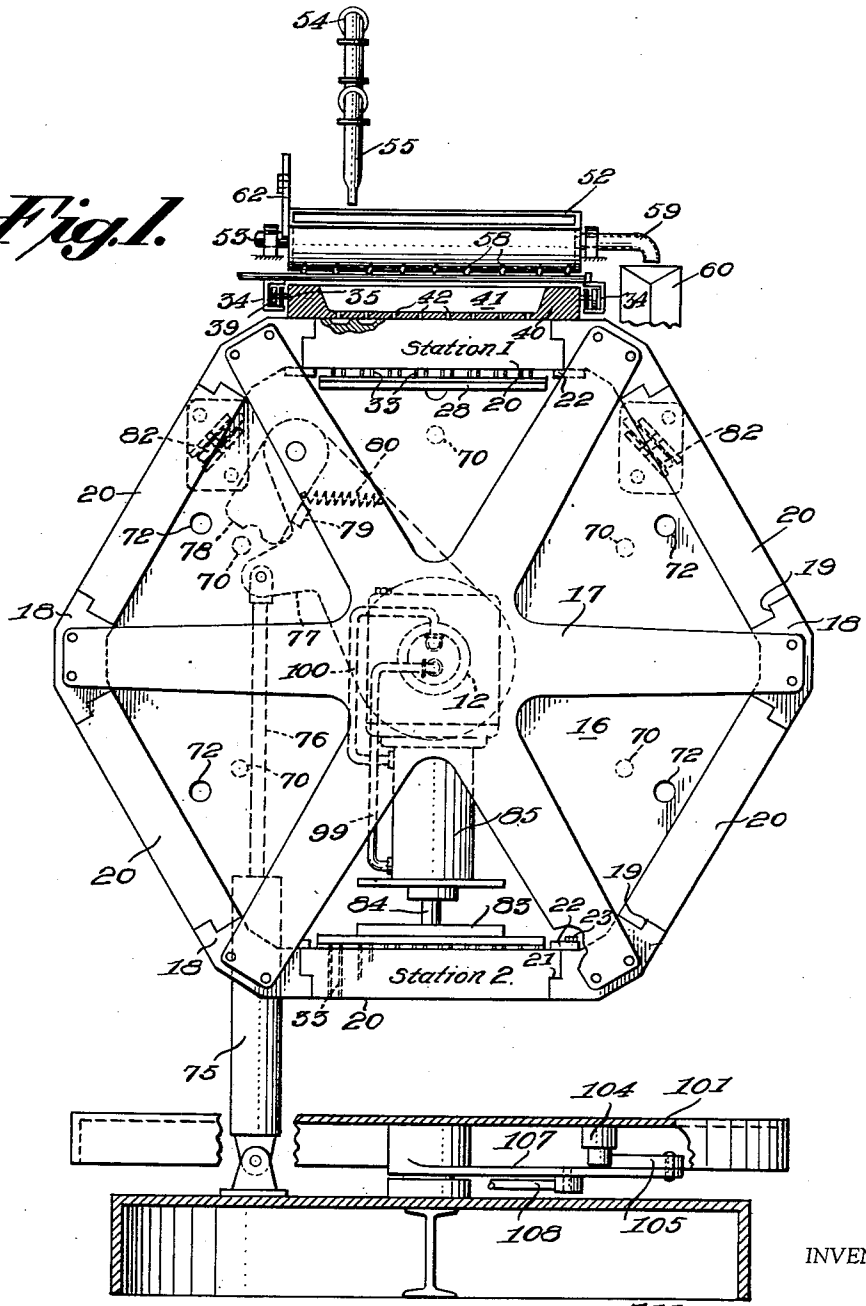
Sept. 11, 1956 A. B. VIETH 2,762,094

AUTOMATIC CASTING MACHINE

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Fig. 1.



