearings and for performing similar operations.

One conventional machine which is now used for performing this operation comprises a heated receptacle for the casting metal and a pump provided with a nozzle. A lower die member registers with the nozzle, and an upper die member is movable to register with the lower and to hold between the two an article on which a casting is to be formed. My invention has to do with improvements in this type of apparatus.

It is an object of the invention to provide an apparatus of this character which will be kept thoroughly heated during operation so that there will be no hardening of part of the alloy and the consequent partial separation of the constituent metals. It is a further object of the invention to arrange the nozzles and dies nearer the surface of the melted metal than has heretofore been practicable. With this arrangement the path of flow is very short, and the nozzle is kept sufficiently hot to prevent the metal freezing on it.

One of the particular advantages of the present construction is the lack of disturbance of the surface of the molten metal. This feature reduces oxidation and the formation of dross on the surface of the pot.

It is an object of the invention to provide an apparatus in which the movable parts of the die will be cushioned during their operation.

It is a further object of the invention to provide improved clamping means for the articles on which the casting is formed. The invention contemplates an apparatus with which one or more castings are formed in one operation and in which the movable die member and clamps for the articles worked upon are operated by fluid pressure, such as air pressure, and in which the pressure is applied separately to hold each in its position. With this construction, the clamps and the die member are each assured sufficient pressure even if the parts should become worn or slightly out of alignment.

A further advantage of the construction resides in an improved and simplified pumping mechanism which will operate effectively without drawing in air bubbles and without unnecessary disturbance of the surface of the casting metal.

Other objects and advantages of the invention will appear in the course of the following description, taken in connection with the accompanying drawings and appended claims.

In the drawings:—

Figure 1 is a side elevation of my improved apparatus;

Figure 2 is a front end view, with parts broken away;

Figure 3 is a section on the line 3—3 of Figure 2;

Figure 4 is a section on the line 4—4 of Figure 2;

Figure 5 is a section on the line 5—5 of Figure 4;

Figure 6 is a longitudinal section through the pump cylinder and piston;

Figure 7 is an end view of the pump cylinder and piston, taken as indicated by the line 7—7 of Figure 6;

Figure 8 is a section on the line 8—8 of Figure 4;

Figure 9 is a section on the line 9—9 of Figure 1;

Figure 10 is a section on the line 10—10 of Figure 4;

Figure 11 is a rear view of a portion of the beam and associated parts, taken as indicated by the line 11—11 in Figure 1;

Figure 12 is a section on the line 12—12 of Figure 1.

Referring to the drawings, I have illustrated in Figure 1 a support comprising a substantially rectangular pan 10 supported on four legs 12. The pan 10 is formed with lugs 13 positioned to center the substantially rectangular side wall casting 14 fixed in position by means of stud bolts 15 extending through the sides of the casting 14 into the lugs 13. Within the side walls is a receptacle 20 formed with an integral flange 22 which fits over and rests upon the side wall casting 14. Bosses 16 are formed on the inner side of the side wall casting 14 and are re-

cessed to receive screws 24 extending through flange 22.

Within the pan 10 are two layers 28 of insulating material, such as silocell. Similar vertically disposed layers 30 of insulating material rest on layers 28 just within the side walls. Resting on top of insulation 28 is a ring 40 yoke shaped in cross section, of heat resistant alloy metal, adapted to receive the electrical insulating supports 34 for the heating units 36. The latter may be the conventional flexible resistance element or elements and it is preferred to make the supports 34 of suitably notched vertically arranged wedge or segment shaped pieces seated in yoke 40.

The heating unit extends from the ring 40 up to the flange 22 of the receptacle, and is provided with the usual terminals protected by a cover 38 on the outer side of the side wall 14.

