

June 24 , 1924.

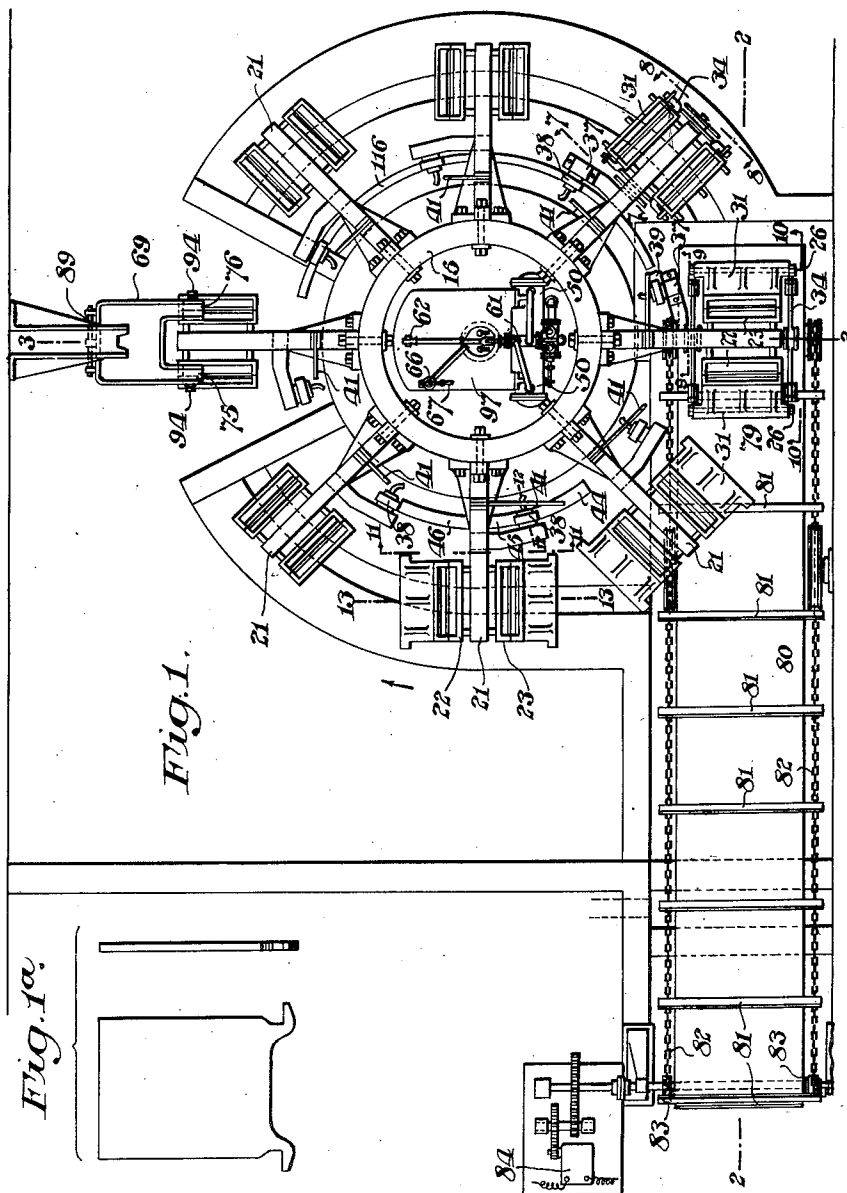
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1,498,971

MEANS FOR ANODE CASTING

Filed July 16. 1923

5 Sheets-Sheet 1



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Fig. 6.