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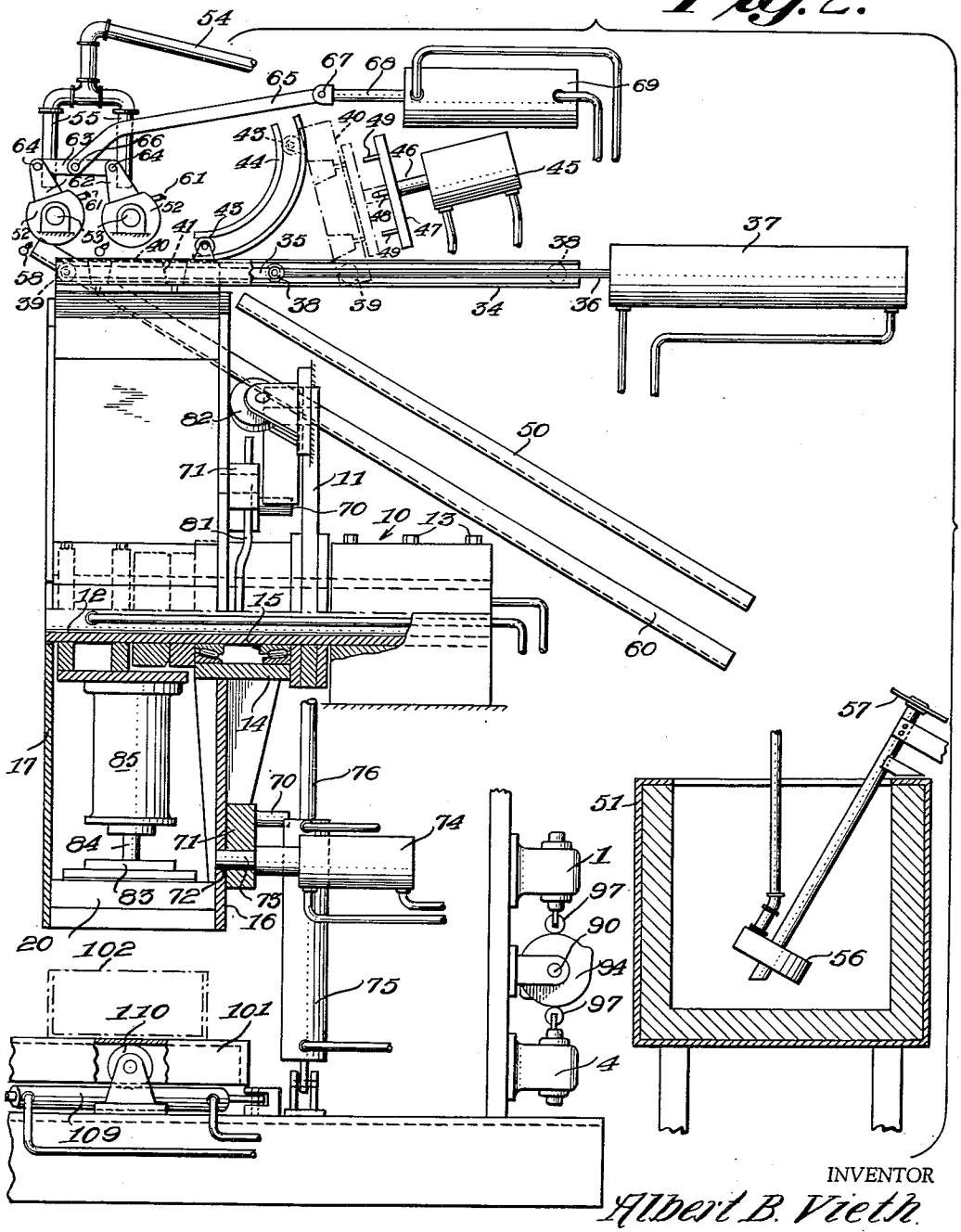
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AUTOMATIC CASTING MACHINE

Filed Sept. 30, 1954 4 Sheets-Sheet 2

Fig. 2.



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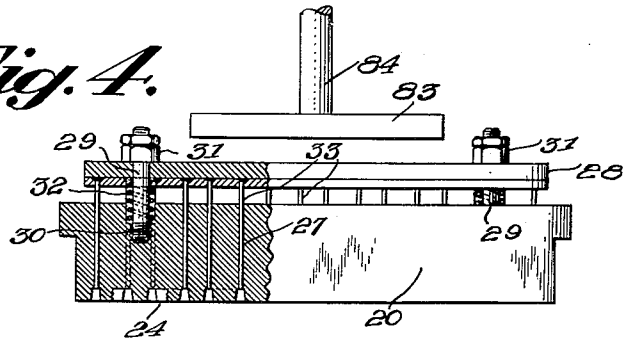
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AUTOMATIC CASTING MACHINE

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Fig. 4.



