May 2, 1939. G. A. DONATH 2,156,379

AUTOMATIC BATTERY GRID CASTING AND TRIMMING MACHINE

Filed April 5, 1937 3 Sheets-Sheet 1

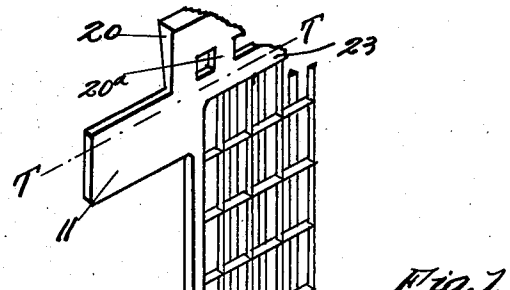



Fig. 1.

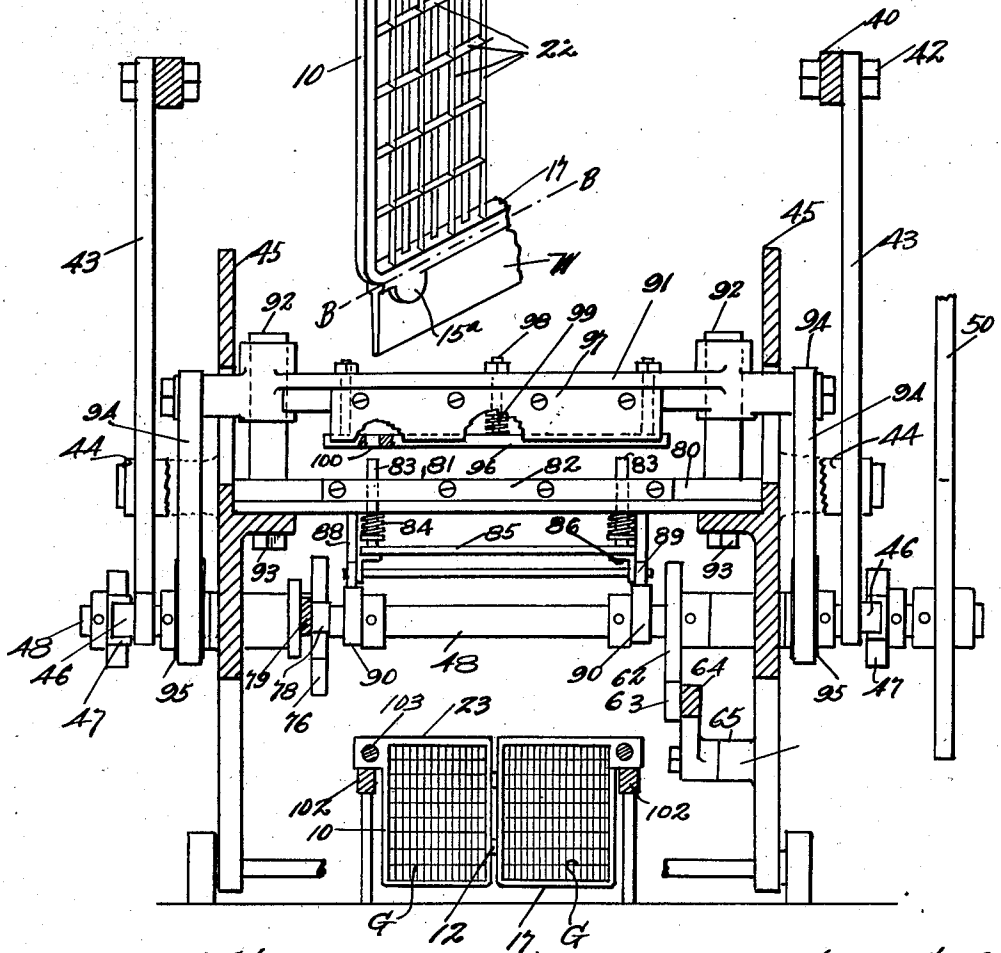



Fig. 2.