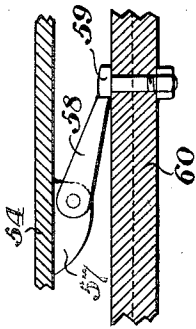
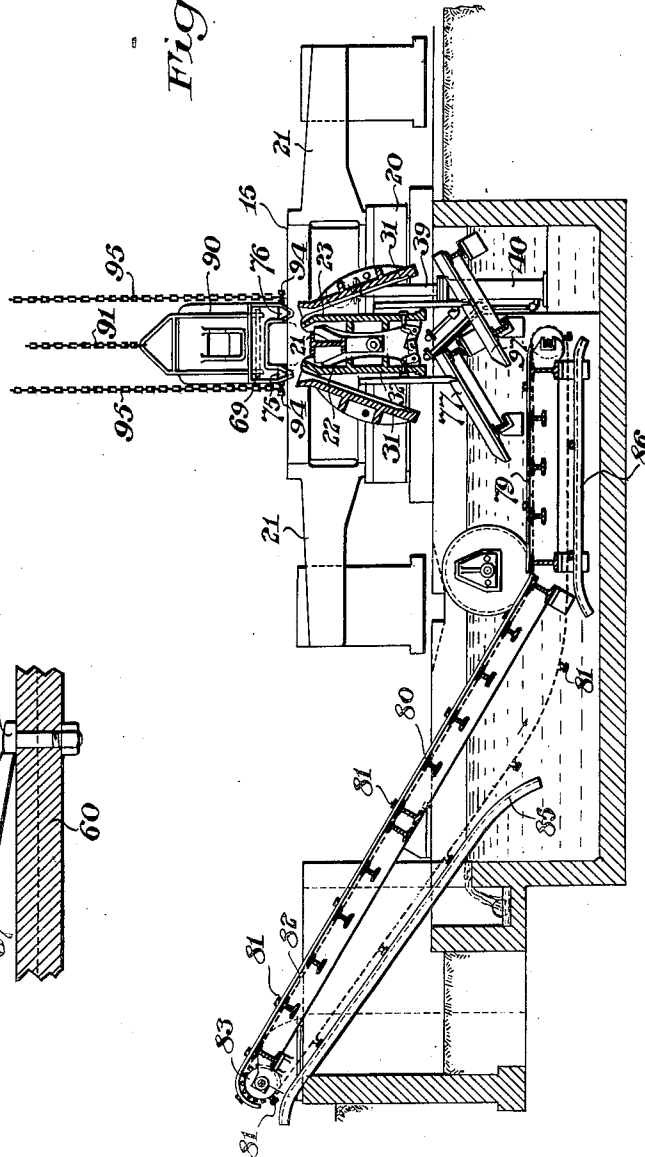


Fig. 2.



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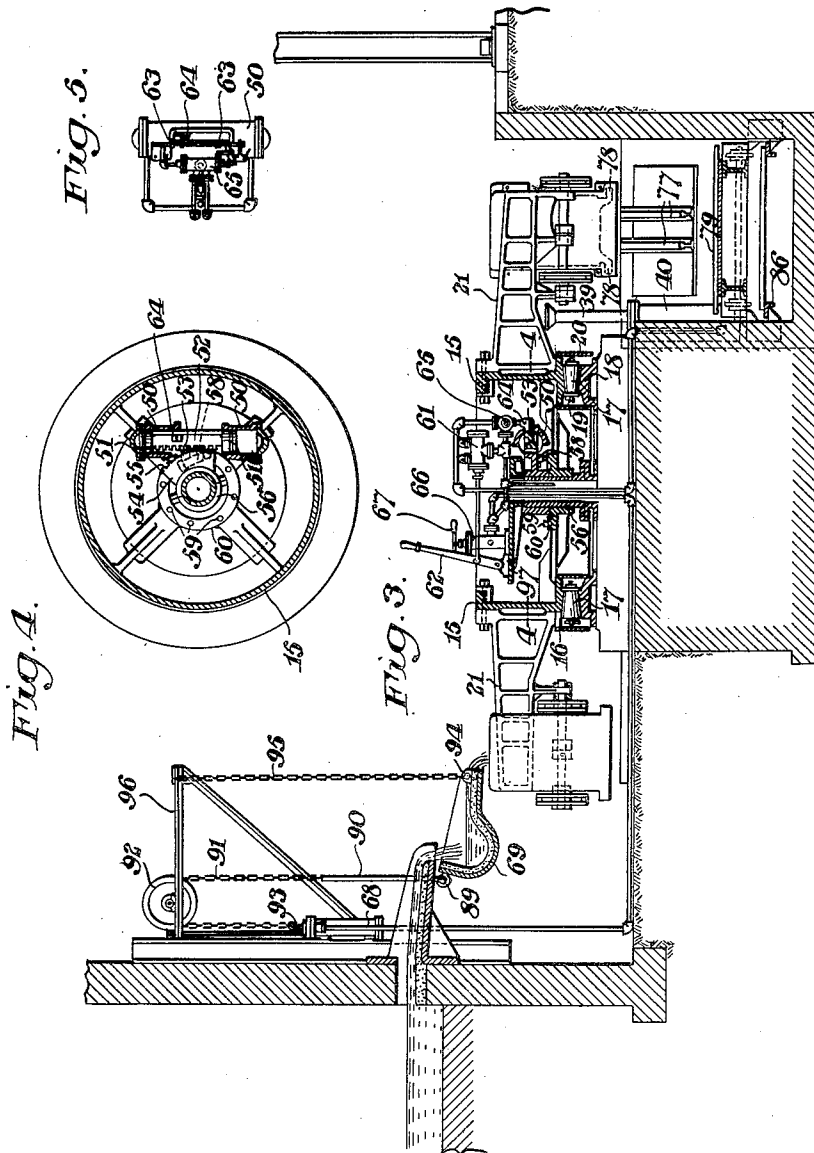
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MEANS FOR ANODE CASTING