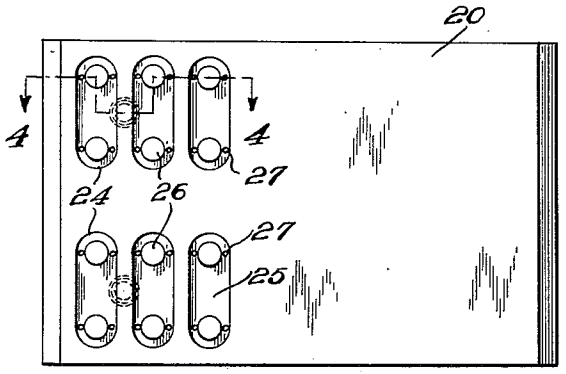


Fig. 5.

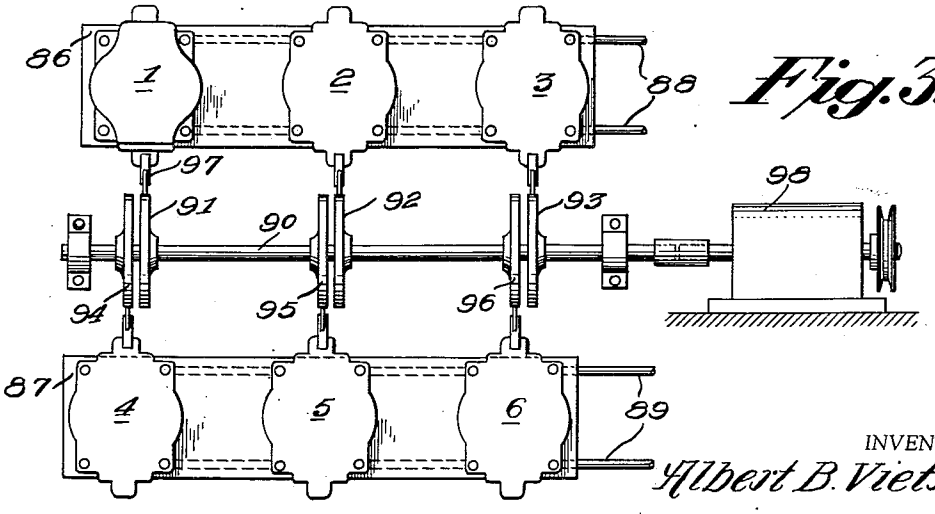


Fig. 3.

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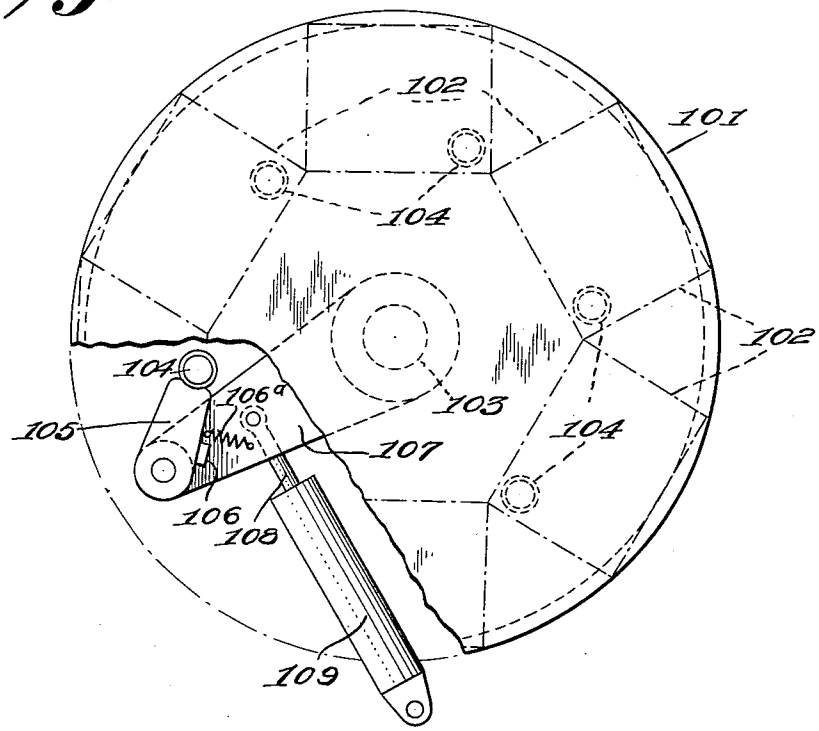
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AUTOMATIC CASTING MACHINE

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Fig. 6.