Supported on the flange 22 on opposite sides of the receptacle and adjacent the front end are two vertical columns or pillars 44 formed on their lower ends with feet 46 bolted to flange 22. Supported on columns 44 is the lower die carrier consisting of the casting 54 and the die plate 54<sup>a</sup>, the member 54 being formed with bifurcated ends 58 fitting the pillars 44. On each end 58 on the lower die plate are clamping screws 60 for holding a removable cap provided to allow quick removal of the carrier casting 54. The lower end of each column 44 is hollow as at 62 and within this hollow portion is a coil spring 64. The upper end of the hollow portion 62 is formed with vertical slots 68 for receiving a pin 66 fixed in the end 58 of the die carrier. With this construction, the coil springs normally hold the lower die member in its upper position. Two openings 55 are provided in the lower die member 54<sup>a</sup> and are tapered on the upper side of the plate for receiving the cores of the upper die member, described below.

Supported on the reduced upper ends of columns 44 is a supporting beam 90 held in position by nuts 50. Beam 90 is formed with a vertically disposed bearing in which is slidable a hollow ram 92 on the upper end of which is fixed a piston 98. Piston 98 is adapted to reciprocate in a cylinder 96 on the upper side of beam 90 and fixed thereto by stud bolts 94.

Within the hollow ram 92 is a rod 102 which is reduced at its upper end for carrying a washer 112, sleeve 114 and a plunger 106 comprising leather washers 106<sup>a</sup> held between metal washers, the parts being held on rod 102 by nut 110. The plunger 106 is adapted to reciprocate a limited distance in a cylindrical recess 107 in the upper part of piston 98. Piston 98 is formed with a conduit 99 extending from the lower side up into the recess 107 so that air pressure ap-

plied to either side of piston 98 will be applied directly to the corresponding side of the plunger 106.

The lower end of ram 92 is preferably split and threaded on its outside coating with split bracket 128 by means of which there is fixed therewithin a boss 125 of an upper die-carrying plate 124 which is provided with a vertically disposed bearing 123 at each end for receiving a guide shaft 122 rigidly fixed within a recess extending through a boss 120 on the under side of beam 90. The split bracket 128 surrounds ram 92 just above the plate 124 and is substantially star-shaped (see Figure 8). The split ends of member 128 are drawn together by means of stud bolt 130, the lower end of ram 92 being split so that tightening of bolt 130 causes the ram to grip the boss 125 tightly. Stud bolts 132 are slidably mounted in ears 133 on the sides of the brackets 128 and carry the coil springs 144 between said ears and rounded caps 140, the rounded heads of which fit in spherical seats in the upper ends of clamps 138 which are pivoted intermediate their ends in the downward extending ears 126, secured in a suitable fashion as by screws 126<sup>a</sup> to die-carrying plate 124.

Each clamp 138 is forked at its lower end for extending over a work piece 141, which in the illustrated embodiment is a connecting rod, and carries on its lower end two screws 9 which may be adjusted to permit the clamp to center the connecting rod accurately on the core. If desired, interchangeable clamps 138 of slightly different form for other shapes of work pieces may be used. On the side opposite the clamping arms 126 the bracket 128 carries a lug 136 having an inclined cam surface 137.

Fixed to the plate 124 (see Figure 9) on each side of the center is a downward extending plunger having a reduced upper end 150 fitting within and rigidly pinned to the plate 124, an enlarged central portion 152 and a core 154. Each core 154, as illustrated in Figure 10, is formed with side portions 170 to each of which is fixed a centering finger 174. The lower end of each core is tapered to fit within the opening 55 in plate 54<sup>a</sup>, and is formed on its tapered end with a recess 57 for connecting the nozzle 74 with the space in front of the core. The core 154 and work 141 fit against the upper surface of plate 54<sup>a</sup> to form the die.

The core 154 is hollow as illustrated and has threaded therein a fitting 178 carrying an inner pipe 180 connected with an inlet opening 182, and provided with an outlet opening 184. The usual flexible couplings may be connected with the openings 182 and 184 for maintaining a constant flow of cooling fluid through the core during operation of the machine.