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5 Sheets-Sheet 3



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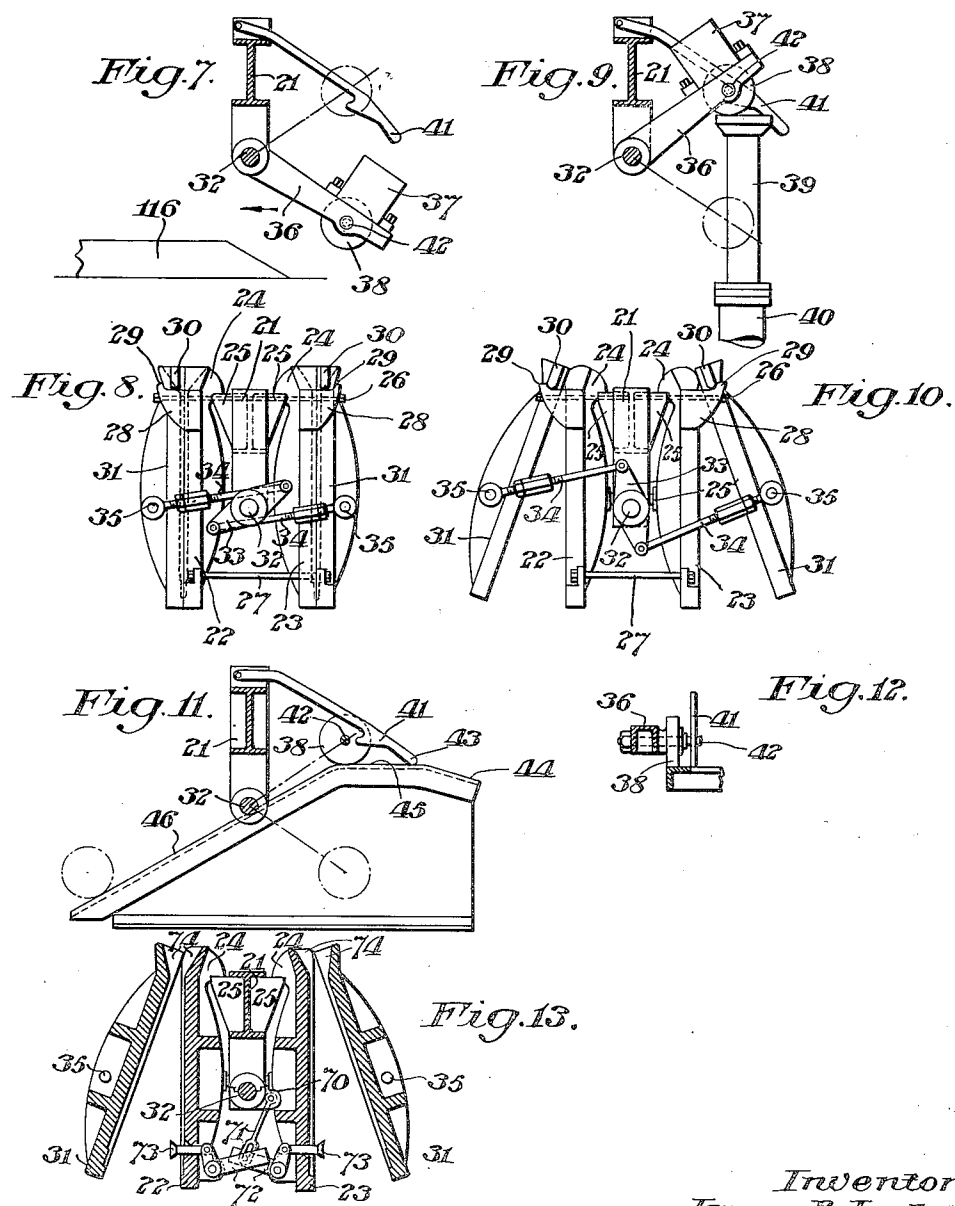
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5 Sheets-Sheet 4



