

July 28, 1931.

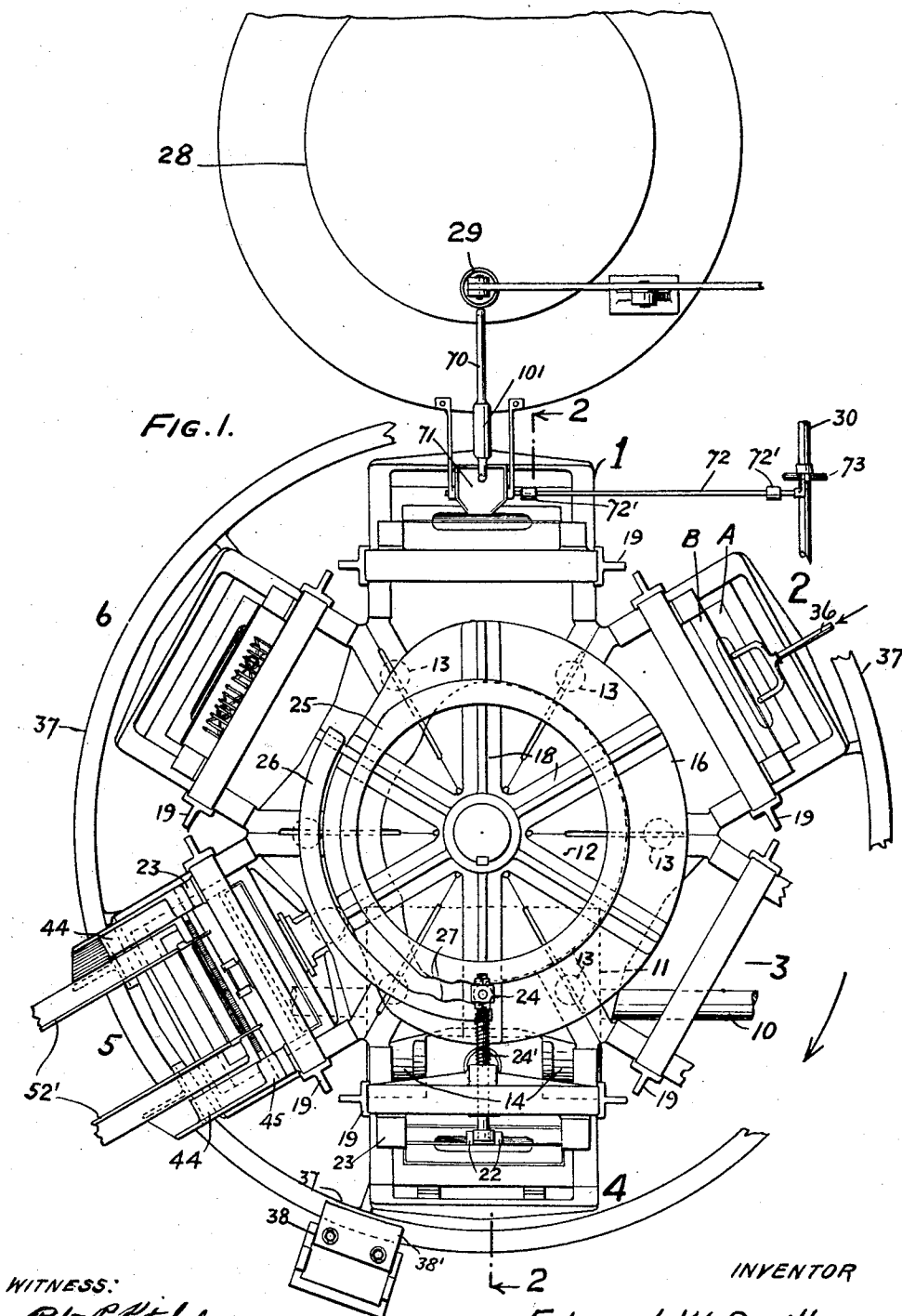
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1,816,059

ROTARY CASTING MACHINE

Filed Dec. 24, 1928

7 Sheets-Sheet 1



WITNESS:

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INVENTOR

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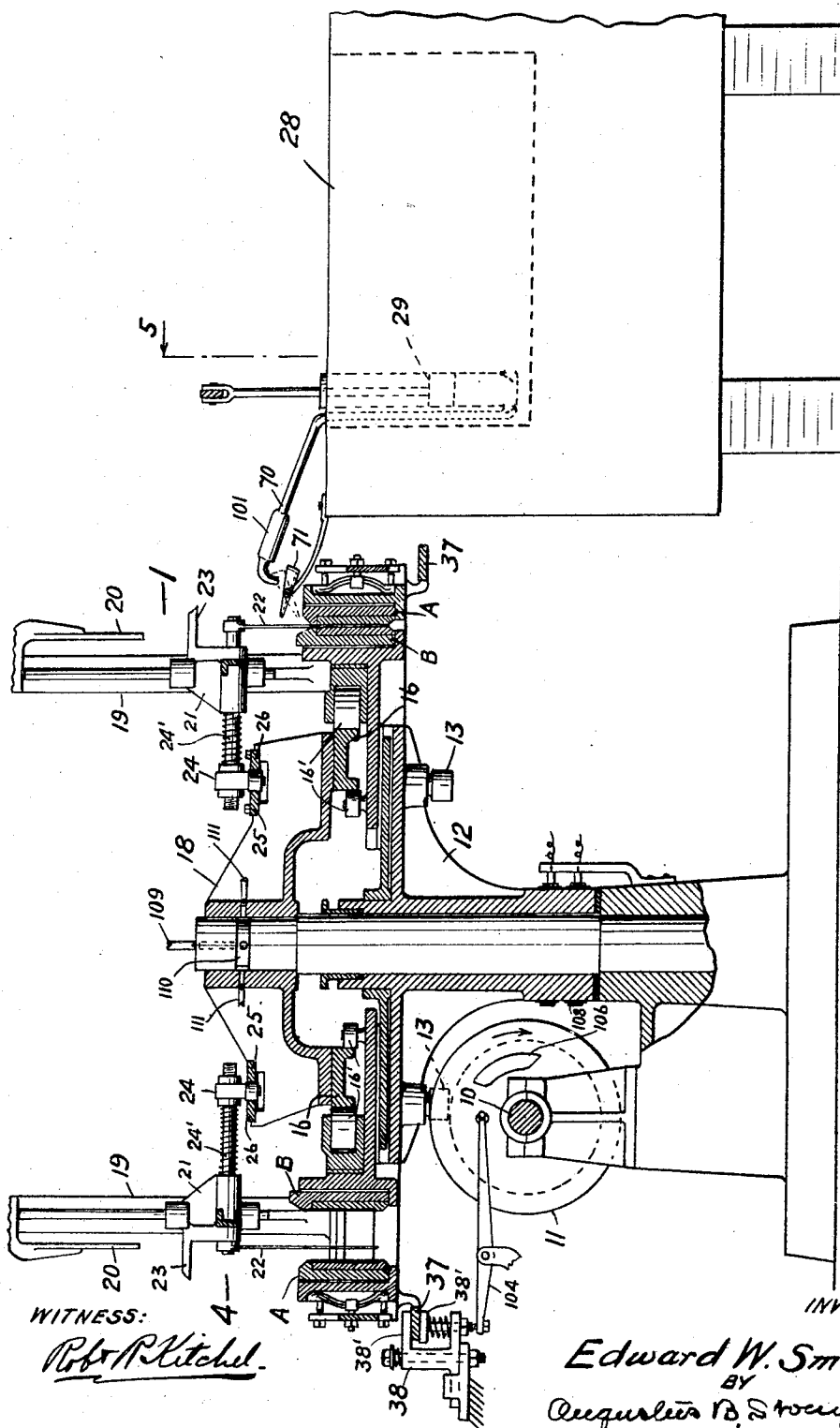
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ROTARY CASTING MACHINE