Surrounding each central portion 152 (see

Figure 4) of the plunger and vertically slidable thereon is a sleeve 156 provided on opposite sides with grooves 160. Fitting in each groove is an enlarged rounded end of an H-shaped evenner 162 which is formed on its upper side with a recess 164 into which extends the rounded lower end of rod 102, it being noted that rod 102 is offset forwardly at its lower end, as indicated in Figures 4 and 5. A transverse pivot pin 166 is fixed in the central portion of evenner 162 and extends through an opening in the lower end of rod 102, this construction permitting the evenner to rock a limited distance on the lower end of the rod.

Within the receptacle 20 is a manifold 70 which is provided at its upper end with nozzles 74 which are slightly spaced from the lower part of openings 55 in plate 54<sup>a</sup> when the latter is in its normal raised position. Formed integrally with manifold 70 is an apertured ear 76 resting on a shelf or bracket 78 integral with the side wall of the receptacle 20. Ear 76 is formed with an upwardly extending boss 80 so that the nut 82 on the upper end of the bolt 81 extending up through shelf 78 and ear 76 will be above the level of the melted metal.

Rigidly fixed in the lower end of the manifold 70 is a cylinder 72 extending rearward and slightly upward. Slidable in the cylinder 72 is a piston 250 formed with a central recess 251. The recess 251 is open at both ends, the forward opening forming a tapered valve seat 252, and the rear opening being formed with slots 260.

Within the recess 251 is extended a portion of a pitman rod 254, the forward end 256 being rounded to fit the valve seat 252. Lugs 258 on opposite sides of rod 254 serve to contact the rear wall of the recess 251, the slotted opening 260 permitting entrance of the end of the pitman rod 254 which is held, in operating position, with lugs 258 out of register with slots 260, as shown in Figure 7. This construction permits limited reciprocation of the end of rod 254 within the piston and thereby allows reloading the cylinder after each discharge.

Mounted in bearings 262 on the receptacle flange 22 is a shaft 264 having fixed thereto a downward extending arm 266 pivotally connected at its lower end with the rear end of the pitman rod 254. The arm 266 is stream-lined, as indicated in Figure 12, to prevent rapid stirring of the metal and the drawing in of air bubbles. A small counter shaft 270 is rockably supported just ahead of shaft 264 and carries arms provided with perforated paddles 272 extending down into the receptacle 20. The arms carrying the paddles are streamlined similar to arm 266. An arm 274 is fixed to shaft 264 and is connected by means of a link 276 with an arm 274 on shaft 264. A stub shaft 284 is fixed

on the outer side of side wall 14 and carries an operating lever 282 having a short arm 283 to which is pivotally connected a link 280, pivoted at its opposite end to an arm 278 on shaft 264. With this construction, movement of lever 282 causes reciprocation of piston 250 within cylinder 72 and also fore and aft movement of the agitating paddles 272.

The stub shaft 284, lever 282, arms 283 and link 280 comprise a toggle for operating the arm 278 fixed on the shaft 264. By reference to Figure 1, in which the pitman rod 254 is shown at the end of its working stroke, it will be noted that the pivotal connection of link 280 on arm 283 has almost reached a position in line with the stub shaft 284 and the movable end of link 278. With this construction, the leverage of arm 282 gradually increases from the beginning to the end of the working stroke. This is an important feature of my invention since the molten metal begins to cool and to harden as soon as it passes into the die, and a greater pressure is necessary toward the end of the stroke than at the beginning.

Integral with beam 90 on the forward side is an ear 200 and on the rear side an ear 206. Pivotally mounted on ear 200 is a lever 202 having a fixed cross pin 204 on its lower end. A pivot bolt 203 carrying spacer sleeves 205 is extended through the lever 202 and has pivotally connected at each end the front end of a link 210, the links extending through openings in beam 90 on opposite sides of ram 92. The rear ends of links 210 are pivotally connected to the opposite ends of pin 209 fixed in the lower end of links 208 spaced by sleeve 211. It will be apparent, by reference to Figure 1, that as the ram 92 moves upward, cam surfaces 137 push sleeve 211 to the rear and this motion is transmitted through links 210 to lever 202.