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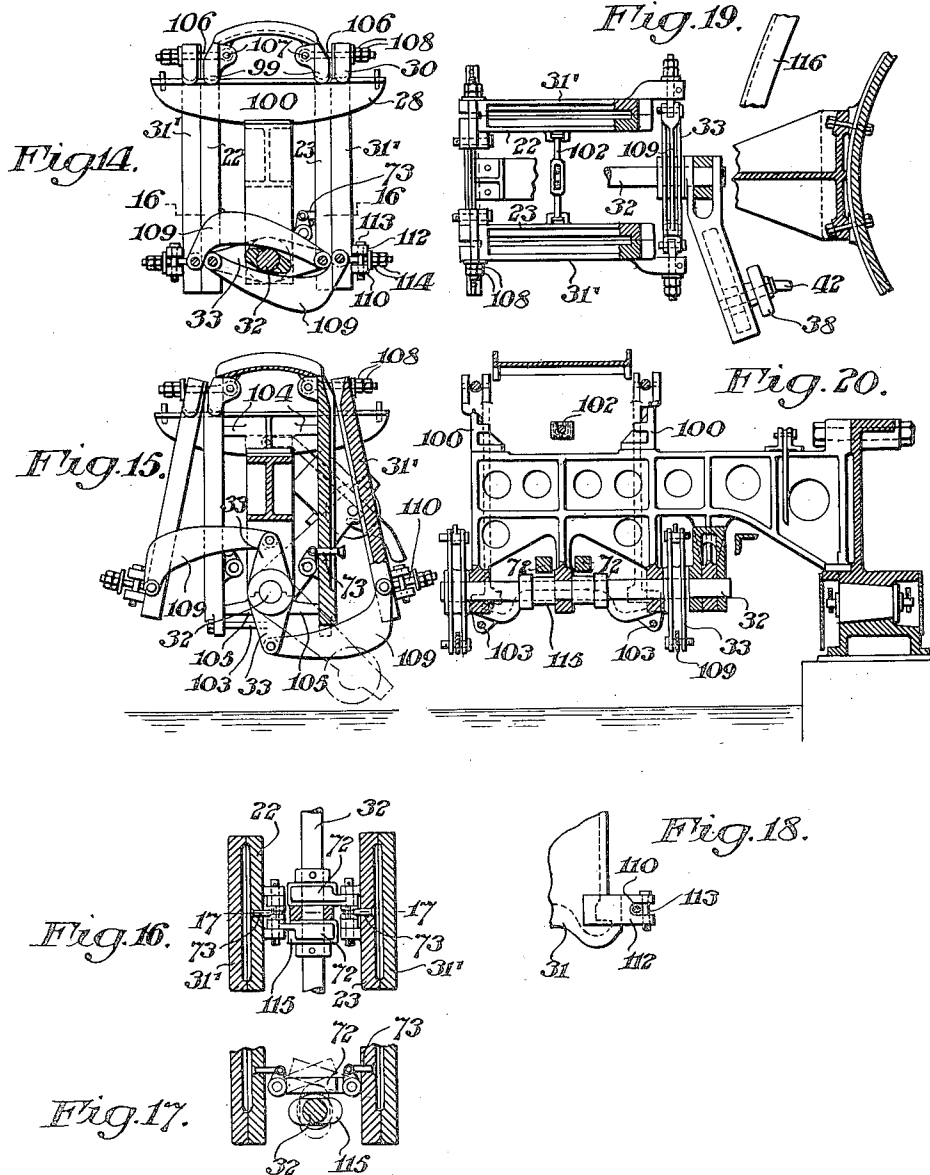
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MEANS FOR ANODE CASTING

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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE.

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MEANS FOR ANODE CASTING.

Application filed July 16, 1921. Serial No. 485,393.

To all whom it may concern:

Be it known that I, JAMES B. LADD, a citizen of the United States, residing at Ardmore, in the county of Montgomery, State of Pennsylvania, have invented a new and useful Means for Anode Casting, of which the following is a specification.

My invention relates to improvements in anode casting. The object is to provide improved means for casting anodes or similar forms, with or without ears or projections, as uniformly and expeditiously as possible. The form of anode shown in the drawing is one form given merely by way of illustration.

In operating with furnaces of a capacity of from one hundred tons to one hundred and fifty tons, the necessity arises for pouring large quantities of metal in a short time. With this in view, the method and means herein described are designed to cast four anodes a minute or one ton of metal a minute.

Further the present practice is to cast anodes in open molds, namely in horizontal molds with the entire top open. This practice produces anodes with one rough and irregular surface and of variable thickness, whereas my process produces anodes smooth on both sides and of uniform thickness.

The invention comprises means whereby the molds have an open or receiving mouth in one of the lesser dimensions of the anode, so that two opposite surfaces of the anode, having the greater dimensions, are cast against the wall surfaces of the molds. Improved means are provided for actuating the mold elements for receiving the molten metal and for readily discharging the anodes in most convenient manner.

Improved means are provided for carrying the mold to the receiving position and to the discharging position, by a step by step actuation, including inter-acting mechanism for securing the required relative movements of the several parts.

Referring to the drawings, which illustrate merely by way of example, a suitable embodiment of my invention:—

Fig. 1 is a plan view of my improved apparatus.

Fig. 1^a comprises front and side elevations of one form of electrode.

Fig. 2 is a vertical section on the line 2—2 of Fig. 1.

Fig. 3 is a vertical section on the line 3—3 of Fig. 1.

Fig. 4 is a horizontal section on the line 4—4 of Fig. 3.

Fig. 5 is a detail in plan.

Fig. 6 is a detail in section and elevation on enlarged scale.

Fig. 7 is a section on line 7—7 of Fig. 1.

Fig. 8 is an elevation from the position indicated by the line 8—8 of Fig. 1.

