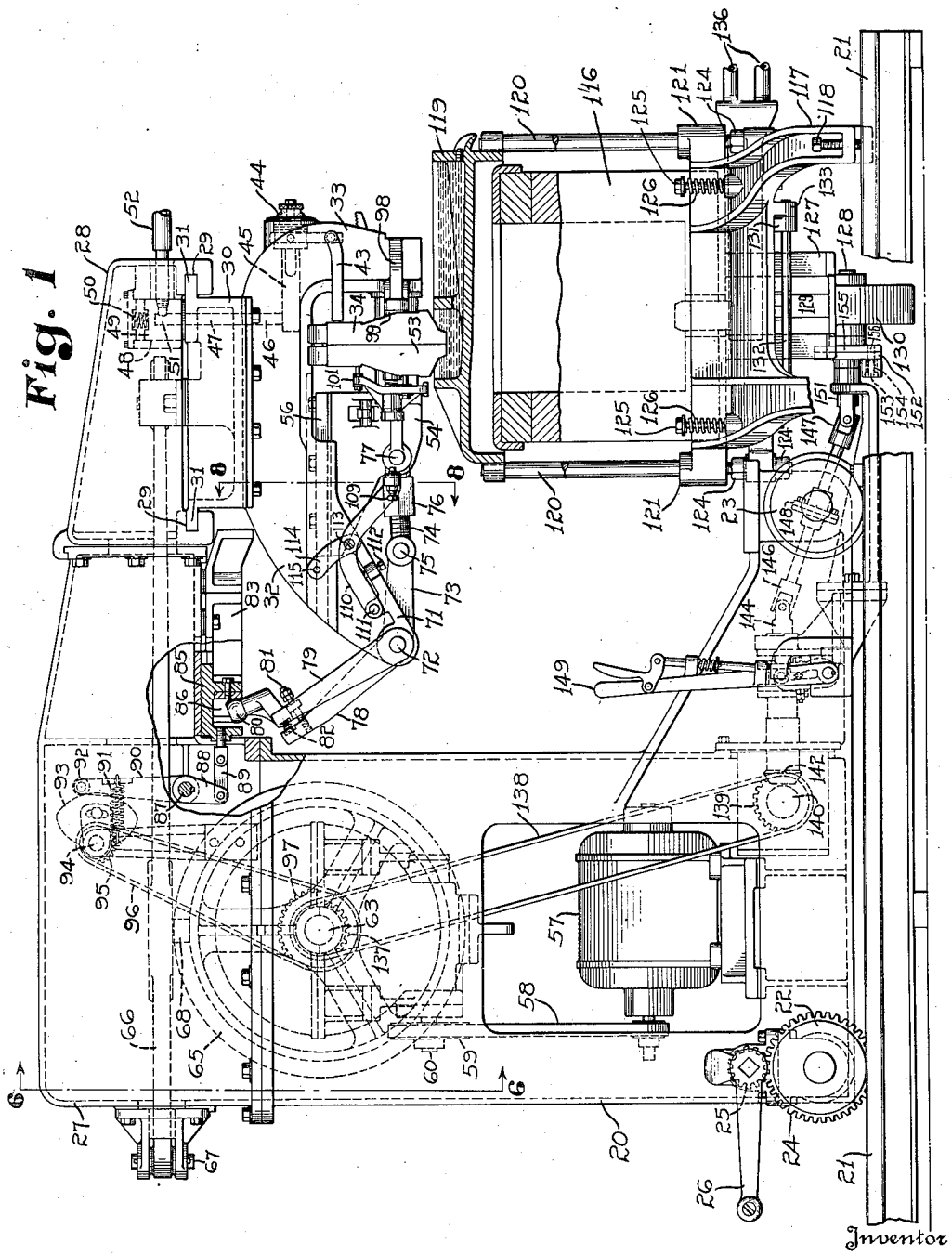
June 17, 1930. A. KADOW 1,763,710

METAL CASTING APPARATUS

Filed June 2, 1928 6 Sheets-Sheet 1

Fig. 1



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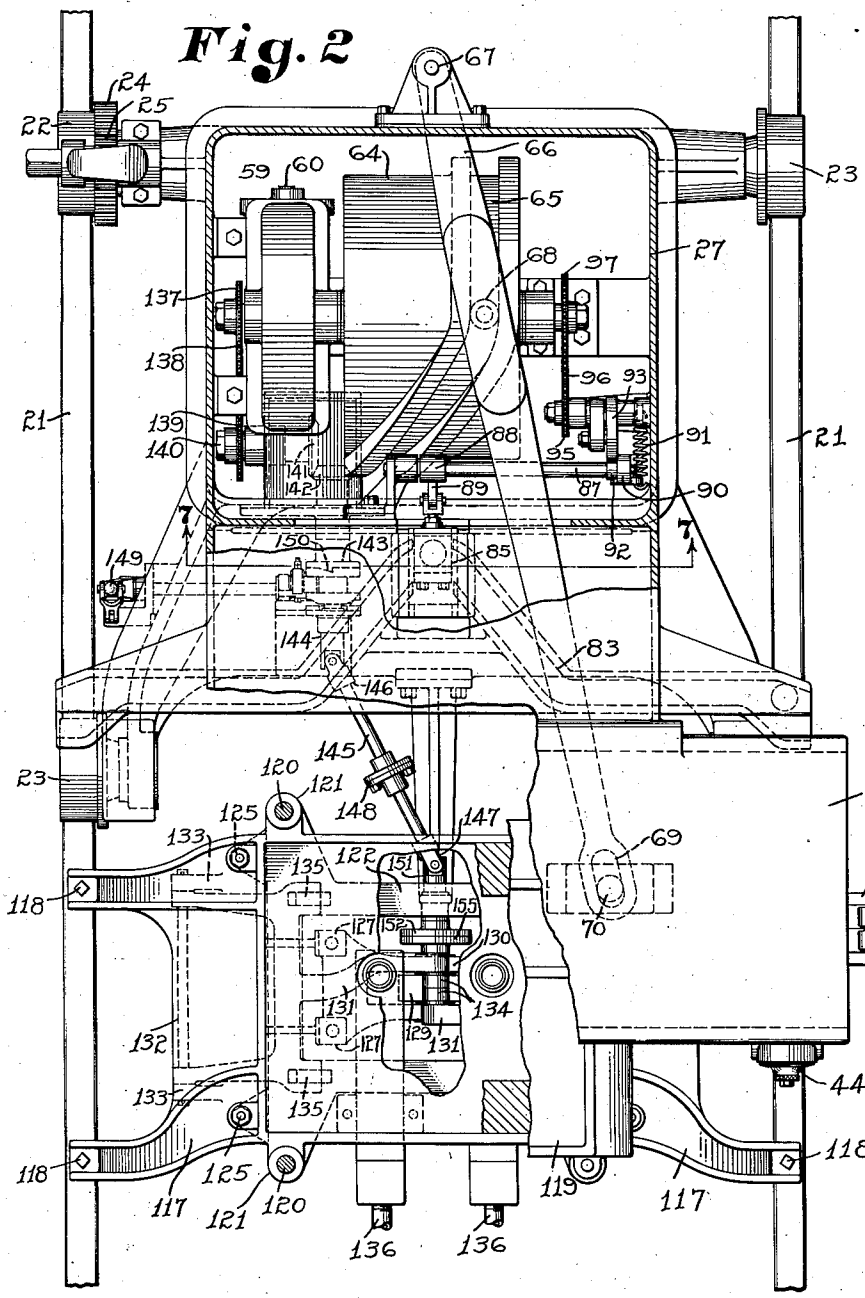
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June 17, 1930. A. KADOW 1,763,710