When this movement occurs, the upper ends of the rocker arms 138 are even with pin 204, and rearward movement of the lever 202 causes the pin 204 to rock the upper ends of the clamps 138 rearwardly for releasing the works 141 held against the cores. Downward movement of the core releases the clamping arms and permits them to clamp a work in position against the core.

In Figure 2, I have indicated at 216 a conventional two way valve provided with inlet tube 222 and outlet tube 224 and connected to the upper and lower portions of the cylinder 96 by means of tubes 218 and 220 respectively. The position of the valve may be controlled by means of an arm 226 connected with the movable member of the valve and connected by means of a link 228 with the upper arm 230 of a bell crank lever, the lower arm 232 of which is connected with a link 234. The lower end of link 234 is pivotally connected with the end of an arm 238 mounted on a shaft 240 journaled in leg 12 and pro-

vided with a foot pedal 242. Spring 244 connecting link 234 with leg 12 constantly urges the link 234 upward to a position in which the air will be admitted through tube 220 to the lower portion of the cylinder to force the piston and plunger upward.

The numeral 290 indicates a pair of spaced brackets fixed to the flange 22 on the rear of the machine, and supported over the receptacle adjacent the brackets is the funnel 292. Brackets 290 are grooved on top for supporting the trunnions of a container 294 which may be used to pour melted metal into the receptacle.

The operation of the device is as follows: The receptacle 20 will be filled to the line A with preheated metal which will be maintained at the desired temperature by the heating unit. The piston 98 on the ram 92 will be maintained in raised position by air pressure in the lower part of the cylinder 96. The operator holds the works, which in the present case are the two connecting rods, against the cores, as best illustrated in Figures 3 and 4. He then presses down on pedal 242 and, by reversing valve 216, causes air pressure to be applied through tube 218 to the upper part of piston 98 and plunger 106, thus forcing the piston and plunger downward. As the ram 92 moves downward, the cam surface 137 on lug 136 moves away from sleeve 211 and releases the lever 202, thus permitting springs 144 to push the upper ends of clamps 138 outward, causing the lower end of each clamp to move inward and engage one of the connecting rods 141 and hold it against the respective core. When the lower end of the core fits within the opening 55, each sleeve 156 will be forced down on the upper side of the respective connecting rod, due to the air pressure on plunger 106 on the upper end of rod 102, and this force will be evenly divided between the two sleeves, due to the connection of rod 102 to the H-shaped evener 162. The lower part of shaft 102 is offset forward in order to cause the shaft to press downward on the forward side of the sleeves. The advantage of this arrangement is obvious, since the works are held by the forward half of each sleeve and since the melted metal is forced in through an opening in the forward portion of the die.

During further downward movement of the ram and plate 54<sup>a</sup> to register the openings 55 with nozzles 74, the plate is cushioned by springs 64 in the columns 44. With the connecting rods thus held firmly in position, the operator rocks the lever 282 rearward to move piston rod 254 forward to fit in valve seat 252 and move piston 250 forward, thus pumping metal into the space between the inner surface of the surface of the work and the core. As lever 282 is moved back, the head 256 pulls away from valve seat 252,

thus permitting the piston 250 to be pulled freely through the molten metal without creating suction and drawing in air bubbles. During movement of the pumping mechanism, the paddles 272 are moved by the connection described and serve to keep the metal well mixed and uniform in temperature throughout. The works may then be removed and the operation repeated.

With the apparatus described, the heating unit extends to the rim of the receptacle and keeps the metal well heated. As the nozzles are close to the surface of the casting metal and the dies are moved down to the nozzles, there is a very short path of flow so that the metal will not freeze between the nozzle and dies and completely fill the dies before hardening. This arrangement has caused a material reduction in the percentage of rejected castings. In the operation of the apparatus described, there are certain advantages attained by my improved clamping means for the works. A pivoted clamp 138 presses a work inward against the core, while a clamping sleeve 156 holds the work against vertical movement.