Filed Dec. 24, 1928

7 Sheets-Sheet 2



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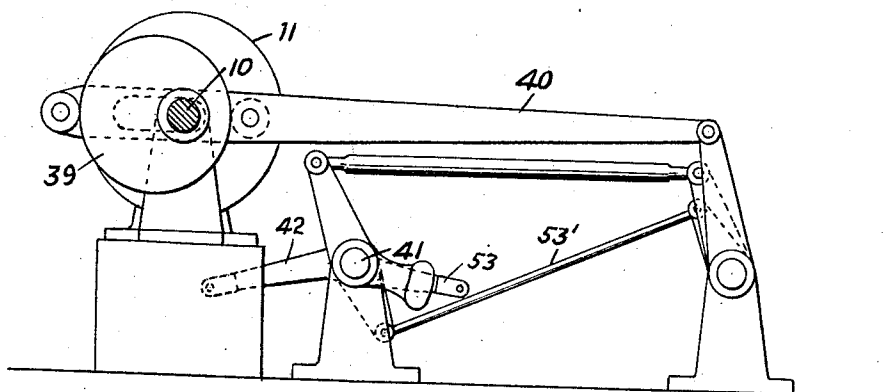
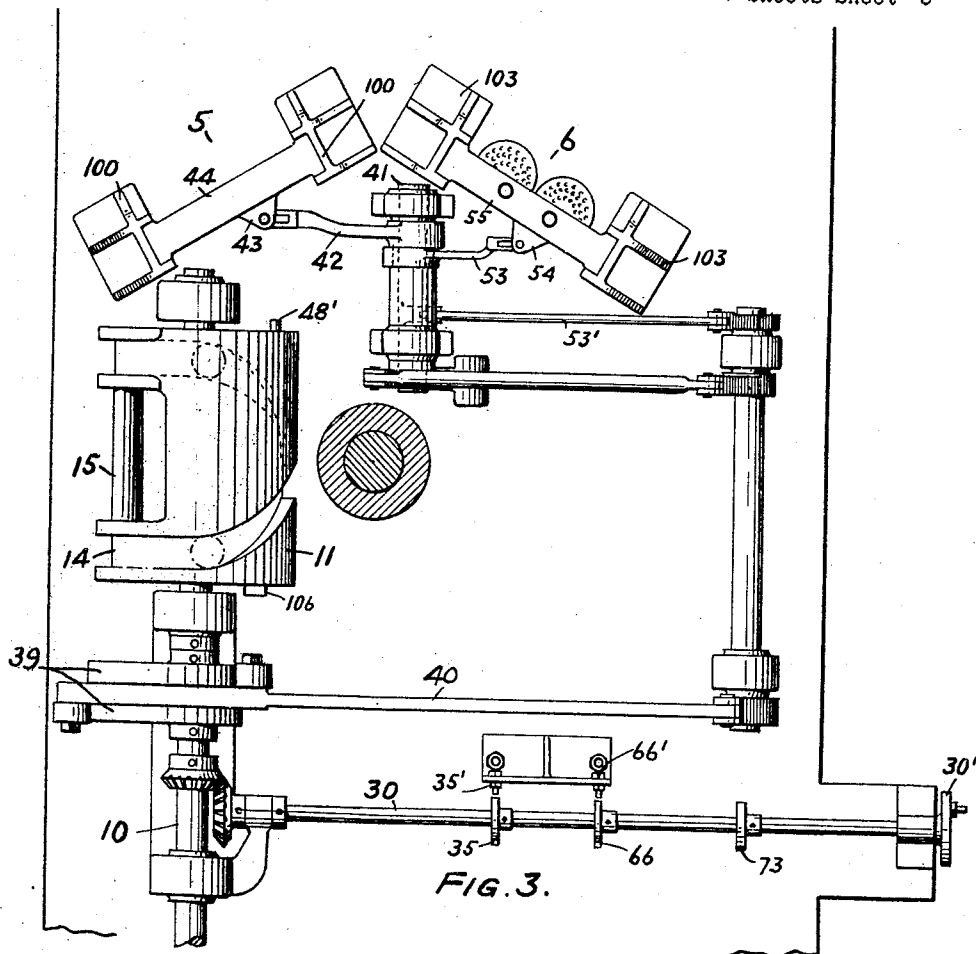
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ROTARY CASTING MACHINE

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7 Sheets-Sheet 3



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FIG. 4.