Fig. 9 is a section on line 9—9 of Fig. 1.

Fig. 10 is an elevation from the position indicated by the line 10—10 of Fig. 1.

Fig. 11 is a section on line 11—11 of Fig. 1.

Fig. 12 is a section on line 12—12 of Fig. 1.

Fig. 13 is a section on line 13—13 of Fig. 1.

Fig. 14 is an end elevation in part section of a pair of molds and supporting mechanism showing modifications.

Fig. 15 is a similar view partly in section with the molds in the open position.

Fig. 16 is a horizontal section on line 16—16 of Fig. 14.

Fig. 17 is a fragmentary vertical section on line 17—17 of Fig. 16.

Fig. 18 is a fragmentary elevation of the lower corner of the movable mold element.

Fig. 19 is a plan view partly in horizontal section of a pair of molds and part of the supporting frame.

Fig. 20 is a side elevation partly in vertical section of the same.

Similar numerals refer to similar parts throughout the several views.

The annular body 15 is provided with the bearing surface 16 mounted on the rollers 17, which are supported on the stationary annular bearing 18. These rollers are housed by the annular plates 19 and 20, which are secured to the body 15 and extend therefrom to the annular bearing 18. To body 15 are also secured the radiating arms 21. To these arms 21 are secured the stationary elements 22 and 23 of the molds. They are

held in position by the hooks or projecting portions 24 resting on wings 25, connected with the arm 21 and secured by the bolts 26 and 27. Intermediate bearing lugs 25' are also provided, see Fig. 10.

The mold elements 22 and 23 are provided with wings or extensions 28 having the ears or projections 29, which receive the lugs 30 of the movable mold elements 31, so that the lower ends of the movable mold elements may swing away from the stationary mold elements as shown in Figs. 2 and 10.

On the shaft 32, mounted in the lower portion of arm 21, is secured double crank arm 33, the outer ends of which are connected by connecting rods 34 with trunnions 35, on the movable mold elements 31, so that the rotation of shaft 32, either in one direction or the other, serves to move the said movable mold elements into the open and into the closed position. The actuation of shaft 32 is caused by the lever 36 secured thereto, and carrying the weight 37 and the roller 38. The closing actuation of the shaft 32 is a gravity actuation due to the weight on the end of the lever 36. The opening actuation is caused by the engagement of the top of the plunger 39 with the roller 38, this plunger operates in the hydraulic cylinder 40. When the lever 36 is moved into the full open position as indicated in Figs. 9 and 10, it is locked in the said open position by means of the latch 41 engaging a stud 42 having an axis corresponding approximately with the axis of the roller 38, although bent somewhat out of line therewith. As the frame, including the annular body 15 and the radiating arms 21, rotates from the position in which the molds are opened by the plunger 39, the roller 38 engages the inclined track 44 and is slightly elevated thereby, so that when the tail 43 of latch 41 engages the inclined track 44 the latch is lifted from the engagement with the pin 42, and the roller 38 is carried away from the same, along the horizontal portion 45 of the track, and then down the incline 46, to permit an easy and gradual closing of the said mold elements.

The step by step rotative movement of the mold supporting frame, comprising the body 15 and arms 21, is caused by the following mechanism. The two cylinders 50 are oppositely disposed. In these cylinders work the pistons 51 connected by a rod or bar 52, provided with a rack 53. These pistons are adapted to be actuated by any suitable medium, such as pneumatic or hydraulic pressure.

A segment or sector 54 is provided with teeth 55, adapted to mesh with the rack 53. This sector has its bearing about the post or hollow standard 56.

Secured to the underside of the sector 54, is a lug 57, see Fig. 6, to which is pivoted

the pawl 58. This pawl is adapted, in the movement in one direction of the sector 58, to ride over head 59 of bolts secured to the annular flange 60, forming part of the rotating frame member 15, and in the movement of the sector in the opposite direction, the pawl engages one of said bolt heads and causes the partial rotation of the mold frame. It will thus be seen, that by the reciprocating movement of the rack 53, the mold frame is given a step by step rotative movement.

The valve 61 which controls the pressure delivered to said cylinder is controlled by a hand lever 62.

The rack bar 52, see Fig. 4, is provided with a pair of nuts or other projections 63, see Fig. 5, adapted to engage the tappet 64, see Figs. 3, 4 and 5, which operates the valve 65. This valve controls the pressure to cylinder 40, which causes the raising and lowering of the plunger 39. The parts are so related that at the end of a stroke of the piston 50, and consequently at the end of a step movement of the frame, the plunger 39 is actuated to ascend or descend as the case may be.

The valve 66 controlled by the handle 67 controls the pressure to cylinder 68, which actuates the ladle 69 as desired.

The shaft 32 is also provided with the crank arm 70, Fig. 13, connected by the connecting rod 71 to the bell levers 72, which in turn are connected to push pins 73, which operate to dislodge the anodes when the molds open.