METAL CASTING APPARATUS

Filed June 2, 1928 6 Sheets-Sheet 2

Fig. 2



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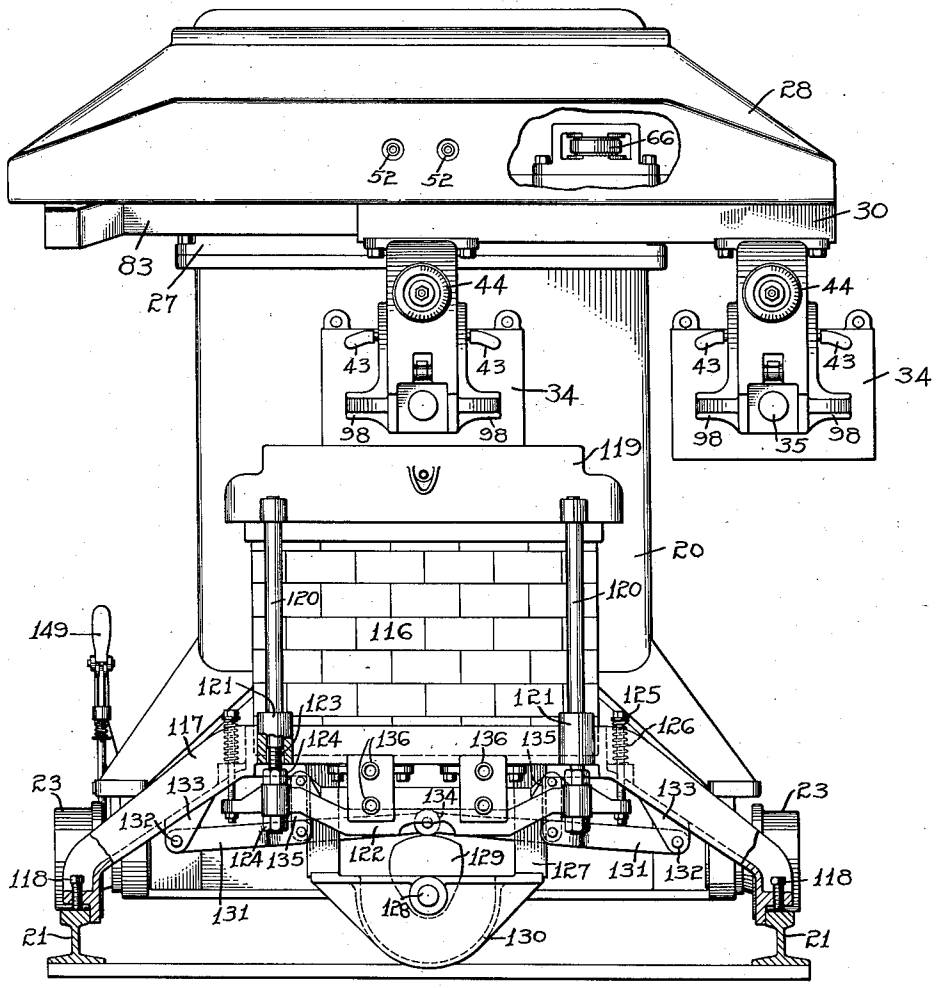
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June 17, 1930. A. KADOW 1,763,710