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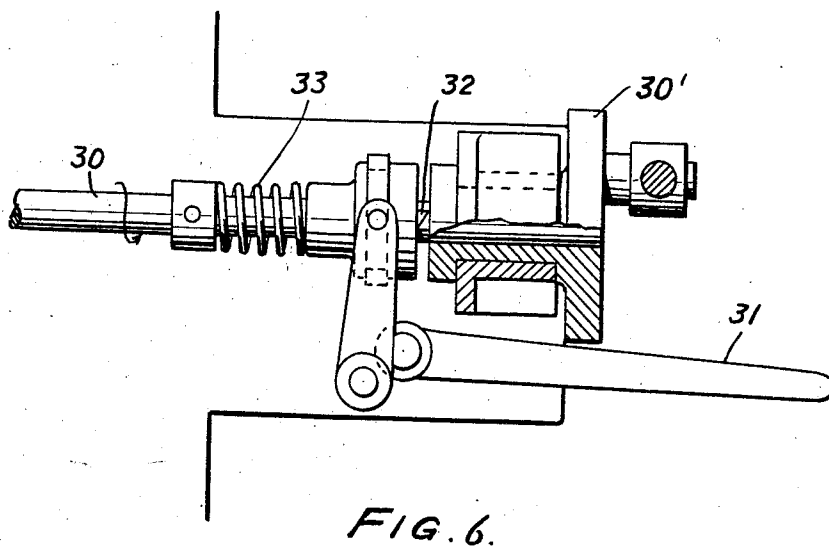
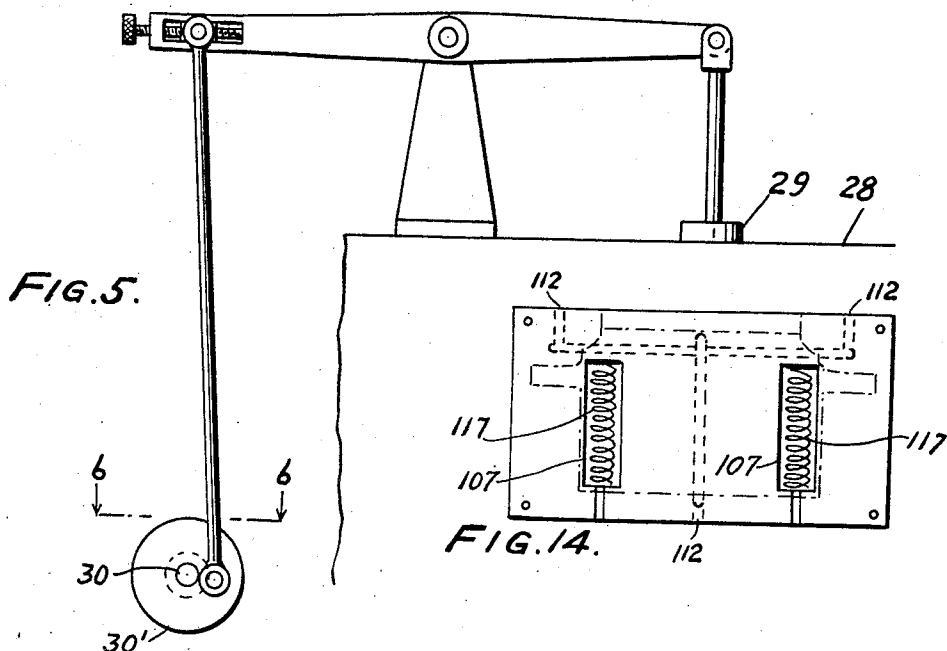
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ROTARY CASTING MACHINE

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7 Sheets-Sheet 4



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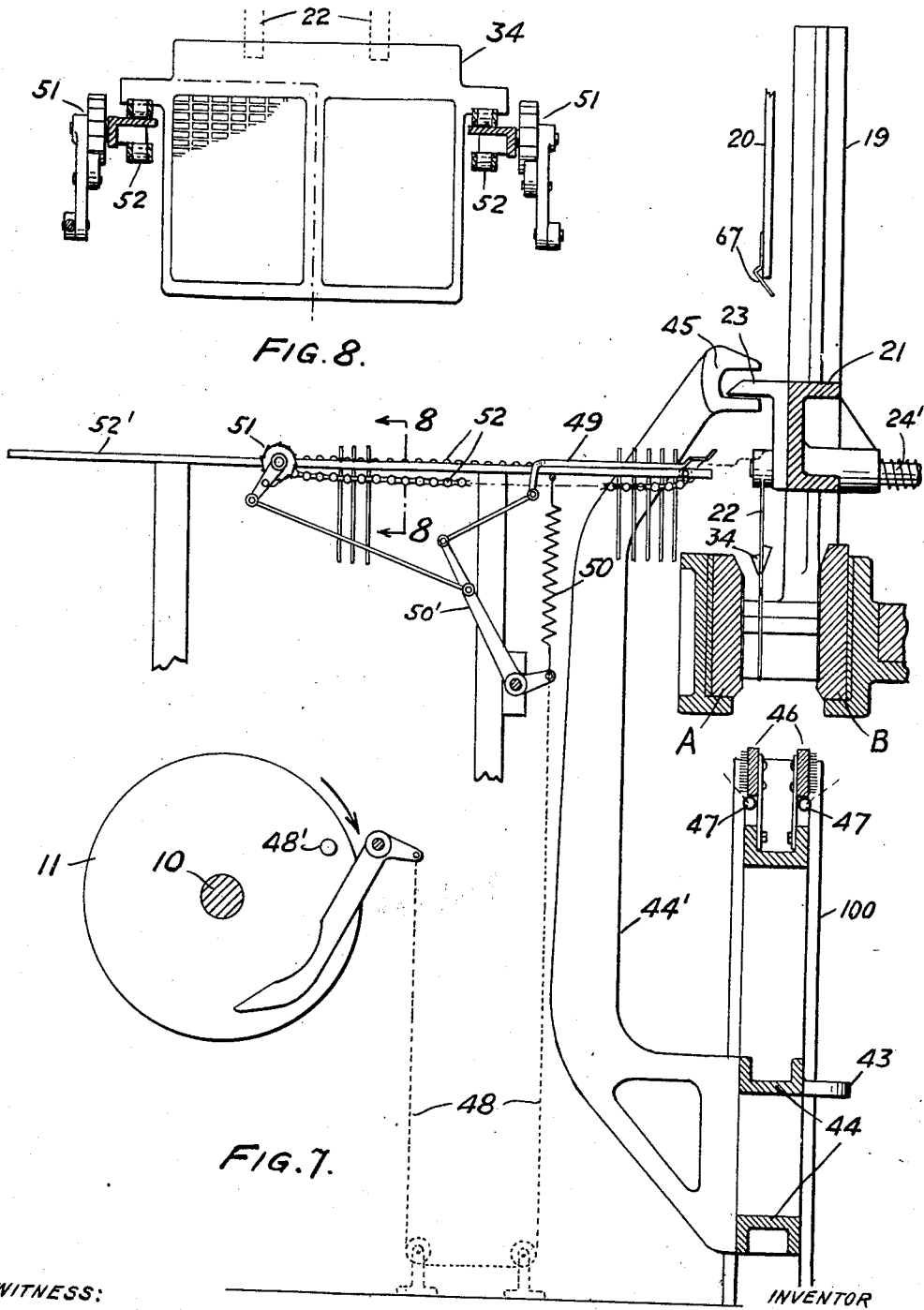
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ROTARY CASTING MACHINE