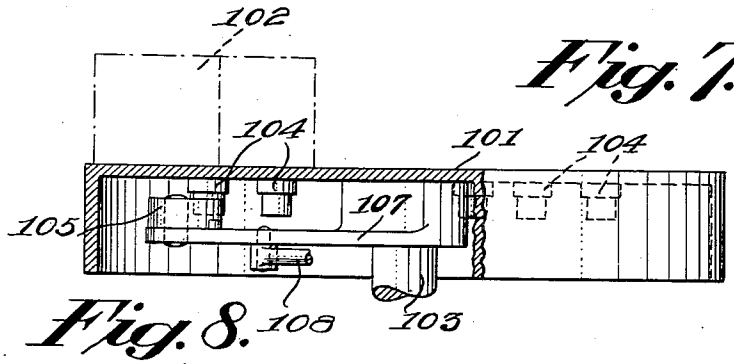
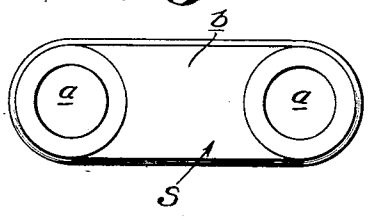


Fig. 7.

Fig. 8.



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2,762,094

AUTOMATIC CASTING MACHINE

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Application September 30, 1954, Serial No. 459,230

9 Claims. (Cl. 22—75)

This invention relates to an automatic casting machine, and an improved method of forming castings.

The invention is more particularly concerned with a machine and method for continuously casting battery post connecting straps.

A primary object of the invention is to provide an improved method of casting wherein a plurality of casting blocks are intermittently rotatable to and from a casting station and a casting ejecting station, and wherein the casting and ejecting operations at said stations are carried out simultaneously.

A further object of the invention is to provide a plurality of battery post connecting strap molds supported on a rotatable cage having provision for intermittent rotation through predetermined angular ranges, and wherein the molds are successively supplied with molten lead at a station in the path of rotation of said cage for formation of a group of straps, and wherein the successive molded groups of straps are simultaneously ejected at a second station in the path of rotation of the cage.

A still further object of the invention is to provide a battery post connecting strap molding structure of the character above referred to wherein the movements of all parts thereof is effected by hydraulic cylinders which are time controlled by a single rotatable cam shaft.

A still further object of the invention is to provide a molding structure of the character referred to wherein molten lead is supplied to the molds under pressure from a source and wherein all excess lead is automatically returned to said source thereby avoiding waste of lead which accounts for a large part of the price of a battery.

Other objects and advantages of the invention will become apparent in the course of the following detailed description, taken in connection with the accompanying drawings, wherein:

Figure 1 is an end view of the improved casting machine, partly in elevation and partly in vertical section.

Fig. 2 is a broken side view, partly in elevation and partly in vertical section.

Fig. 3 is a side elevational view of a group of cam-actuated cylinder control valves involved in the machine.

Fig. 4 is a view of one of the mold blocks, partly in elevation and partly in vertical section in the plane of line 4—4 on Fig. 5, the view further including a portion of the casting ejecting means.

Fig. 5 is a plan view of one of the mold blocks and a portion only of the mold cavities being shown.

Fig. 6 is a broken top plan view of the casting sorting table.

Fig. 7 is a view of the sorting table, partly in elevation and partly in vertical section.

Fig. 8 is a top plan view of one of the castings provided by the improved method as carried out by the improved machine.

Referring now in detail to the drawings, **10** designates a rigid support, and extending upwardly therefrom is a main frame **11**. A tubular shaft **12** has the rear end thereof disposed within the support **10** and is rigidly secured thereto as by bolts **13** extending into the support and having their inner ends engaged with the shaft.

A hub **14** is rotatably supported on the shaft **12** through intervening roller bearings **15**, and an inner plate **16** surrounds the hub and is rigidly connected thereto, as by welding.

An outer spoke-like plate **17** is disposed in axially spaced relation to the inner plate **16** and is rotatably supported on the shaft **12**.

Disposed between and rigidly secured to the plates **16** and **17** are a circumferential series of spacing blocks **18** and which, together with the plates **16** and **17**, provide a rotatable mold-supporting cage. The ends of blocks **18** are undercut in the provision of shoulders **19**.