The mold members are provided with the flaring lips 74, forming a funnel shaped mouth to receive the metal poured from the ladle.

The ladle 69 is made with double spouts 75 and 76 to pour simultaneously to a pair of molds. The molds are adapted to open over a pit containing water, and discharge the anodes upon inclined rails 77 which are sufficiently close together to engage the anodes between the ears 78, see Fig. 3, so as not to injure the same. From these rails the anodes slide onto platform or way 79 over which, and the inclined way 80, are constantly moving the cross bars 81 connected to the chains 82, operated by the sprockets 83, driven by the motor 84, which mechanism serves to move the anodes along the way up to a point of discharge. The bars 85 and 86 serve to support the chains 82 against sagging.

The ladle 69 is supported at the rear by the trunnions 89, frame 90 and chain 91, running over a sheave 92 and connected with the piston rod 93 of the piston operated in cylinder 68. The front end of the ladle is supported by the trunnions 94 and chains 95, having stationary connection with the frame 96, so that the front end or pour-

ing nozzle, is nearly stationary, while the rear is elevated or lowered, to pour or stop pouring, as desired, by controlling the pressure in cylinder 68.

5 The stationary platform 97 is supported on the hollow standard 56, and supports the valves 61, 65 and 66 and the cylinder 50, and also forms a supporting platform for the operator who controls the levers 62 and 67, while controlling the filling of the molds and the movement of the frame. The
10 hollow standard 56 also accommodates the piping to the various cylinders. This standard also forms a bearing for the rotating
15 body 15.

As the anode begins to cool and contract in the mold, the body of the anode tends to adhere to the sides of the mold, which results in breaking the ears 78. To obviate
20 this tendency, I provide the track 116, see Fig. 1, which engages the roller 38 shortly after the pouring operation, to cause a slight opening of the molds, say about $\frac{1}{4}$ of an inch. This allows a free contraction of
25 the anode without danger of breaking the ears. This track continues to near the point where the plunger 39 engages the roller to cause a complete opening of the molds as shown for example, in Fig. 2.

Operation.

The operator stands upon the platform 97 within convenient reach of the levers 62 and 67. His position is such that he may
35 readily watch the metal flowing into the molds from the ladle 69. He can observe when the level of the charge in the molds has reached such a point that the flow should be interrupted.

40 Assuming that a pair of molds are in position to receive the molten metal flowing from the two spouts 75 and 76 of the ladle 69, the operator moves lever 67 of valve 66. This admits air or liquid under pressure
45 to cylinder 68 above its piston. The piston is driven downwardly pulling chain 93 over its sheave 92 and elevating frame 90 and consequently the rear of ladle 69, thereby causing the ladle to pour as indicated in
50 Fig. 3. When the operator observes that the metal has reached the required level in the two molds, he reverses the valve 66 thereby relieving the pressure above the piston in cylinder 68, whereupon the rear of ladle 69
55 descends and the pouring is interrupted.

The operator now moves lever 62 to actuate valve 61 to admit a medium under pressure to one of cylinders 50, thereby causing the actuation of pistons 50 and the rack
60 bar 52, which actuates the sector 54 (we will assume in the clockwise direction) causing the movement of the mold frame, to bring another pair of molds into charging position beneath the ladle, as described. At
65 the same time the tappet 64 is engaged by

one of the nuts or projections 63 and is actuated to operate valve 65 to admit a medium under pressure to cylinder 40 beneath the piston therein. This causes the piston rod 39 to rise and engage the roller 38 on
70 arm 36 on shaft 32. This shaft 32 is in operative relationship with a pair of mold elements which have thus been brought into the discharging position, over the inclined rails 77, in the water pit. That is to say, 75 the said actuation of arm 36 causes the actuation of the shaft 32 and the movement of the movable mold elements 31 into the open position, as shown in Figs. 10 and 13, and also the movement of the pins 73, which
80 are adapted to dislodge the anodes, which thereupon fall upon the inclined rails 77, and from thence slide on to the platform 79. The moving cross bars 81 carry the anodes up the incline 80 out of the pit to a
85 suitable point of discharge.

A reverse movement of lever 62 admits pressure into the opposite cylinder 50 and relieves pressure in the former cylinder 50. This causes an opposite movement of the
90 pistons 51 and rack bar 52, and a counter-clockwise movement of the sector 54. This carries the pawl 58 over a bolt head 59 ready for the next clockwise movement of the sector. This second movement of the rack bar
95 52 causes the operation of the valve 65 which relieves the pressure from the cylinder 40 below the piston therein and admits pressure above the piston, thus causing the
100 descent of same. Meanwhile the arm 36 has become engaged by the latch 41 and held in the elevated position as already described.