METAL CASTING APPARATUS

Filed June 2, 1928 6 Sheets-Sheet 3

Fig 3



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June 17, 1930. A. KADOW 1,763,710

METAL CASTING APPARATUS

Filed June 2, 1928 6 Sheets-Sheet 4

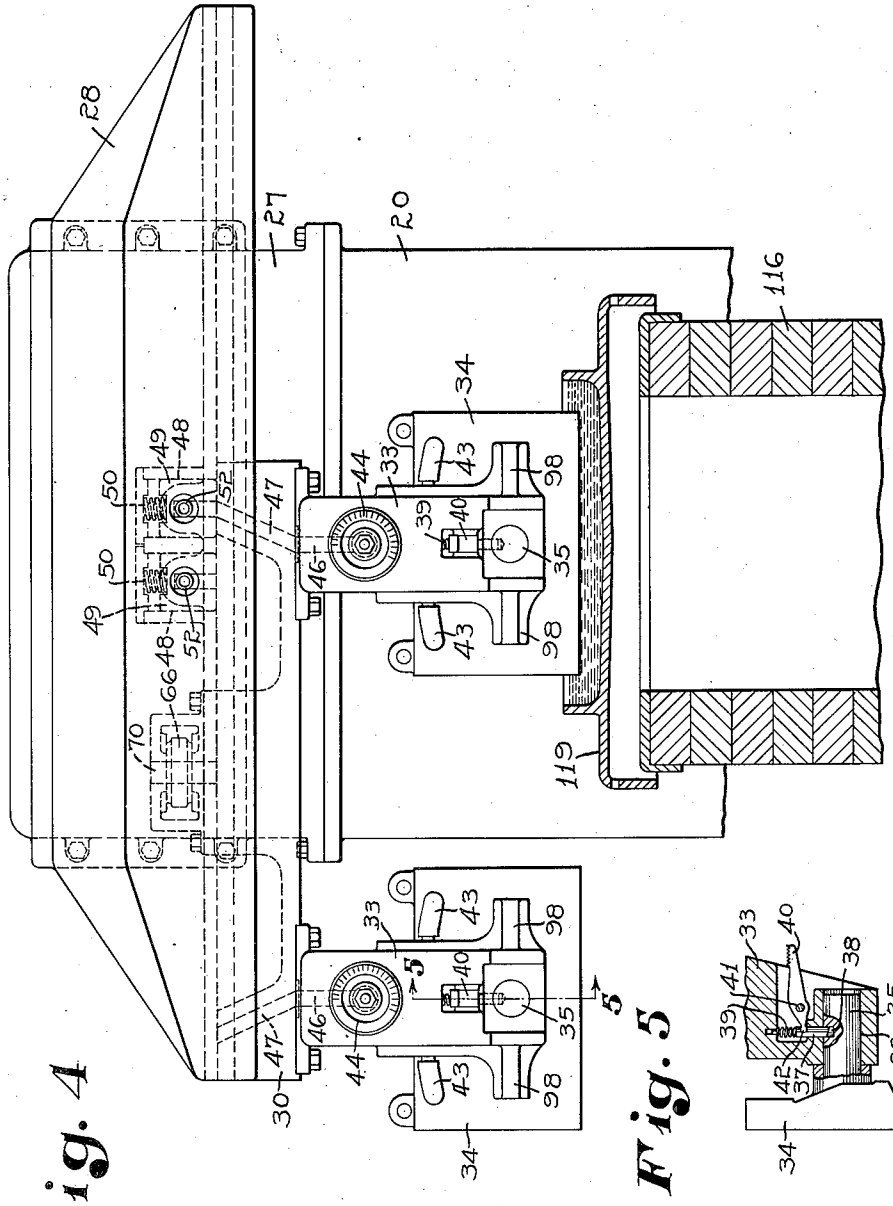


Fig. 4

Fig. 5

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June 17, 1930. A. KADOW 1,763,710