An indicated in Fig. 1, the mold-supporting cage is generally polygonal in front elevational view and same is adapted to removably support mold blocks **20**. The mold blocks have shoulders **21** on their opposite ends which engage shoulders **19**, and the mold blocks are removably retained in the cage by means of latches **22** which are pivoted on the blocks **18**, as indicated at **23** in Fig. 1.

While the mold-supporting cage is shown in Fig. 1 as being of hexagonal form and thereby being capable of supporting six mold blocks, same may be formed to accommodate a greater or less number of mold blocks.

While the mold block supporting cage is supported for intermittent rotation, there is at each rest interval of the cage, a pair of vertically spaced parallel and horizontally disposed mold blocks **20**, with the upper one disposed at station No. 1 whereat the casting is poured, and with the lower one disposed at station No. 2, whereat the casting is ejected from the mold block.

Each mold block is provided with a plurality of cavities **24** which are of forms corresponding to the forms of the particular castings to be formed, and which in the present instance are battery post connecting straps, as indicated at S in Fig. 8. The straps, as is generally known, each comprises an elongated rounded ended body *b* having a post-receiving aperture *a* in each end thereof.

Accordingly, the cavities **24** each includes a depression **25** conforming to the body portion *b* and a cylindrical projection **26** at each end of the depression.

The block **20** is provided with a plurality of pairs of apertures **27** with those of each pair being disposed within a depression and diametrically of a projection **26**, as is clearly indicated in Fig. 5.

A casting ejecting means is supported by each block **20** (shown only at stations 1 and 2 in Fig. 1 of the drawings), and same comprises a plate **28** which is traversed by a pair of bolts **29** whose inner threaded ends **30** are secured within the block, and whose outer ends are provided with nuts **31** engaged with the outer face of the plate.

The plate **28** is normally yieldably maintained in spaced relation to the side of the block opposed to the side thereof which is provided with the cavities **24**, by means of a coil spring **32** surrounding each bolt and having its opposite ends reacting upon the block and plate.

The plate **28** is provided with a plurality of pairs of casting ejecting pins **33** conforming to the apertures **27** and movably disposed within same. The free ends of the pins are normally retracted to the bottom walls of the cavities **24** by the springs **32**, and the extent of retraction of the pins may be determined by adjustment of the nuts **31**.

With the cage at rest, as in Fig. 1, a casting pouring operation is carried out at station No. 1, while a casting is ejected at station No. 2, and the pouring operation and structure involved therein will now be described.

At station No. 1 is rigidly supported a pair of laterally opposed parallel tracks **34** on which is reciprocably supported a carriage **35** to the outer end of which is se-

cured the stem 36 of a hydraulic operating cylinder 37. The carriage is provided with a pair of advance track-engageable wheels 38 and a pair of rear track-engageable wheels 39, and the axial range of movement of the stem 36 is such that the carriage is moved from a position over the mold block 20 to a position substantially remote therefrom, as indicated in Fig. 2.

A gate 40 is disposed between the tracks 34 and same is provided with a pair of molten lead-receiving cavities 41, and the base of the gate is provided with a plurality of apertures 42 in communication with the mold block cavities 24 when the gate is in the pouring position, as in Fig. 2.

The lower surface of the gate 40 has a uniform firm contact with the upper face of the mold block 20 for a purpose as will later appear. The gate 40 is connected to the carriage 35 at the rear wheels 39 only, and the gate has vertical pivotal movement about the axes of such wheels.

The gate 40 is provided at its front end with a pair of wheels 43 which are in constant engagement with arcuate tracks 44, whereby upon movement of the carriage from its left-hand lead-pouring position to its extreme right-hand limit, the gate 40 will assume the position indicated by dot-and-dash lines in Fig. 2.

Upon the above described movement of the gate, the slugs extending through the apertures 42 therein are sheared from the casting S, due to the aforementioned contacting surfaces of the mold block and gate.

When the gate is in the dot-and-dash line position in Fig. 2, the cooled metal is ejected from the apertures 42 by the following means.

A hydraulic cylinder 45 is suitably supported and is provided with a piston stem 46, on the outer end of which is secured a plate 47 which is provided with a pilot pin 48 and a plurality of pins 49 which correspond in spacing to the apertures 42, and which upon entering same upon movement of plate 47 to the dot-and-dash line position in Fig. 2 eject the cooled metal from the apertures and which metal falls into a chute 50, whereby the ejected metal is returned to the melting pot 51.