The operator will now proceed with filling the new set of molds brought beneath the ladles as above described.

At a suitable position in the travel of the molds from the discharging position to the charging position, is provided the track 44, 45 and 46, see Figs. 1 and 11. This track is adapted to encounter first the roller 38, to
110 take the weight of arm 36, and then the tail 43 of latch arm 41, to disengage it from the projection 42. The inclined portion 46 of the track then permits the gentle or gradual movement of the movable mold elements
115 into the closed position as shown in Fig. 8. It will be noted that by the descent of arm 36 the shaft 32 is rotated so as to bring the crank arm 33 into position with the connecting rods approaching the dead centre, or
120 completely into dead centre, which securely maintains the mold elements in closed position, during the charging of same and until they reach the discharging position.

It will also be noted that in this movement of shaft 32, the pins 73 are withdrawn from the position shown in Fig. 13.

It will be understood that the means disclosed for actuating the mold elements into open or closed position, are merely given by 130

way of example. These mold elements may be actuated by any suitable mechanical, electric, steam, hydraulic or pneumatic device, controlled either automatically or by hand, or arbitrarily.

In Figs. 14 to 20 inclusive, I show modifications in the structures illustrated in the preceding figures; the principle of operation however being for the most part substantially the same.

In the preceding figures it will be remembered that the lugs 30 of the movable mold elements rest upon the stationary wings or extensions 28 having the ears 29, and are capable of lateral movement thereon as shown by a comparison of Figs. 8 and 10. The movable mold element is held with its entire engaging face engaging the stationary mold element, by the connecting rod 34 connected to the movable mold element 31 near the middle part thereof, said movable mold element being held in the closed position when the member 33 is in the position as shown in Fig. 8. In other words this movable mold element is held in the closed position entirely by the pressure or tension of rod 34 acting at its connecting point 35, a substantial distance below the upper end of said movable mold element. It has been found in practice that this does not always suffice to counteract the tendency, due to the expansion of the movable mold element when heated by the charge, to separate at its upper end from the fixed mold element. To counteract this tendency I have provided the means shown in Figs. 14, 15, 19 and 20.

In these figures the stationary mold elements are supported on the horizontal surface of the stationary members 100, there being a pair, by the engaging lugs or ears 99.

These stationary mold elements are tied together by the rod 102, near the top, and by the tie rods 103, at the bottom, and are firmly held against the abutments or lugs 104 and 105 of the supporting frame. The movable mold elements 31' are also supported on the member 100 by the lugs or ears 30 and are engaged at the top by the eye bolts 106 which are pivotally secured to the stationary mold elements at 107. These bolts carry the adjusting lock nuts 108, for engaging the top of said movable mold elements, so that when these elements are in the closed position as shown in Fig. 14, the upper ends of same are prevented from separating from the fixed mold elements.

The actuating mechanism for the movable mold element is slightly modified from that shown in the preceding figures. Each element 109 is secured at one end to the lever 33 and at the other end to an eye bolt 110 which engages in the slotted lug 112 at the lower end of the movable mold element,

and held therein from disengagement by the pin 113. This eye bolt 110 is provided with the adjustable lock nuts 114 and a washer for engaging said lug.

It will also be noted that the pivotal connection of members 109 with the lever 33 and with the eye bolts 110 all lie in alignment with each other and with the axis of shaft 32 when the molds are held in the closed position as shown in Fig. 14. This dead center position assures a secure locking of the molds in the closed position during the casting operation.

From this construction it will be obvious that when the lever 33 is brought into the horizontal position, as shown in Fig. 14, the lock nuts 108 at the top and the lock nuts 114 at the bottom may be properly adjusted to bring the movable mold elements into complete and perfect engagement with the cooperating fixed mold element, after which the molds may be operated into the open and closed position, without further adjustment.

Another slight modification consists in the operation of the bell levers 72, which actuate the push pins 73, by the cam 115 on shaft 32.

What I claim is:—

1. The combination of an anode mold comprising elements, one movable relatively to the other, adapted when in cooperating position to form a single mold chamber open at the top, said opening forming a narrow receiving gate coextensive with the width and thickness of the main portion of said chamber.

2. The combination of an anode mold comprising elements, one movable relatively to the other, adapted when in cooperating position to form a mold chamber entirely open at the top, said opening forming a narrow receiving gate coextensive with the width and thickness of the main portion of said chamber, and operating means for causing the elements to assume separated positions for discharging the anode.

3. The combination of an anode mold comprising elements adapted to form a mold chamber and to be separated to discharge the anode and means for receiving the discharged anode between the ears thereof to prevent breaking the same.

4. The combination of an anode mold comprising elements adapted to form a mold chamber and to be separated to discharge the anode and means forming an inclined engaging surface for receiving the discharged anode engaging same between the ears thereof to prevent breaking the same.