The plunger 106 which moves the rod 102 connected with the evener on the clamping sleeves is operated by air pressure with and independently of the ram and piston which move the cores, the arrangement insuring that sufficient force will be applied to the ram and to each clamping sleeve. The provision of two sets of clamps, which operate automatically, insures that each work will be accurately centered on a core. This is a considerable factor in reducing the percentage of rejected castings.

When the upper die member is moved down to strike the plate 54<sup>a</sup>, the impact is cushioned by the springs in the column 44, and the die members are moved downward against the tension of these springs to register the openings 55 with the nozzles 74. This arrangement reduces noise and wear on the parts. The movement of the plate 54<sup>a</sup> away from the nozzle after the casting is formed prevents hardening of the casting metal in the opening through the plate 54, since any metal which is frozen is removed with the casting and any metal which is not frozen runs back over the nozzle, which is sufficiently near the surface to melt any casting metal which might be on it.

Another feature of the invention resides in the pumping mechanism. The toggle for operating the pump is constructed to give an increasing leverage as the operating lever approaches the end of its working stroke. This is necessary since the metal freezes quickly in the die and greater pressure is required at the end than at the beginning of the working stroke.

The pump is not constructed with the usual valves which might cause a drawing in of air

bubbles, but is provided with piston which moves freely through the metal on its idle stroke without causing any considerable change in the pressure within the cylinder. The pump operating arm is streamlined in order that it may stir the surface as little as possible. The result is that there is very little disturbance of the surface of the metal, this being a very desirable feature, since air mixed with the molten metal will cause oxidation and formation of dross on the surface. The stirring paddle, which is operated in unison with the pump, extends well down within the receptacle and causes the metal to be uniform in temperature throughout.

I claim:—

1. In a die casting apparatus, a receptacle, pumping mechanism supported therein and including a nozzle, a lower die member resiliently supported over said nozzle and movable to register therewith, an upper die member movable to register with said lower die member, means for reciprocating said upper die member, and means for supporting a work in fixed position relative to said die members.

2. In a die casting apparatus, a receptacle for molten metal, pumping mechanism within said receptacle comprising a cylinder and nozzle connected therewith, a piston reciprocable within said cylinder, a reciprocable rod connected with said piston and closing said piston on the working stroke and opening said piston on the idle stroke, means for reciprocating said rod, and a die positioned to receive metal from said nozzle.

3. In a die casting apparatus, a receptacle, pump mechanism comprising a nozzle and a cylinder, a piston slidable in said cylinder and provided with a recess open at each end, a rod extending within said recess and provided with a head adapted to reciprocate therein a limited distance said head being shaped to close the opening in the recess in the side toward the nozzle, means for reciprocating said rod, and a die supported over said nozzle.

4. In a die casting apparatus, a relatively movable receptacle and die member constructed to hold an article therebetween positioned to receive metal from said receptacle, means for so moving said members, a clamp movable to engage said article, and means controlled by relative movement of said receptacle and die member for operating said clamp.

5. In a die casting apparatus, a receptacle, a die member movable relative to said receptacle and constructed to hold an article therebetween positioned to receive metal from said receptacle, means for moving said die member, a pivoted clamping arm supported on said die member and positioned to engage and hold said article, and means operated by movement of said die member for operating said clamping arm.

6. In a die casting apparatus, a receptacle,

a die member movable vertically relative to said receptacle and constructed to cooperate with an article to form a die, a movable clamp positioned to hold said article against vertical movement, a movable clamp positioned to hold said article against horizontal movement, and means for controlling said clamps.

7. In a die casting apparatus, a receptacle, a hollow ram mounted for movement toward said receptacle and carrying a core for engaging with an article to form a die, a rod within said hollow ram, a member movable to clamp said article relative to said core and operated by the rod, and means for moving said rod and ram.