METAL CASTING APPARATUS

Filed June 2, 1928 6 Sheets-Sheet 5

Fig. 6

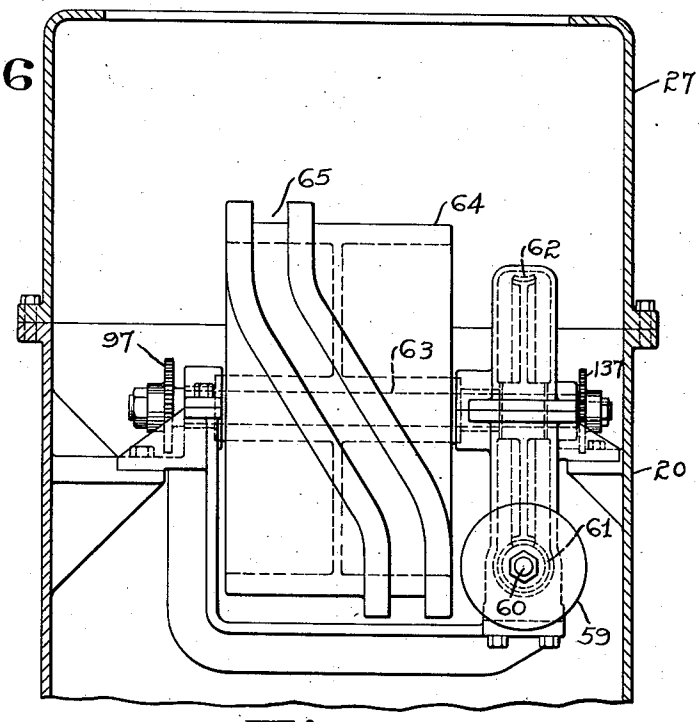
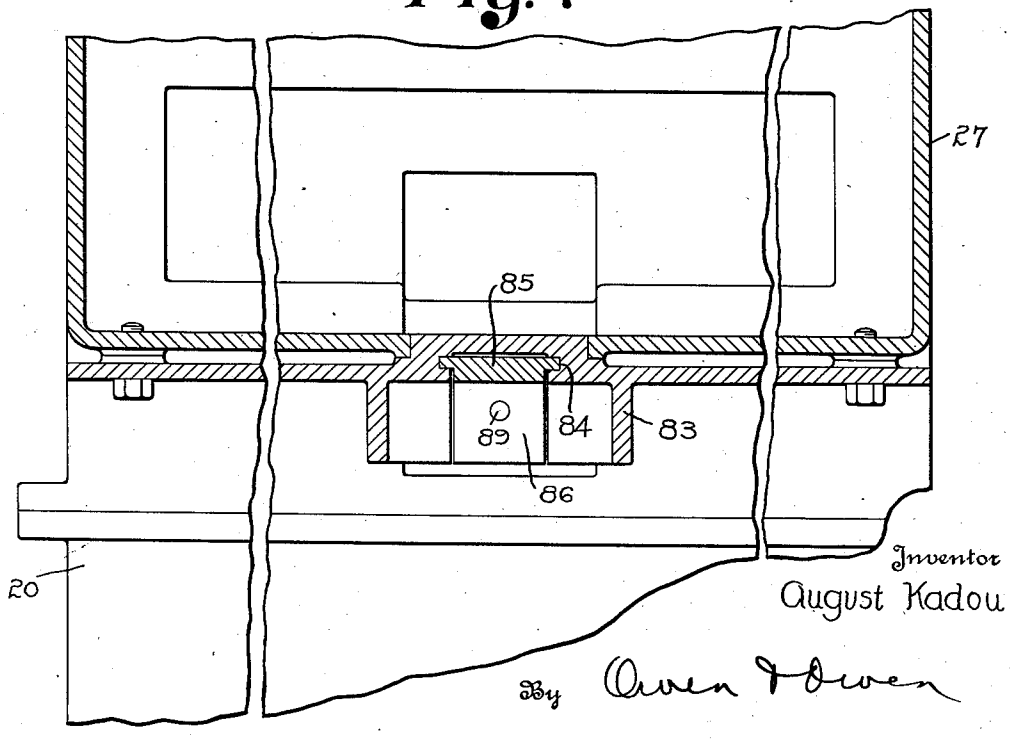


Fig. 7



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June 17, 1930. A. KADOW 1,763,710

METAL CASTING APPARATUS

Filed June 2, 1928 6 Sheets-Sheet 6

Fig. 8

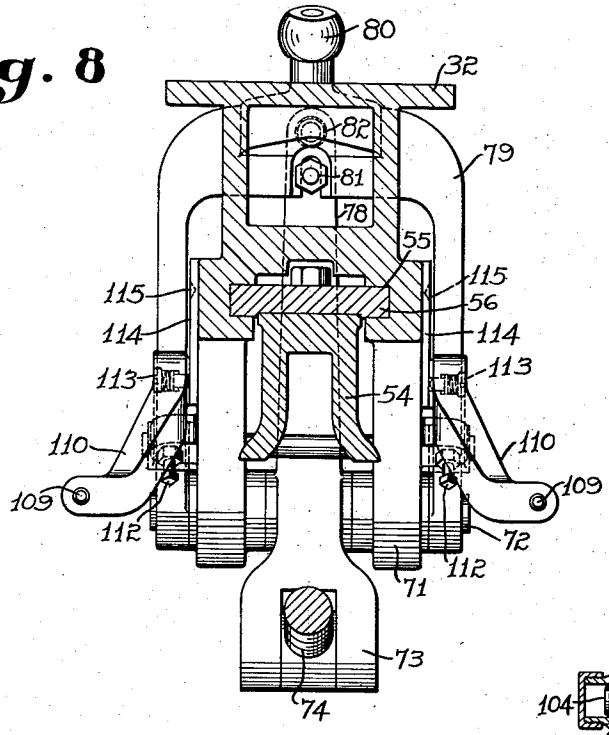


Fig. 10

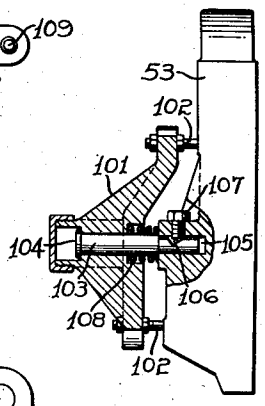
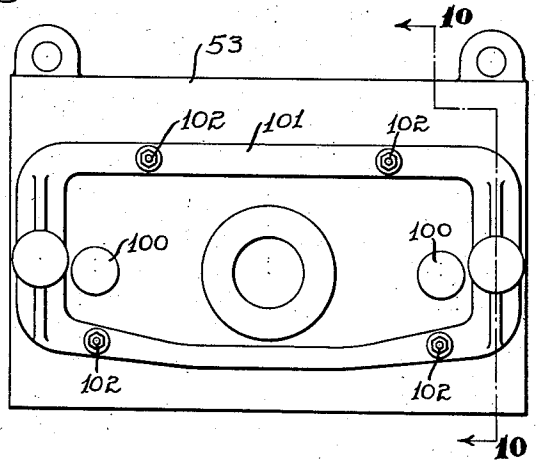