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7 Sheets-Sheet 5



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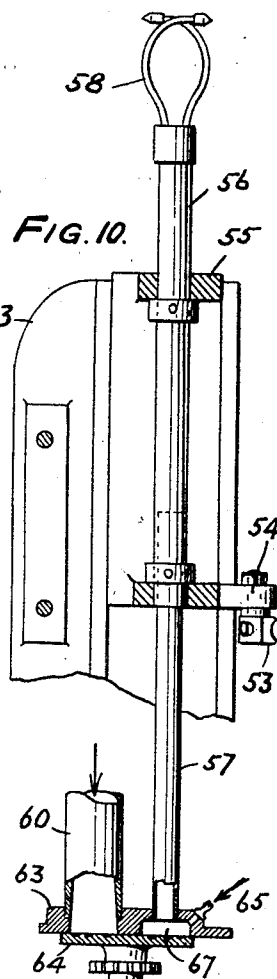
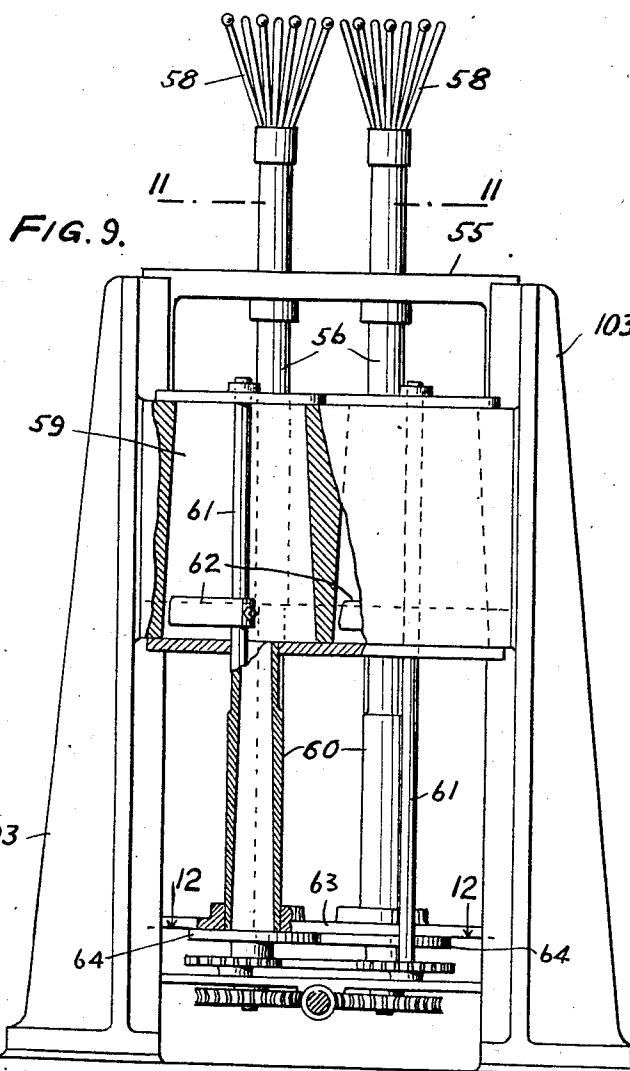
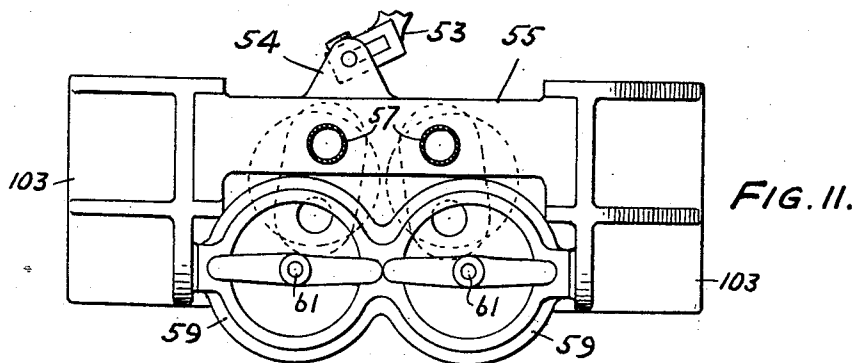
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ROTARY CASTING MACHINE

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7 Sheets-Sheet 6



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1,816,059

ROTARY CASTING MACHINE

Filed Dec. 24, 1928

7 Sheets-Sheet 7

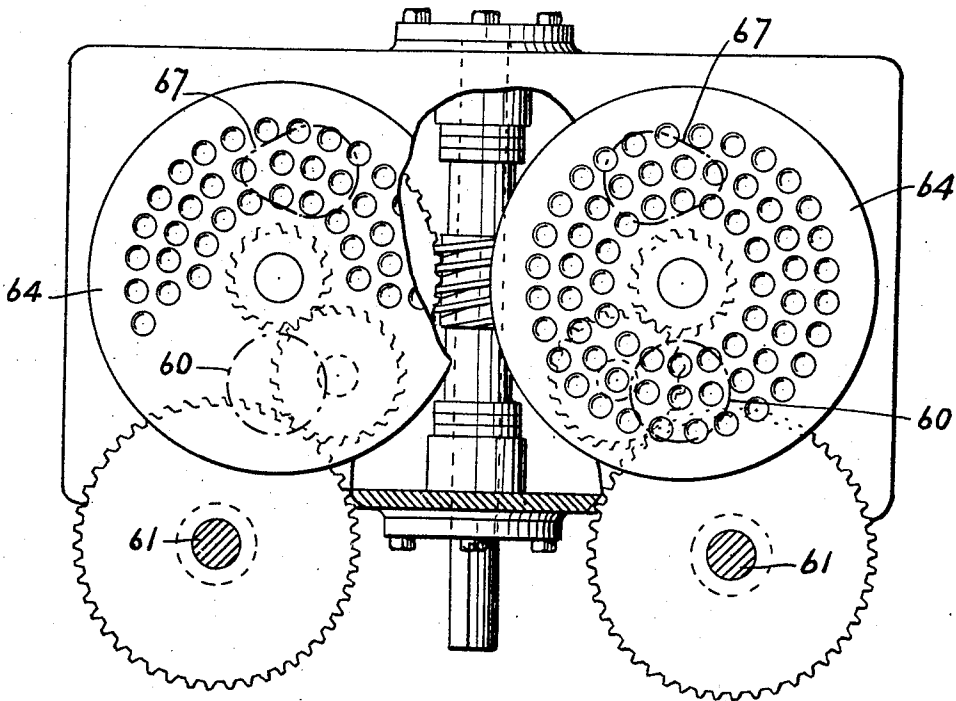


FIG. 12.

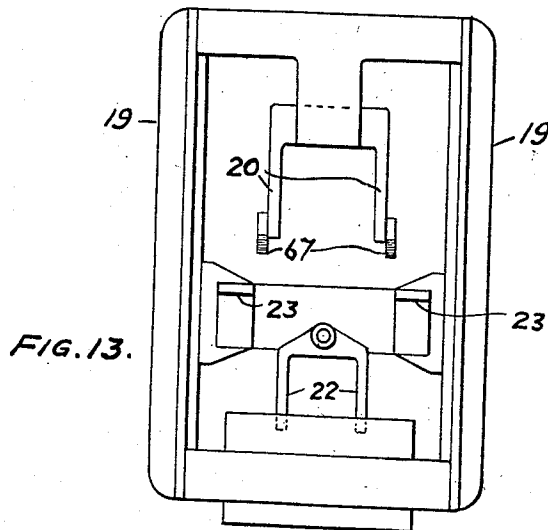


FIG. 13.

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UNITED STATES PATENT OFFICE

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ROTARY CASTING MACHINE

Application filed December 24, 1928. Serial No. 328,100.