While the gate 40 is in the ejecting position of Fig. 2, the mold block supporting cage is indexed through a predetermined angle to bring a succeeding mold block 20 into pouring position at station No. 1, it being understood that a casting immediately preceding has been ejected from the mold block at station No. 2. Thereafter, the gate 40 is returned by the cylinder 37 to a pouring position over the newly arrived mold block 20.

With the gate 40 returned to station No. 1 and in a position over the newly arrived mold block 20, the cavities 24 therein are filled with molten metal by the following described means.

A pair of ladles 52 are rotatably supported on suitable bearings 53 disposed above the gate 40 in its mold block engaging position, and molten lead is supplied to the ladles from the pot 51 through a main conduit 54 and a pair of branch conduits 55. The molten lead is forced through the conduits by means of a pump 56 disposed within the pot 51 and which is driven by a motor-operated means 57.

Suitable heating means 58 are disposed beneath the ladles for maintaining the lead in a molten condition.

The ladles 52 are shown in their normal positions in Fig. 2 and same are adapted to contain a sufficient volume of molten lead to fill the cavities 24 in a mold block with a predetermined excess, which is governed by an overflow pipe 59 which communicates with a chute 60 leading to the pot 51.

The ladles 52 are provided with pouring spouts 61 which are positioned over the gate cavities 41 when the ladles are rotated clockwise in Fig. 2.

In order to rotate the ladles about their bearings 53 each thereof is provided with an upwardly projecting

arm 62. A link 63 has the opposite ends thereof pivotally connected to the upper ends of arms 62, as at 64, and an elongated bar 65 has one end thereof pivotally connected to the link at a point intermediate pivots 64, as indicated at 66. The opposite end of bar 65 is pivotally connected at 67 to the piston rod 68 projecting from the hydraulic operating cylinder 69.

After pouring molten lead into the gate 40 and mold block 20, the gate is again moved to the ejecting position shown in Fig. 2 and the rotatable cage is again indexed to bring another empty mold block into pouring position at station No. 1 while a casting is being simultaneously ejected at station No. 2.

The hexagonal cage illustrated will require an angular movement of 60° in each indexing thereof between successive simultaneous casting, pouring and casting ejecting operations.

The cage is periodically rotated counter-clockwise or indexed by the following means. The plate 16 is provided with six index pins 70 which project rearwardly from blocks 71 on the back wall of the plate 16. The plate 16 is further provided with six locking pin receiving holes 72 which also extend through the blocks 71 and which are in radial lines with pins 70 disposed intermediate the spokes 17, as indicated in Fig. 1.

When the rotatable mold block supporting cage is stationary with any one of the six mold blocks at station No. 1 which is in pouring position, a locking pin 73 is disposed within one of the holes 72, as indicated in Fig. 2, and such pin is withdrawn to permit movement of the rotatable body. The locking pin 73 is operated by a hydraulic cylinder 74. With the pin 73 withdrawn the hydraulic cylinder 75, through the rod 76, actuates the member 77 to which is pivoted a pin-engaging latch 78 normally engaged with a stop 79 by a spring 80, and which latch engages pin 70 and thereby imparts rotation to the mold-block supporting cage through an angle whereby another hole 72 is brought into axial alignment with the locking pin 73, whereupon cylinder 74 is actuated to move pin 73 into the aligned hole and retain the rotatable cage in fixed position. The mold blocks will be loaded between stations Nos. 1 and 2 in the direction of rotation of the mold block supporting cage and the mold blocks between station No. 2 and station No. 1 will be empty.

A segmental flat-faced support 81 is disposed rearwardly of plate 16 and upon which the locking pin 73 can bear if any unwanted movement of the pin occurs during the indexing cycle. This segmental support extends in a circular fashion completely around the rear face of plate 16. Actually, there are six flat track segments, each of which extends between each block containing holes 72. These parts guarantee that the locking pin 73 will always be in correct position ready to be dropped into the locking holes 72.

A wheel 82 is rotatably supported by the frame 11 at each side of the vertical center plane and engages the rear face of plate 16 for supporting the cage against the thrust resulting from the shearing action of cage 40.

The means for ejecting the castings from the successive mold blocks at station No. 2 comprises a plate 83 on the end of a piston rod 84 of a hydraulic operating cylinder 85. The plate 83 upon outward movement of rod 84 moves the plate 28 inwardly against the action of springs 32, whereby the pins 33 eject the castings from the cavities 24.

Upon withdrawal of the rod 84 the springs 32 function to automatically retract the pins 33.