Fig. 9



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1,763,710

UNITED STATES PATENT OFFICE

AUGUST KADOW, OF TOLEDO, OHIO, ASSIGNOR TO THE VACUUM CASTING COMPANY, OF TOLEDO, OHIO, A CORPORATION OF OHIO

METAL-CASTING APPARATUS

Application filed June 2, 1928. Serial No. 282,368.

This invention relates to apparatus for casting metal and more particularly to the operation of molds into which the metal is introduced by atmospheric pressure. The purpose of the invention is to provide a simple and efficient apparatus by means of which castings may be made rapidly and uniformly. Details of the invention will appear as the description proceeds.

In the accompanying drawings forming a part of this specification, Figure 1 is a side elevation of apparatus embodying this invention, parts being broken away; Fig. 2 is a plan view of the apparatus shown in Fig. 1, parts being broken away; Fig. 3 is a front elevation of the apparatus shown in Fig. 1, parts being broken away; Fig. 4 is a partial front elevation showing the molds in a different position from that in which they are shown in Fig. 3 and showing a part of the furnace and crucible in section; Fig. 5 is a detail section on the line 5—5 of Fig. 4; Fig. 6 is a section on line 6—6 of Fig. 1; Fig. 7 is a section on line 7—7 of Fig. 2; Fig. 8 is a section on the line 8—8 of Fig. 1; Fig. 9 is an elevation of the inner mold section; Fig. 10 is an end view of the inner mold section partly in section on the line 10—10 of Fig. 9.

In the construction shown, a frame 20 is supported on track rails 21 by means of a drive wheel 22 and supporting wheels 23. Attached to drive wheel 22 there are gear teeth 24 which mesh with a gear 25 which may be rotated by a crank 26.

Upon the upper end of frame 20, there is supported a framework 27 having attached to the forward side thereof a slideway support 28. Guideways 29 are provided in the underside of slideway support 28. A mold carrier 30 is provided with ears 31 which slide in guideways 29. Attached to mold carrier 30 there are two mold supporting brackets 32. As these brackets with the supported mold and associated parts are identical, the same reference numerals are applied to corresponding parts of each and one description will answer for both.

Mold supporting bracket 32 is turned downwardly at 33 at the outer end. An outer mold section 34 is provided with a trunnion 35 adapted to fit within a socket 36 in end 33 of supporting bracket 32. A pin 37, see Figs. 4 and 5, working through the wall of socket 36 enters a socket 38 in trunnion 35. A spring 39 normally maintains pin 37 in its holding position. A releasing handle 40 pivoted at 41 is provided with a rounded end 42 which enters a suitable notch in pin 37.

Pipes 43 connect suitable vacuum grooves, not shown, in mold section 34 to vacuum passages in bracket end 33. A regulating valve between pipes 43 and passages in member 33 may be controlled by a disc 44 provided with an indicating dial. Passages from pipe 43 lead to a vacuum chamber 45 in member 33 and a passage 46 leads upward from chamber 45 to an alining passage 47 in member 30.

In the middle of member 28 there is a vertical guideway 48 in which there slides a block 49 normally held down by spring 50 against the upper side of slide 30. Block 49 is provided with a passage 51 connected by a pipe 52 to any suitable means for exhausting air. Passage 51 is adapted to aline with passage 47 when the respective mold carrier is in filling position. Two of the blocks 49 with their connecting pipes and passages are provided, one for each mold, although it will be readily understood that by a suitable positioning of block 49 and proper placing of passage 47, it might be possible to use a single block 49 with the two molds in turn.

An inner mold section 53 is supported on a carrier 54 in position to mate with mold section 34. Mold carrying bracket 32 is provided with a guideway 55, see Fig. 8, in which there moves a slide 56 on carrier 54.

Supported in frame 20, there is a motor 57 connected by a chain or belt 58 with a drive wheel 59 on shaft 60. Shaft 60 is provided with a worm 61 meshing with a worm wheel 62 on shaft 63. Shaft 63 carries a drum 64 having on its surface a cam track 65. See Fig. 7. A mold operating lever 66 is fulcrumed at 67 on frame 27 and carries a cam roller 68 working in cam track 65. The outer end of lever 66 is provided with a slot 69 which embraces a pin 70 projecting upward from mold carrier 30.

The inner end of mold carrying bracket 32

is extended downward at 71 and has mounted therein a rock shaft 72. An arm 73 extends forward from rock shaft 71 and a screw threaded link 74 is pivoted at 75 to arm 73. An internally threaded member 76 is threaded on member 74 and is pivoted at 77 to mold carrying slide 54.