The object of this invention is to provide a novel and highly practical machine for making large numbers of castings. It is particularly applicable for casting lead or lead alloy grids for storage batteries.

This machine also embodies numerous novel and ingenious mechanisms for performing parts of the complete operation of casting a grid. There are provided also several novel and practical safety devices which prevent damage to the machine or injury to the operator. The desirability of these safeguards is readily seen when it is remembered that the material being treated is molten lead.

In the drawings,

Figure 1 is a plan view of the machine.

Figure 2 is a cross section on line 2—2 of Figure 1.

Figure 3 is a plan view of the main driving cam, the auxiliary cam shaft, and the lifting linkage.

Figure 4 is an elevation of the lifting linkages and cams.

Figure 5 is an elevation on line 5—5 of Figure 2.

Figure 6 is a plan view on line 6—6 of Figure 5 enlarged with parts in section.

Figure 7 is a side elevation of the grid and brush lifting mechanisms with parts shown in section.

Figure 8 is an enlarged cross section on line 8—8 of Figure 7.

Figure 9 is a side elevation of the dusting or soap stone blowing mechanism with parts broken away.

Figure 10 is a partial sectional view of the apparatus shown in Figure 9.

Figure 11 is a partial cross section on line 11—11 of Figure 9.

Figure 12 is a cross section on line 12—12 of Figure 9 enlarged.

Figure 13 is a front elevation of the grid lifting apparatus.

Figure 14 is a side view of the mould showing the cooling passages and heaters.

The grids are cast in twins with extending lugs and overflow metal 34 at the top as shown in Figure 8.

The machine may be described as follows:

It consists essentially of a rotating wheel or table 12, Figs. 1 and 2, mounted upon a vertical axis and carrying a plurality of moulds A, B. As the table rotates, each mould in succession is brought to pouring position 1, in Fig. 1, where the molten lead is introduced into it, then next, into position 2, where cooling water is introduced on the top of the gate to cool this part, following next, into position 3 and 4, where the cooling of the whole casting continues. Between positions 4 and 5 the mould is opened. At position 5 the casting is removed and at the same time the mould is brushed. At position 6 the mould is dusted. Between positions 6 and 1 the mould is closed. At position 1 it is again ready for the introduction of more lead. These various operations and the mechanism and mechanical devices for performing them may now be described in further detail:

Table 12, Figs. 1 and 2, is provided with a set of cam rollers 13 corresponding in number to the number of positions of the table, the same engaging in groove 14 of the main driving cam 11 shown in Figs. 1-2-3-4.

Cam 11 is fixed upon the horizontal shaft 10 and is driven at the required speed by motor and gears, or other suitable means not shown in the drawings. The groove 14 may be so designed as to produce an intermittent rotation of the table, causing it to remain fixed for a definite period, in the positions of rest, where the necessary operations are performed on the moulds. In order to relieve the cam 11 of the operation of stopping the table at each position, a brake ring 37 is attached to the moving member 12 passing between brake shoes 38 and 38' which are cam operated by lever 104 and cam 106 (Fig. 2)

mounted on the end of main cam 11 so as to apply the braking action only during the period when the moving member is coming to rest. The brake shoes 38 and 38¹ open as soon as the machine is brought to rest, so as to allow it to be started up freely. This mechanism contributes very materially to the smooth operation of the machine. Each mould consists of two parts A and B parted in a vertical plane, and opened by the parallel motion of one half (B) with regard to the other, so as to allow of the removal of the casting after it has sufficiently cooled. The mould parts are mounted on yokes or brackets projecting from the rim of the table. In Fig. 2 at the right hand a mould is shown closed and at the left hand a mould is shown open and a grid or casting, partially removed, dependent from forks (22) placed there for the purpose hereinafter more fully described. The outer half (A) of each mould is spring mounted but otherwise fixed relative to the main table, while the inner half (B) is slidable in a radial direction either to or away from the fixed half.

The movable half of each mould is operated by cam rollers 16¹ shown in Fig. 2, which engage with a fixed cam 16 which is rigidly attached to the main central column by means of the spider 18.

Mounted on the table 12 adjacent to each mould, is a pair of upright guides 19 which carry between them a vertically movable crossarm 21 which in turn carries a horizontal sliding bar 24¹. This bar 24¹ which is made so as to be non-rotatable in the arm 21 is caused to move in and out in a radial direction by means of the double cam 25 and 26 and cam roller carried by part 24.

To the outer end of this slide bar 24¹ is attached the fork 22 which is shown on Figs. 2-7-8, and which may be designated as a removing member. This fork is so placed that when the mould is in the closed position, it projects downward into the gate of the mould. By reason of the prongs of the fork being somewhat roughened, or notched, near the ends, the casting attaches itself to them, and, when the mould opens, is left pendent from them. Fixed cam 25 and 26 is shaped so that between positions 4 and 5 while the mould is opening, the forks 22 are also moving inward toward the center of the machine, thus freeing the dependent grid or casting entirely from both halves of the mould, as shown in Fig. 2 at the left. The vibratory motion imparted to the forks by undulations 27 assists in freeing the plate from the mould. The grid, now depending freely from the forks 22, is free to be lifted upward, which is accomplished by means of projections 23 forming part of the movable crossarm 21 operated in turn by lifting arms 44 having jaws 45 at the upper end.

As the fork 22 carrying grid 39 approaches

its upper position, the gate 34 of the grid comes in contact with two fixed arms 20 which prevent the grid from lifting any further, and therefore cause the fork 22 to be withdrawn from the grid, thus leaving the grid free to drop. Just before this takes place, however, two movable fingers 49, Fig. 7, are projected forward directly under the grid lugs, so that as the grid drops the lugs rest on these fingers and the fingers are then withdrawn so as to get the grid out of the way of the movement of the machine and deposit it on a conveyor chain 52. The action of the fingers 49 in catching the plate is assisted by small springs 67 attached to arms 20, so arranged that, as the grid is freed from the fork 22, the springs throw it slightly forward. Fixed arms 20 are attached to a cross-arm, which in turn is attached rigidly to upright guides 19.

The mechanism for lifting the sliding member 44 may be better understood by referring especially to Figs. 3-4-7-8. At position 5 there are provided a pair of upright guides 100 fixed to the base of the machine, which carry between them the sliding member 44. Vertical motion is transmitted to this sliding member by means of the lug 43 by a small connecting rod to rocker arm 42 fast on shaft 41, which in turn is operated through a system 40 of rods and rocker arms from a cam 39 attached to the main shaft 10. The sliding member 44 has rigidly attached to it the arms 44¹ which operate through crossarm 21 the grid forks 22 and it further carries with it a pair of brushes 46 so placed as to brush the two faces of the mould when the arm is raised.

These brushes are so mounted that they may be adjusted outward as the bristles wear down from coming in contact with the hot mould faces. There are further provided, attached directly below the brushes, a couple of pipes 47 having small perforations, so arranged that compressed air may be blown on to the mould when required to aid the brushes in the work of cleaning the mould faces.