Means are provided for operating the several hydraulic cylinders in proper sequence, and such means, in a preferred embodiment thereof, is shown in Figs. 2 and 3 as including six valves designated as 1, 2, 3, 4, 5 and 6 (Fig. 3).

The valves 1, 2 and 3 are secured to a support 86, and

the valves 4, 5 and 6 are secured to a support 87 which is parallel with and in spaced relation to the support 86. The valves 1, 2 and 3 are provided with fluid supply conduits 88, and the valves 4, 5 and 6 are provided with fluid supply conduits 89.

Rotatably supported intermediate the supports 86 and 87 is a cam shaft 90 to which are rigidly secured six cams designated as 91 to 96, inclusive, and which cams cooperate with rollers 97 on the ends of the several valve stems. The cam shaft 90 is operated by a motor-driven reduction unit 98.

The several cams 91 to 96 are so disposed that upon rotation of the cam shaft 90, valve 1 will render the cylinder 75 operative to rotate or index the mold block supporting cage, valve 2 will render the cylinder 74 operative to lock the cage in stationary position, valve 3 will render the cylinder 69 operative to pivot the ladles 52 into pouring position, valve 4 will render the cylinder 37 operative to move the gate 40 to ejecting position, valve 5 will render the cylinder 45 operative to eject the slugs from the gate 40, and valve 6 will render the cylinder 85 operative to eject the castings from a mold block 20.

While the various conduits between the several valves and the respective cylinders controlled thereby are not shown, such should be obvious to one skilled in the art. It may, however, be noted at this point that the conduits 99 and 100 for the cylinder 85 extend through the tubular shaft 12.

The invention further includes a casting sorting table 101 which is adapted to carry a plurality of casting receiving pans 102, one for each mold block 20, and the table is supported for increment rotation about a shaft 103 beneath station No. 2, and which is so disposed that the pans 102 will pass directly beneath the block 20 from which castings are being ejected, and each pan will receive castings from the same mold block. Six indexing pins 104 project downwardly from the table top and are successively engaged by an indexing pawl 105 which is normally drawn into engagement with a stop 106 on an arm 107 rotatable about the shaft 103 by a spring 106a.

The arm 107 is moved by the rod 108 of an operating cylinder 109 which is controlled by the valve 6, which also controls the casting ejecting cylinder 85.

The table 101 may be rotatable on one or more rollers 110, as indicated in Fig. 2.

From the above disclosure, it will be seen that the present invention provides a machine for carrying out an improved method of automatic casting, and wherein the various operations involved therein are controlled by fluid cylinders which are rendered operative in proper sequence by valves operated by a common cam shaft.

While I have disclosed my invention in accordance with a single specific structural embodiment thereof, such is to be considered as illustrative only and not restrictive, the scope of the invention being defined in the sub-joined claims.

What I claim and desire to secure by United States Letters Patent is:

1. An article casting machine comprising a metal pouring station, a casting ejecting station, a rotatably mounted cage disposed between the pouring and casting ejecting stations, a plurality of mold blocks rigidly supported by the cage in uniform circumferentially spaced relation, means for imparting intermittent step-by-step rotation to the cage to position a mold block at each of said stations at each quiescent period of the cage, means intermittently operative to pour molten metal into the block at said pouring station, means operative simultaneously with the last means for ejecting castings from the block at said ejecting station, and means for effecting said step-by-step rotation of the cage, pouring of the molten metal and ejecting the castings in timed sequence, said rotatably mounted cage being provided with a circumferential series of indexing pins equal in number to and corresponding in circumferential spacing to that of the mold blocks, and wherein said cage is further provided with a circumferential series of locking pin-receiving apertures corresponding in number to and corresponding in circumferential spacing to that of the mold blocks, valve-controlled pneumatic means engageable with successive pins for indexing the cage through said predetermined angles, and a pneumatically operable locking pin engageable within the successive apertures for retaining the cage in fixed position while one block is being poured and the castings ejected from another block.