8. In a die casting apparatus, a receptacle, a hollow ram mounted for movement toward the receptacle and carrying two cores, each being positioned to cooperate with an article to form a die, a clamping member movable relative to each die, an evener connected with said clamping members, a rod within said hollow ram and connected with said evener, and means for moving said ram toward and from the receptacle for clamping and releasing said articles.

9. In a die casting apparatus, a support including a cylinder having openings adjacent the ends for the admittance of a fluid under pressure, a piston reciprocable in said cylinder, said piston having a recess and a plunger reciprocable a limited distance therein, said plunger being fixed to a rod extending down within the hollow ram, said cylinder having an opening into the recess so that fluid pressure applied to one end of the piston will be applied to the corresponding end of the plunger, a core for receiving an article carried by one of said reciprocable members and a clamp for said article actuated by the other of said reciprocable members.

10. In a die casting apparatus, a receptacle, heating means for the receptacle extending adjacent the rim, pumping means including a nozzle below the rim of the receptacle and within the heating zone, and relatively movable die members adapted to register with said nozzle.

11. In a die casting apparatus, a receptacle and heating means about the sides and extending adjacent the rim thereof, pumping mechanism within said receptacle and including a nozzle below the rim of said receptacle, a lower die member carrying a portion of a die and movable to position said portion below the rim of said receptacle and in register with said nozzle, and an upper die member movable to register with said lower die member, and movable therewith to register with said nozzle.

12. In a die casting apparatus, a receptacle for molten metal, heating means surrounding said receptacle and extending adjacent the rim thereof, pumping mechanism within said receptacle and including a nozzle below

- the rim of said receptacle, a lower die member supported on said receptacle for vertical movement and having a central downwardly extending portion carrying a portion of a die positioned to register with said nozzle, and an upper die member movable to register with said lower die. 70
13. In a die casting apparatus, a receptacle for molten metal, pumping mechanism within said receptacle and including a pair of nozzles, and a manifold provided with diverging passages having rounded walls, a die positioned to register with said nozzles, and operating means for said pumping mechanism including a part immersed in the metal and streamlined to reduce disturbance of the metal to a minimum. 75
14. In a die casting apparatus, a receptacle for molten metal, pumping mechanism within said receptacle, a die positioned to receive molten metal from said pumping means and toggle operating means for said pumping means adapted to be moved toward aligned position during the pumping stroke whereby to secure an increasing leverage from the beginning to the end of the working stroke. 80
15. In a die casting apparatus, a receptacle, a die member movable relative to said receptacle and constructed to hold an article for forming a die positioned to receive metal from said receptacle, a clamp movable relative to said die member for engaging said article, and means actuated by fluid pressure and controlled simultaneously for moving said die member and operating said clamp. 85
16. In a die casting apparatus, a receptacle, pumping mechanism supported therein and including a nozzle, a die member movable toward and from the nozzle and carrying two dies, a movable clamping element supported adjacent each die, operating means for said die member, and pneumatic operating means, operated in unison with the die member operating means, for equalizing the pressure on said clamps. 90
17. In a die casting apparatus, a receptacle, a die member movable relative thereto and constructed to hold an article therebetween to form a die positioned to receive metal from said receptacle, a clamp movable relative to said die member for engaging said article, and means for simultaneously moving said receptacle and operating said clamp. 95
18. In a die casting apparatus, a relatively movable receptacle and die member constructed to hold two articles therebetween positioned to receive metal from said receptacle, a clamp movable relative to said receptacle and die member for engaging each of said articles, means for moving said receptacle and die member together and apart, means for applying force to the clamps, and means for equalizing the force on the two clamps. 100
19. In a die casting apparatus, a receptacle, a die member movable relative thereto, a clamp movably supported on the die member for engaging a work, a source of fluid pressure adjacent thereto and connectible with said clamp and die member, and means for distributing the force of said fluid pressure between said clamp and die member in a predetermined ratio. 105
- FRANK L. SAXTON. 110
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