The mechanism for removing the grid after it has been freed from the forks 22 may be understood by reference to Figs. 1-7-8. This whole mechanism is located at position 5 in Fig. 1. Two bars 49 which do the actual catching of the plate are made to slide toward and away from the center of the machine by means of bell cranks 50¹ to which they are attached by connecting rods, the bell cranks in turn being operated by means of spring 50 and chain 48, driven in its turn by a second bell crank operated by cam 48¹ attached to the end of the main cam drum 11. Bell crank 50¹ is also connected by a second connecting rod to a pair of ratchet and pawl mechanisms 51, which in turn, by means of a sprocket wheel, operate collecting chains

52 upon which the plates are finally deposited as shown in Figs. 7 and 8. With the intermittent motion of chains 52 the plates are placed at regular intervals and carried back to rails 52¹ whence they are finally removed.

At position 6 the dusting of the mould takes place. It is well known in the art that the filling of a mould of the type under consideration with molten metal is very much facilitated, as well as the removal of the plate after filling, if the mould surfaces have been previously coated with a thin application of powder, talcum, or the like. In the present machine, this is accomplished by the mechanism shown especially in Figs. 9-10-11.

In Figs. 9 and 11 are shown two uprights 103 which carry between them a sliding piece 55 to which is imparted a vertical motion from cam 39 by means of connecting rods 53¹ and rocker arms 53 pivoted on shaft 41, shown in Figs. 3 and 4. Timing of this slide 55 is identical with that of slide 44 and arms 44¹ so that the dusting of one mould takes place at the same time as plate removal and brushing of another. Attached to the sliding frame 55 are a couple of pipes 56 carrying at their upper ends a number of small jets 58 projecting so as to impinge directly upon the two mould faces, as the slide ascends. At the lower end of the pipes 56 they are telescoped to the second pipes 57 each of which ends in a small chamber 67. Chamber 67 is formed by a counterbore in the plate 63 which is rigidly attached to the two fixed upright members. Under each of the cavities 67 of plate 63 is a movable disk 64 mounted on a vertical axis and shown better in Fig. 12. Through plate 63 there extend a second pair of tubes 60 extending upward to vessel 59 into which the dusting powder is initially introduced. The vertical shaft 61 with the paddle 62 on it turns slowly, keeping the powder in constant agitation, so that the pipe 60 is constantly full. The rotation of shaft 61, as of the two disks 64, is caused by means of a worm and gears, as shown. At 65 is shown a small tube or jet entering chamber 67 and this tube is connected by means of suitable piping to an air valve 66¹ shown in Fig. 3. The air valve, in turn, is operated by a cam 66 so that as jets or nozzles 58 enter between the two mould surfaces, on their upward motion, air is turned on and admitted to the space 67.

Each of the disks 64 is made with a series of slight depressions in its upper face, and as the disk rotates under the tube 60 which is tapered outwardly at the bottom so that the powder will always fall freely, these depressions become filled with powder. As soon, therefore, as the air is turned on to the jet 65 that part of the disk which is exposed to it in chamber 67 is blown clear, and the cloud of powder and air together are carried up through tubes 57 and 56 and the jets 58

whence it is discharged onto the mould surfaces. By means of this arrangement it is possible to distribute powder and dust with comparative uniformity over the whole surface of the mould, and it is also possible to deliver the same amount each time, since the air jet in each instance blows out the dust contained in a certain number of the depressions of the disk. The amount delivered may be varied at will by changing the speed of rotation of the disk 64 and by changing its position with regard to the opening 67 so that the opening will be nearer to or further from the center of the disk. The amount of powder can also, to a certain extent, be regulated by adjusting the amount of air introduced through the jet 65, but regulation of this sort is not so positive as by changing the disk in either of the ways above noted.

A further advantage of this arrangement of dusting the moulds consists in that fresh dust may be introduced into the reservoir 59 at any time, without necessitating interruption in the operation of the machine.

In position 1, molten metal is fed into the mould from pivoted tilting ladle 71. This ladle is operated by shaft 72, having universal joints 72¹ which in turn is actuated by cam 73 on cam shaft 30. The molten metal is introduced into ladle 71 by means of pump 29 and pipe 70, the latter preferably enlarged as shown at 101 so that, by the application of a gas flame or other heating means, the temperature of the metal may be controlled largely independently of the temperature of the pot 28. The plunger of pump 29 is actuated through a couple of connecting rods and a walking beam, by crank 30¹ mounted through a clutch shown in Fig. 6, upon a shaft 30. The clutch is arranged with jaws 32 which engage when in a certain predetermined position of the shaft only, so that if the lever 31 is operated so as to throw out the clutch, it will always come into action again, when the lever is released, at the correct position and in time with the rest of the machine. In case, through carelessness, the machine is operated while the metal in the pump is in solid condition and without throwing out the lever 31, the spring 33 will compress and allow the jaw 32 to slide free, thus saving the mechanism from breakage which would occur were the clutch positive. The adjustment shown at the left hand side of the walking beam is for the purpose of regulating the amount of lead delivered by the pump exactly as required. Owing to slight collection of dross within the pump or slight leakage of the valves, the amount of lead delivered is constantly subject to slight variation and this has to be corrected by adjusting the stroke of the pump, by the means shown.

In the casting of plate grids for storage batteries, for which the subject of this specification is especially adapted, it has been

found that very exact temperature regulation of the moulds is necessary, in order to produce perfect castings. Certain parts of the moulds tend to become overheated and
 5 require cooling, while other parts do not keep hot enough, unless heated. To furnish the necessary heat to the moulds, each half of each mould is provided with recesses 107 for electric heaters 117, attached at required points to
 10 the back of the mould, and fed by means of collector rings 108 mounted on the central part of the rotating table from an outside source of current, and individually regulated by rheostats or other controlling device
 15 mounted adjacent to the mould but not shown in the drawings. Wires not shown in the drawings connect the heaters with the collector rings 108.

To cool certain parts of the moulds which
 20 tend to become overheated, each half of each mould is drilled with passages 112 through which cooling air is forced.

The air for cooling the moulds is brought into the rotating table 12 by means of pipe
 25 109 which leads to circular groove 110, whence the air is distributed through pipes 111 to the moulds.

The pouring gate of each mould directly after filling with molten metal is cooled by
 30 pouring a definite quantity of water into it. This is done in position 2, by means of a plunger pump 35¹ operated by cam 35, delivering water through the stationary pipe 36 and nozzles, as shown in Figures 1 and 3.

35 I claim:

1. A casting machine adapted for making storage battery parts, comprising a rotating table and a plurality of moulds mounted thereon, a removing member mounted with
 40 each mould, and means for so actuating the removing member that when the mould is being filled, the removing member shall project into the mould opening so that the casting will attach itself thereto.