Rock shaft 72 is provided with an arm 78 extending rearward and upward. A U-shaped lever 79 has its ends pivoted on rock shaft 72 and is provided at its upper end with a cam roller 80. A bolt 81 connects members 78 and 79 and limits the distance which they can be separated, while a spring 82 between members 78 and 79 tends to maintain them separated as far as bolt 81 allows.

A cam track 83 is provided on the lower side of frame member 27 in position to receive cam roller 80. At the central portion of cam track 83, there is provided a slideway 84, see Fig. 7, in which there slides a block 85 having a groove 86 on its underside adapted to form a continuation of cam groove 83.

A rock shaft 87 mounted in frame 27 has a downwardly extending arm 88 connected by a link 89 to slide block 85. An arm 90 extends upward from rock shaft 87 and is normally urged to the rear by a spring 91. A cam roller 92 on the upper end of arm 90 works against a cam 93 mounted on shaft 94. A sprocket wheel 95 on shaft 94 is connected by a chain 96 to a sprocket wheel 97 on shaft 63.

Member 33 of mold carrying bracket 32 is provided with abutment extensions 98 adapted to contact abutments 99 on mold section 34. Mold section 53 is provided with similar abutments 100 adapted to contact abutments, not shown, on carrier 54.

Inner mold section 53 is provided with an ejector frame 101, see Figs. 9 and 10, carrying pins 102 extending through the mold section and normally ending at the mold cavity. Studs 103 mounted on the mold section carry the ejector frame and are provided with heads 104 for limiting the outward movement of the ejector frame. The mold section is provided with sockets 105 for receiving the ends of studs 103 and the end of stud 103 within the socket is provided with a slanting or cam-faced groove 106 against which there operates the end of a set screw 107. A spring 108 around stud 103 normally presses the ejector frame away from the mold section.

In alinement with suitable portions of the ejector frame, there are stop screws 109, see Figs. 1 and 8, mounted in arms 110 pivoted at 111 to member 71. Arms 110 are curved and are adapted to rest normally upon stop screws 112. Catch-bolt 113 mounted in arm 110 normally works against a plate 114 mounted on the mold carrying bracket. The plate is provided with sockets 115 in which the ends of catches 113 may engage to hold arms 110 in the desired position. In this way the arms may be thrown upward and stop screws 109 held out of the way of the ejector frame when desired.

A furnace 116, see Figs. 1 and 3, is provided with supporting brackets 117 through which there work adjusting screws 118 against rails 21. In this way the furnace may be mounted in fixed position upon the rails in front of frame 20.

A crucible 119 adapted to contain molten metal is mounted above furnace 116. The crucible is supported upon rods 120 which project vertically downward outside of furnace 116 through guideways 121. A supporting framework 122 has the lower threaded ends 123 of rods 120 passed therethrough and fixed in adjusted position with respect thereto by means of nuts 124. Rods 125 project upward from supporting frame 122 through brackets 117 and springs 126 about rods 125 support part of the weight of the crucible.

Extending downward from beneath furnace 116 there are brackets 127 supporting a drive shaft 128. A cam 129 is mounted upon drive shaft 128 and a trough-shaped casing 130 is provided beneath the drive shaft where cam 129 may pass therethrough during its rotation.

Lifting levers 131 are fulcrumed at 132 upon brackets 133 extending downward from brackets 117. The inner ends of levers 131 are connected to a cam wheel 134 which rides upon cam 129. Links 135 connect levers 131 to the supporting frame 122.

The furnace may be supplied with fuel from any desired source in any desired way, fuel pipe 136 being diagrammatically illustrated for this purpose.

Shaft 63 is provided with a sprocket wheel 137 connected by a chain 138 with a sprocket wheel 139 on a short shaft 140 carrying a bevel gear 141 on its other end. Meshing with gear 141, there is a bevel gear 142 connected to one member of a clutch 143. The other member of the clutch is connected to a shaft 144. A shaft 145 is connected by a universal joint 146 to shaft 144 and by a universal joint 147 to a shaft 151. In the construction shown, shaft 145 is composed of two sections united by a coupling 148. Clutch 143 is governed by a handle 149, and the clutch members include teeth 150 which engage only when shaft 63 is in the desired timed relation with shaft 144, as will be explained hereafter. Means are provided whereby the clutch is disengaged only when cam 129 is turned downward. Means by which the clutch ceases to operate only when the parts are in the desired position are well known and therefore need not be described in detail.

Shaft 151 is provided on its forward end with a disc 152 having a pin 153 mounted thereon. A spring 154 normally thrusts pin 153 forward. Shaft 128 is provided with a disc 155 against the face of which disc 152

may be brought, and a hole 156 in disc 155 is adapted to receive the end of pin 153.

The operation of the device will be fairly apparent from the foregoing description, but may be briefly recapitulated for convenience.

When the metal which is to be cast has been placed in crucible 119 and is either molten or maintained molten by heat from furnace 116, frame 20 is moved into position with slide supporting member 28 above the crucible, and the two discs 152 and 155 encounter. Thereupon, motor 57 is started which drives cam shaft 63 in a manner which will be readily understood and thereby moves mold carrying slide 30 until one of the molds is positioned directly over crucible 119. At or prior to this time handle 149 is actuated to close clutch 143. Pin 153 rides against the face of disc 155 until it comes into register with hole 156, into which it is pressed by spring 154. Thereafter, shaft 128 turns with shaft 151. Gears 141 and 142 are so proportioned that shaft 128 is turned twice for every rotation of the shaft 63, and teeth 150 are so arranged that cam 129 is moved into position to raise frame 122 and crucible 119 each time one of the molds is brought into position over the crucible.