5. The combination of an anode mold comprising elements, one movable relatively to the other, adapted when in cooperating position to form a mold chamber, having a narrow receiving mouth coextensive with

the horizontal cross-section of the mold chamber, and operating means for automatically causing the elements to assume separated positions for discharging the anode and then to assume the receiving position for the next charge of molten metal.

6. The combination of means forming a pair of anode molds, comprising a fixed element and flanking elements fulcrumed thereto, each flanking element forming, when cooperating with the fixed element, a single mold chamber, having a narrow receiving mouth coextensive with the width and thickness of the main portion of said chamber.

7. The combination of means forming a pair of anode molds, comprising a fixed element and flanking elements fulcrumed thereto, each flanking element forming, when cooperating with the fixed element a single mold chamber, having a narrow receiving mouth coextensive with the width and thickness of the main portion of said chamber, and means for the actuation of the movable elements from closed to open position and vice versa.

8. The combination of means forming a pair of anode molds, comprising a fixed element and flanking elements fulcrumed thereto, each flanking element forming, when cooperating with the fixed element, a single mold chamber, having a narrow receiving mouth coextensive with the width and thickness of the main portion of said chamber, and means for the simultaneous actuation of the movable elements from closed to open position and vice versa.

9. The combination of means forming a pair of anode molds, comprising a fixed element and flanking elements fulcrumed thereto, each flanking element forming, when cooperating with the fixed element, a single mold chamber, having a narrow receiving mouth coextensive with the width and thickness of the main portion of said chamber, means for the actuation of the movable elements from closed to open position and vice versa and means for causing a step by step rotative movement of the molds.

10. The combination of means forming a pair of anode molds, comprising a fixed element and flanking elements fulcrumed thereto, each flanking element forming, when cooperating with the fixed element, a single mold chamber, having a narrow receiving mouth coextensive with the width and thickness of the main portion of said chamber, means for the simultaneous actuation of the movable elements from closed to open position and vice versa and means for causing a step by step rotative movement of the molds.

11. The combination of means forming a pair of anode molds comprising a fixed element and flanking elements fulcrumed thereto, each flanking element forming,

when cooperating with the fixed element, a single mold chamber, having a narrow receiving mouth coextensive with the width and thickness of the main portion of said chamber, means for the actuation of the movable elements from closed to open position and vice versa and coacting means for causing a step by step rotative movement of the molds.

12. The combination of means forming a pair of anode molds comprising a fixed element and flanking elements fulcrumed thereto, each flanking element forming, when cooperating with the fixed element, a single mold chamber, having a narrow receiving mouth coextensive with the width and thickness of the main portion of said chamber, means for opening and closing said molds and means for causing a step by step rotative movement of the molds acting relatively to the opening and closing means.

13. The combination of means forming a pair of anode molds comprising a fixed element and flanking elements fulcrumed thereto, each flanking element forming, when cooperating with the fixed element, a single mold chamber, having a narrow receiving mouth extending the width of the chamber, means for opening and closing said molds, and means for causing a step by step rotative movement of the molds, acting relatively to the opening and closing means, whereby the molds are opened when reaching the discharging position, and are closed before arriving at the receiving position.

14. An anode mold comprising elements, one movable with respect to the other, adapted when in cooperating closed position to form a mold chamber, adjustable means comprising an eye-bolt pivoted to one member and engaging at its free end the other member for locking the elements together at the upper ends thereof when in the closed position.

15. An anode mold comprising elements, one movable with respect to the other adapted when in cooperating closed position to form a mold chamber, actuating means for moving a mold element, comprising a crank, a connecting member operating between the crank and said mold element, and means for securing an adjustable connection between said connecting member and said mold element.

16. An anode mold comprising elements, one movable with respect to the other, adapted when in cooperating closed position to form a mold chamber, actuating means for moving a mold element, comprising a crank, a connecting member operating between the crank and lower end of said mold element and means for securing an adjustable connection between said connecting member and said mold element.

17. In combination with a supporting

frame, means forming anode molds comprising fixed and movable elements, adapted when in cooperating position to form mold chambers, and disengageable means for adjustably clamping the fixed elements to the supporting frame, comprising bolts and intermediate engaging lugs.

18. In combination with a supporting frame, an anode mold comprising elements, movable relative to each other, adapted when in cooperating position to form a mold chamber, and said frame and element provided with cooperating bracket and lug as means for hanging a mold element upon the supporting frame with slight adjustable movement.

19. The combination of means forming an anode mold, comprising elements, movable relative to one another, adapted when in cooperating position to form a mold chamber, and means for causing a slight preliminary opening of the mold elements shortly after the filling operation.

20. The combination of means forming an anode mold, comprising elements, movable relative to one another, adapted when in cooperating position to form a mold chamber, and means for causing a slight preliminary opening of the mold elements to allow free shrinkage of the anode before it is discharged from the mold.

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