45 2. A casting machine adapted for making storage battery parts, comprising a rotating table and a plurality of moulds mounted thereon, a removing member mounted with each mould and adapted to become attached
 50 to the casting, means for actuating said member so that as the mould opens, the casting by a vibrating horizontal motion is caused to assume a position midway of the two mould parts.

55 3. A casting machine adapted for making storage battery parts, comprising a rotating table and a plurality of moulds mounted thereon, a removing member mounted with each mould and adapted to become attached
 60 to the casting, means for actuating said member so as to free the casting from both mould parts, a fixed member in suitable relation thereto, and means for raising said first mentioned removing member so that the pendent
 65 casting contacts with fixed member, and is

thereby freed from the removing member.

4. In a casting machine adapted for making parts for storage batteries, a melting pot, a pump for transferring molten metal from said pot to a ladle, a ladle adapted to feed
 70 each of a plurality of moulds in succession, a plurality of moulds mounted to rotate about a vertical axis one part of each of the moulds being radially movable with respect to the remainder of the mould, a cam to
 75 actuate the mould parts, and a fork mounted above and adjacent to each of the moulds for removing castings therefrom.

5. In a casting machine adapted for making parts for storage batteries, a melting pot, a pump for transferring molten metal from said pot to a ladle, a ladle adapted to feed
 80 each of a plurality of moulds in succession, a plurality of moulds mounted to rotate about a vertical axis, one part of each of the moulds being radially movable with respect to the remainder of the mould, a cam to actuate the mould parts, a fork mounted above
 85 and adjacent to each of the moulds for removing castings therefrom, said forks being radially movable and a cam to move said
 90 forks.

6. In a casting machine adapted for making parts for storage batteries, a melting pot, a pump for transferring molten metal from said pot to a ladle, a ladle adapted to feed
 95 each of a plurality of moulds in succession, a plurality of moulds mounted to rotate about a vertical axis, one part of each of the moulds being radially movable with respect to the remainder of the mould, a cam to actuate the mould parts, a fork mounted above
 100 and adjacent to each of the moulds, said forks being radially movable for removing castings therefrom and a cam to move said
 105 forks, the cam for the forks having notches which cause the forks to vibrate when commencing radial movement inward.

7. In a casting machine adapted for making parts for storage batteries, a table pivoted about a vertical axis, a cam for actuating the table, a plurality of moulds mounted
 110 on the table, the parting lines of the moulds extending in vertical planes, parts of the moulds being radially movable, a cam
 115 mounted on the table to effect such movement, a fork slidably mounted above and adjacent to each mould, said forks being radially movable and a cam mounted on the table
 120 to actuate said forks.

8. In a casting machine adapted for making parts for storage batteries, a table pivoted about a vertical axis, a cam for actuating the table, a plurality of moulds mounted
 125 on the table, the parting lines of the moulds extending in vertical planes, parts of the moulds being radially movable, a cam mounted on the table to effect such movement, a fork mounted slidably in a frame
 130 adjacent to and above each mould, means for

raising said forks in said frames, said forks being radially movable when raised and a cam for effecting such movement.

9. In a casting machine adapted for making parts for storage batteries, a table axially mounted, a plurality of moulds mounted thereon, a fork slidably mounted in a frame adjacent to and above each mould and projecting into the upper end of said mould to receive a casting thereon, said forks being radially movable, cams to cause such movement, cam followers attached to said forks, means for raising said forks in said frames, stationary forks attached to the tops of said frames, said movable forks being carried into close proximity with said stationary forks, when raised, in order to remove the castings carried by said movable forks and spring members on the prongs of said stationary forks to assist in the removal.

10. In a casting machine adapted for making parts for storage batteries, a melting pot, a pump for transferring molten metal from said pot to a ladle, a ladle adapted to feed each of a plurality of moulds in succession, a plurality of moulds mounted to rotate about a vertical axis having the parting lines of the moulds in vertical planes and one part of each of the moulds being radially movable with respect to the remainder of the mould, a cam shaft driven from a suitable source of power, means on the shaft to actuate the pump and a jaw clutch between the shaft and the means to prevent breakage of the mechanism when the pump is inoperable.

11. In a casting machine adapted for making storage battery parts, a table pivoted about a vertical axis, a plurality of moulds mounted upon said table, a cam for intermittently actuating said table, a brake member attached to said table, a stationary brake shoe and means to cause said brake to operate intermittently and to cooperate with said cam in bringing said table to rest after each movement.

12. In a casting machine adapted for making parts for storage batteries, a table pivoted about a vertical axis, a cam for actuating the table, a plurality of moulds mounted on the table, a brake shoe attached to the table and a stationary brake adapted to cooperate with the brake shoe to hold the machine against vibration.

13. In a casting machine adapted for making storage battery parts, comprising a rotating table and a plurality of moulds mounted thereon, a removing member mounted with each mould, a pair of fixed tracks adapted to support the casting when freed from the removing member.

14. In a casting machine adapted for making storage battery parts, comprising a rotating table and a plurality of moulds mounted thereon, a removing member mounted with each mould, a pair of fixed tracks with

a link belt chain mounted upon each, means for actuating such chains in step with rest of machine, and movable fingers working in said tracks, and means to actuate them so as to catch the castings, as dropped from removing member, and deposit them on said link belts.

15. In a casting machine adapted for making parts for storage batteries, a table axially mounted and having a plurality of moulds mounted thereon, means for lifting the castings out of said moulds, means for removing the castings from the lifting means, reciprocating arms to receive the castings upon said removal and an endless chain to carry the casting away from the machine.

16. In a casting machine adapted for making parts for storage batteries, a pair of arms mounted for reciprocating motion in a horizontal plane, said arms having a vertically raised portion at their ends nearest the machine, an endless chain lying in the horizontal plane of said arms and beneath the raised portion of said arms, a ratchet and pawl for actuating said endless chain and a cam for actuating both the arms and the chain from a source of power.

17. A casting machine adapted for making storage battery parts comprising a rotating table and a plurality of moulds mounted thereon, means for successively cleaning each mould, which consists of a pair of outwardly facing brushes adjustably mounted upon a vertical slide, and means for raising said slide and brushes between the two parts of the mould in its open position.

18. In a casting machine adapted for making parts for storage batteries, a table pivotally mounted and having a plurality of moulds thereon, a cam for actuating the table, a shaft for the cam, an additional cam on the shaft and a set of brushes mounted on a vertical slide and adapted to clean out the mould when lifted therebetween by the action of said additional cam.

19. In a casting machine adapted for making parts for storage batteries, a table pivotally mounted and having a plurality of moulds thereon, a cam for actuating the table, a shaft for the cam, an additional cam on the shaft, a set of brushes mounted on a vertical slide and adapted to clean out the mould when lifted therebetween by the action of said additional cam and means for blowing air on said moulds mounted with said brushes.