As will be readily apparent from Fig. 4, the vacuum passages are brought into alinement so that the mold cavity is evacuated when the mold is over the crucible, and this results in the filling of the mold by atmospheric pressure on the metal in the crucible when the mouth of the mold is immersed in the molten metal.

As the shafts continue to revolve, the crucible is lowered and the mold carrying slide is moved towards its other extreme position by cam 65 and lever 66. As the mold moves away from its filling position towards discharging position at one side of the crucible, cam roller 80 moves along cam track 83 and so rocks shaft 72 and moves arm 73 downward, thereby moving slide 54 and separating mold half 53 from mold half 34. The cavities in the mold halves are preferably constructed so that the casting separates more easily from mold half 34 than it does from mold half 53, and therefore is carried away from mold half 34 by mold half 53. When the ejector frame encounters stop screws 109, the movement of the frame ceases and continued movement of mold section 53 relative to the ejector frame and ejector pins causes the ejector pins to slide out of the cavity therein.

At the same time that the filled mold is moving away from the filling position in the manner described, the other mold is being moved into filling position. When the first mold is moved to its extreme position away from the crucible and the casting has been discharged therefrom, the surfaces of the mold may be treated by any desired cooling, heating, coating, or brushing action which is found necessary or desirable, while the other mold is being filled.

It will be readily understood that the mold is approximately closed by cam 80 moving along cam track 83 while the mold is moving towards its closed position. When the mold reaches filling position, cam 83 is in block 85, which is normally in approximate alinement with cam track 83. Just as the crucible is raised, cam 93 is rotated so as to actuate arm 90 and link 89 so as to force cam block 85 to the left, as shown in Fig. 1. This results in a final forcible raising of arm 73 so as to clamp the mold sections firmly between abutments 98 on member 33 and similar abutments on member 54. Spring 82 is provided to allow for a slight yielding when cam roller 80 is given movement beyond that which is necessary to completely close the mold. It will be readily understood that members 73 and 74 form a toggle which is so nearly straightened when the mold is closed that the pressure exerted by spring 82 is greatly multiplied against the mold sections and therefore the mold sections are very firmly clamped together.

As will readily appear from Fig. 1, the relative size of sprocket gears 95 and 97 are such that cam 93 is given two rotations for each rotation of cam 65, and the relation of cams 93 and 65 is such that block 85 is actuated in the manner just described to close each mold in turn when it is brought into filling position.

While a description has been given of one form of the device amply sufficient to enable anyone skilled in the art to make and use the same, it will be readily understood that various changes and modifications may be made in the described apparatus within the terms of the appended claims.

What is claimed is:

1. In apparatus of the character described, a crucible, a plurality of molds, means to move the molds in succession into the same position over the crucible, each mold having an inlet opening in its under side, and means to raise the crucible to immerse in molten metal within the crucible the inlet of a mold thereover.

2. In apparatus of the character described a crucible, a plurality of molds, means for moving the molds in succession into position over the crucible, each mold having an inlet opening in its under side, and means connected to operate in timed relation with the mold moving means for raising the crucible during the time each mold is thereover for immersing the inlet of the mold in molten metal within the crucible.

3. In apparatus of the character described, a crucible, a plurality of molds, means for moving the molds in a substantially horizontal path to and from a position over the crucible, each mold having an inlet opening in its

under side, and means to raise the crucible while a mold is thereover to immerse the inlet opening of the mold in molten metal within the crucible.

4. Apparatus of the character described comprising a crucible, two molds reciprocable alternately from positions on opposite sides of the crucible to a position thereover, each mold having an inlet opening in its under side, and means to raise the crucible while a mold is thereover to immerse the inlet opening of the mold in molten metal within the crucible.

5. Apparatus of the character described comprising a crucible, a mold carrier reciprocable horizontally above the crucible, two molds attached to the carrier and movable thereby alternately to a position over the crucible, each mold having an inlet opening in its under side, and means to raise the crucible while the mold is thereover to immerse the inlet opening of the mold in molten metal in the crucible.

6. Apparatus of the character described comprising a crucible, a mold support over the crucible, two molds attached to the support, means to reciprocate the support horizontally to place the molds alternately over the crucible and means timed with said reciprocating means for raising the crucible each time a mold is thereover.

7. Apparatus of the character described comprising a crucible, a plurality of molds each having an inlet opening in its under side, means to move the molds in succession over the crucible, means to raise the crucible while a mold is thereover to immerse the inlet opening of the mold in molten metal within the crucible, and a clutch connecting the mold moving means and the crucible raising means, said clutch being adapted to open only when the crucible is in lowered position and to close only when the mold moving means and crucible moving means are in proper relative position.

8. Apparatus of the character described comprising a reciprocable mold carrier, a mold section fixed to the mold carrier, a mold section mounted slidably upon the mold carrier to move towards and from the fixed section, a fixed cam track and means carried by the carrier and engaging said cam track to move said slidable section.