2. An article casting machine comprising a metal pouring station, a casting ejecting station, a rotatably mounted cage disposed between the pouring and casting ejecting stations, a plurality of mold blocks rigidly supported by the cage in uniform circumferentially spaced relation, means for imparting intermittent step-by-step rotation to the cage to position a mold block at each of said stations at each quiescent period of the cage, means intermittently operative to pour molten metal into the block at said pouring station, means operative simultaneously with the last means for ejecting castings from the block at said ejecting station, and means for effecting said step-by-step rotation of the cage, pouring of the molten metal and ejecting the castings in timed sequence, a horizontal track disposed above the cage at said pouring station, and extending laterally thereof and therefrom, a gate having molten metal receiving cavities therein and a plurality of apertures in its base communicating with said cavities, a carriage having track-engageable wheel at each end thereof, said gate having one end thereof pivotally connected to the carriage axially of the wheels at one end thereof, an arcuate track above said horizontal track, said gate having wheels at its top and adjacent one end thereof movable within said curved track, and hydraulically operable means for moving said carriage horizontally on said first track with a combined horizontal and vertical movement of the gate whereby the gate is alternately positioned above a mold block and disposed in an angular position for ejection of metal slugs from the apertures therein.

3. The structure according to claim 2, together with a lead pot, a pair of ladles rotatably supported above said horizontal track and having pouring spouts, hydraulically operable means for rotating said ladles to position the spouts above the cavities in said gate, and means for pumping molten metal from said pot into said ladles.

4. An article casting machine comprising a cage rotatably mounted on a horizontal axis, a hydraulic cylinder operative to impart intermittent rotation to the cage, a plurality of mold blocks supported by said cage in circumferentially spaced relation, a metal pouring station at the top of said cage, a casting ejecting station at the bottom of said cage, molten lead ladles pivotally supported adjacent said pouring station, pneumatic means for tilting said ladles for pouring molten lead into a mold block while at rest at said pouring station, means operable at said pouring station to shear excess metal from the poured mold block, and means operable at the ejecting station to eject the castings therefrom while the block at the pouring station is being poured.

5. The structure according to claim 4, wherein said mold blocks are removably supported within said cage.

6. An article casting machine comprising a cage rotatable about a horizontal axis, a plurality of mold blocks supported by said cage in circumferentially spaced relation, a metal pouring station at the top of said cage, a casting ejecting station at the bottom of said cage, means to intermittently rotate said cage to bring successive mold blocks into position at said metal-pouring station and said casting ejecting station, means to lock said cage with said blocks in said position, means to pour molten metal into the mold block at said pouring station, means to shear excess metal from the mold block, means to eject the castings from the block at said ejecting station, means to collect the individual castings ejected from the several mold blocks, and cam-operated valves for actuating all of said means in timed sequence of operation.

7. An article casting machine comprising a vertically disposed cage supported for rotation about a horizontal axis, a plurality of elongated mold blocks rigidly supported by the cage in uniform circumferentially spaced relation, a molten metal gate supported for movement into pouring position above the uppermost mold block and for movement to a metal slug ejecting position, metal pouring ladles pivotally supported above said gate in its pouring position, means for ejecting slugs from said gate when in said slug-ejecting position, means disposed within said cage for ejecting castings from each lowermost mold block, and cam-controlled means for rotating said cage step-by-step with quiescent periods wherein a mold block is in metal-pouring position and a second mold block is in casting ejecting position, moving said gate to metal receiving position, tilting said ladles to metal pouring position, ejecting castings from the lowermost mold block, and moving said gate from metal receiving position and ejecting the slugs therefrom.

8. An article casting machine comprising a rigid support, a vertically disposed cage rotatably carried by said support and comprising inner and outer vertically disposed plates of uniform circumferential contour, the outer plate comprising a plurality of spokes, spacing blocks disposed between said plates in equiangular spaced relation at the outer ends of said spokes and secured thereto, an elongated one-piece mold block of rectangular cross-section rigidly supported between each two spacing blocks, said spacing blocks each having a radially outer wall at each side of the respective spoke in angular relation to each other and to the spoke and which walls are alined with the radially outer walls of said mold blocks, a metal pouring station disposed vertically above said cage and comprising a gate having a bottom wall conforming to the radially outer wall of each mold block and adjacent ends of a pair of spacing blocks, a casting ejecting station vertically beneath said cage, and sequentially operable means for rotating said cage step-by-step to simultaneously position a mold block beneath said gate at said pouring station and a poured block at said casting ejecting station.

9. An article casting machine according to claim 8, wherein said spacing blocks and said mold blocks are provided with overlapping shoulders for restraining radial outward movement of said mold blocks, and latch means pivotally supported on said spacing blocks and being swingable to positions overlying the radially inner walls of said mold blocks for removably retaining same within said cage.

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