20. In a casting machine adapted for making storage battery parts, comprising a rotating table, and a plurality of moulds mounted thereon, means for successively cleaning each mould, which consists of a system of compressed air jets mounted upon a vertical slide, a control valve, and means for raising said slide and air system between the two parts of the mould in its open position.

21. A casting machine adapted for making

storage battery parts, comprising a rotating table and a plurality of moulds mounted thereon, a system for dusting said moulds, consisting of a compressed air line terminating in a set of telescopically slidably mounted nozzles; with means for actuating them between the mould faces, a cam operated valve for admitting air in step with motion of moulds, and means for introducing a definite quantity of suitable powder into said air system.

22. In a casting machine adapted for making storage battery parts, a rotating table and a plurality of moulds mounted thereon, a system for dusting said moulds comprising a rotating disk with indentations upon its upper surface, a fixed cover plate contacting therewith, a reservoir provided with a stirring paddle, delivering into a tube of larger area at the bottom than at top projecting through said cover plate, a cavity in said cover plate, an air jet projecting into said cavity, and, leading from said cavity, a telescoping tube terminating in series of jets adapted to pass between the parts of the moulds in succession.

23. In a casting machine adapted for making parts for storage batteries, a rotatably mounted table, a plurality of moulds mounted thereon, a pair of guides mounted under said moulds in one position of rotation, a bin mounted on said guides having a larger area at the bottom than at the top, a paddle movable in the bin, a pipe having a larger cross section at the bottom than at the top leading from the bottom of said bin, a disk at the bottom of said pipe having indentations therein, the radius of the disk being greater than the cross section of the pipe, a second pipe parallel to said first pipe having its bottom end facing said disk, a tube fitted into said second pipe adjacent said disk, a cross frame movable in said guides, a third pipe telescoping with said second pipe carried by said frame and nozzles carried by said third pipe, a source of compressed air attached to said tube, a valve in said air supply and a cam to actuate said valve.

24. In a casting machine adapted for making parts for storage batteries, a furnace, a pump therein, a ladle adapted to receive metal from said pump, a table pivoted about a vertical axis, a cam for actuating the table, a plurality of moulds mounted on the table, a cam shaft driven from a suitable source of power, a water supply pipe, a pump therein, a cam on the cam shaft adapted to actuate the pump and a nozzle for spraying the water on a mould.

25. In a casting machine adapted for making parts for storage batteries, a furnace for melting metal, a piston pump in said furnace and adapted to deliver molten metal to one of a plurality of moulds, a crank mounted upon a shaft to operate such pump in time

with movement of said moulds, and a combination manually spring actuated clutch, arranged so that it may be thrown out of engagement either by hand or by excessive resistance of the pump, and that it will in either case when released, go into operation again, correctly timed with the rest of the machine, and a lever for actuating said clutch by hand.

26. In combination, in a casting machine, a two part mould, means for opening and closing said mould, and means for applying pulverized lubricant to the mould faces when separated comprising a plurality of nozzles adapted to be introduced into the space between the mould faces, a supply pipe connected at one end to the nozzles and at the other end to an air chamber open at the bottom, a reservoir for the lubricant also open at the bottom on the same plane as the air chamber, and a revolving disk closing both open bottoms and having cavities in its upper surface adapted to transfer a definite amount of lubricant from the reservoir to the air chamber, and means for supplying intermittent air jets to the air chamber.

27. In combination, in a casting machine, a two part mould, and means for applying pulverized lubricant to the mould faces when separated, comprising a plurality of nozzles adapted to be introduced into the space between the mould faces, an air chamber connected to said nozzles, means for introducing a definite amount of lubricant into said air chamber, and means for supplying intermittent air jets to the air chamber.

28. In a casting machine adapted for making parts for storage batteries, a plurality of moulds mounted upon a revolving table, means for heating said moulds, and means for delivering a definitely controllable amount of water to each mould in succession, said means comprising a water pump, a shaft, a connection for actuating said pump from said shaft, and a pipe leading from said pump to a position above the path of rotation of said moulds.

29. In a casting machine adapted for making parts for storage batteries, a rotatable table, a plurality of moulds mounted thereon, a source of power for rotating said table, a shaft connected to said source of power, a water pump, a connection for actuating said water pump from said shaft, and a nozzle attached to said water pump and located over the path of rotation of said moulds.

30. In a fully automatic casting machine adapted for making parts for storage batteries including a melting pot, a pump, and a pouring ladle, a plurality of moulds mounted to rotate about a vertical axis, one part of each of the moulds being radially movable with respect to the remainder of the mould and a cam to actuate the mould parts, and a fork mounted above and ad-

adjacent to each of the moulds so as to receive the casting thereon and to support the casting upon its removal from the mold.

31. In a casting machine adapted for making parts for storage batteries including a melting pot, a pump, and a pouring ladle, a plurality of moulds mounted to rotate about a vertical axis, one part of each of the moulds being radially movable with respect to the remainder of the mould and a cam to actuate the mould parts, a fork mounted above and adjacent to each of the moulds, said forks being radially movable, and a cam to move said forks.

32. In a casting machine adapted for making parts for storage batteries including a melting pot, a pump, and a pouring ladle, a plurality of moulds mounted to rotate about a vertical axis, one part of each of the moulds being radially movable with respect to the remainder of the mould and a cam to actuate the mould parts, a fork mounted above and adjacent to each of the moulds, said forks being radially movable, and a cam to move said forks, the cam for the forks having notches which cause the forks to vibrate when commencing radial movement inward.

33. In a casting machine adapted for making parts for storage batteries including a melting pot, a pump and a pouring ladle, the combination of a plurality of moulds mounted to rotate about a vertical axis having the parting lines of the moulds in vertical planes and one part of each of the moulds being radially movable with respect to the remainder of the mould, a cam shaft driven from a suitable source of power, means on the shaft to actuate the pump and a jaw clutch between the shaft and the means to prevent breakage of the mechanism when the pump is inoperable.

34. In a casting machine, a revolving table, a plurality of moulds mounted thereon and having passage-ways perforated there-through, air conduits connected to said passage-ways, a water pump, a nozzle connected to said water pump and extending above the path of rotation of said moulds, and means for actuating said pump.

35. In a casting machine adapted for making parts for storage batteries, a plurality of molds mounted on a revolvable table, and means for accurately controlling the temperature of such molds, said means consisting of electric heaters located in recesses in said molds adjacent the edges of the castings in said molds, cold air passages in said molds passing adjacent the inlet passages for metal to said molds and passing through the center of said molds, and means for supplying water to the upper external surfaces of the inlet passages for metal to said molds and to the metal contained in said inlet passages.

36. In a casting machine adapted for mak-

ing parts for storage batteries including a melting pot, a pump, and a pouring ladle, a plurality of molds mounted to rotate about a vertical axis, one part of each of the molds being radially movable with respect to the remainder of the mold and a cam to actuate the mold parts, a fork mounted above and adjacent to each of the molds, said forks being movable, and means for moving said forks to loosen castings from the molds when the molds are opened.

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