9. Apparatus of the character described comprising a reciprocable mold carrier, a mold section fixed on the carrier, a mold section slidable on the carrier towards and from the fixed section, a stationary cam, means carried by the mold carrier and engaging the cam for moving said slidable section, and a power operated device in position to receive said mold moving means from the cam track and to complete the closing of the mold.

10. Apparatus of the character described, comprising a reciprocable mold carrier, two molds mounted on the carrier, a mold closing device for each mold mounted on the carrier, fixed cams extending from midway on one side of the path of the carrier towards the ends of the path of the carrier and adapted to engage the mold opening and closing means, and a power operated device between said fixed cams in position to operate said mold closing means for the final closing operation.

11. Apparatus of the character described comprising a mold carrier, means to reciprocate the carrier in a substantially horizontal line, a mold attached to the carrier and having a filling opening in its under side, means attached to the carrier for opening and closing the mold, a fixed cam track in position to engage said mold opening and closing means and open and substantially close the mold, a power operated device in position to engage the mold closing means and fully close the mold when the mold is at one limit of its travel, a crucible beneath the position in which the mold is closed, and means operable in timed relation with said power operated device for raising the crucible and immersing the mold opening in molten metal within the crucible.

12. Apparatus of the character described comprising a reciprocable mold carrier, a mold attached to the carrier and having an opening in its under side, and a block resting upon the carrier, there being passageways in the block and through the carrier, mold attaching means and mold to the mold cavity, said passageways being in position to aline when the carrier is at one end of its reciprocatory movement.

13. Apparatus of the character described comprising a reciprocable mold carrier, a mold attached to the carrier and having an opening in its under side, a block resting upon the carrier, there being passageways in the block and through the carrier, mold attaching means and mold to the mold cavity, said passageways being in position to aline when the carrier is at one end of its reciprocatory movement, connections from the passage in the block to suitable air exhausting means and a control valve positioned in the passageway in the mold carrier.

14. Apparatus of the character described comprising a crucible, a mold carrier slidable above the crucible, a block resting upon the carrier, means holding the block above the crucible against movement with the carrier, a mold attached to the carrier and having an inlet opening in its under side, there being passages from the mold cavity through the mold carrier, and a passage in the block adapted to aline with said passage through the mold carrier when the mold is over the crucible, and means to raise the crucible while the mold is thereover and immerse the inlet

opening of the mold in molten metal within the crucible.

15. Apparatus of the character described comprising a mold carrier, means to reciprocate the mold carrier in a substantially horizontal path, a block resting upon the carrier and fixed against horizontal movement therewith, a mold attached to the carrier, there being passages from the mold cavity through the carrier and a passage in the block adapted to aline when the carrier is at one limit of its travel, a mold opening and closing device attached to the carrier and a fixed cam track adapted to engage said device and to close the mold as it is moved towards the position in which said passages aline and to open the mold when it is moved away from the position in which said passages aline.

16. Apparatus of the character described comprising a mold carrier, means to reciprocate the mold carrier in a substantially horizontal path, a block resting upon the carrier and fixed against horizontal movement therewith, a mold attached to the carrier, there being passages from the mold cavity through the carrier and a passage in the block adapted to aline when the carrier is at one limit of its travel, a mold opening and closing device attached to the carrier, a fixed cam track adapted to engage said device and to close the mold as it is moved towards the position in which said passages aline and to open the mold when it is moved away from the position in which said passages aline, a crucible beneath the position of the mold in which said passages aline, and means to raise the crucible while the mold is thereover to immerse the inlet opening of the mold in molten metal within the crucible.

17. Apparatus of the character described comprising a mold carrier, means to reciprocate the carrier in a substantially horizontal direction, a block resting upon the carrier and fixed against horizontal movement therewith, a mold attached to the carrier, there being passages from the mold cavity through the carrier and a passage in the block adapted to aline when the carrier is at one limit of its travel, power operated mold closing means adapted to forcibly hold the mold closed while said passages are in alinement, a crucible beneath the mold when in the position in which said passages aline and means operating in timed relation with said mold closing means for raising the crucible.

18. In apparatus of the character described, a mold comprising a relatively fixed section and a relatively movable section, an ejector frame mounted upon the movable section and having ejector pins passing through said movable section, an adjustable stop spaced away from said frame on a line parallel with said ejector pins and means for sliding said movable section away from the fixed section in a line substantially parallel with said ejector pins and for a distance greater than the distance between the normal position of said ejector frame and said stop.

19. Apparatus of the character described comprising a mold carrier, two molds attached to the carrier, a crucible, means to reciprocate the carrier in a substantially horizontal line to place the molds alternately above the crucible, mold closing means attached to the carrier and comprising a roller, fixed cam tracks on one side of the path of the carrier extending from near the middle of the path towards each end thereof and adapted to engage the rollers of the respective closing devices for the two molds, a block between said cam tracks and adapted to receive the roller of the mold closing device of a mold in position over the crucible, means to operate said block to hold the mold closed while in position over the crucible, there being passageways from the mold cavity adapted to be connected with suitable air exhausting means and the mold having an inlet opening in its lower side, and means timed with the means for reciprocating the mold carrier and with the means for operating said block for raising the crucible to immerse the inlet opening of a mold thereover in molten metal therein.

In testimony whereof, I have hereunto signed my name to this specification.

AUGUST KADOW.