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AUTOMATIC BATTERY GRID CASTING AND TRIMMING MACHINE

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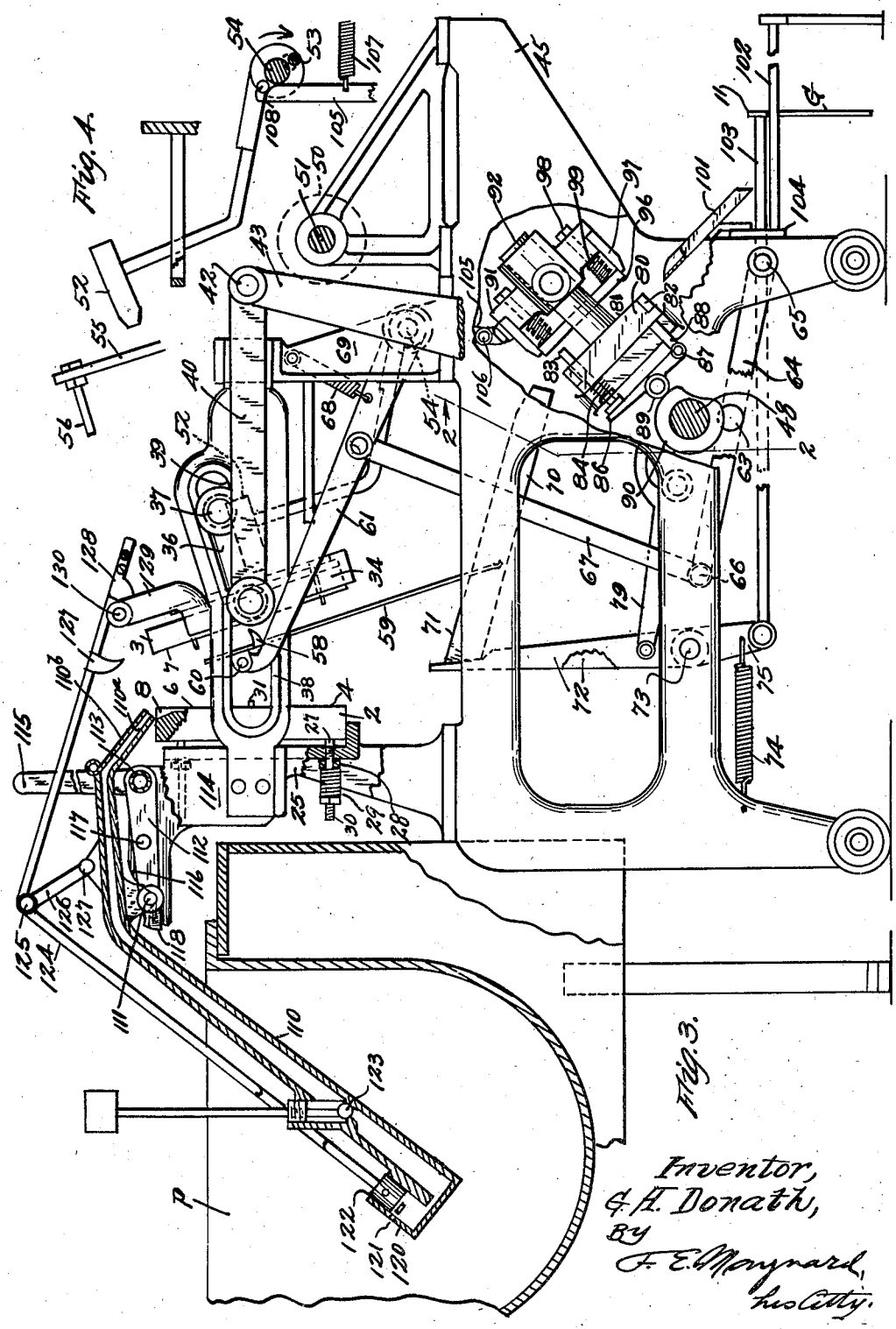


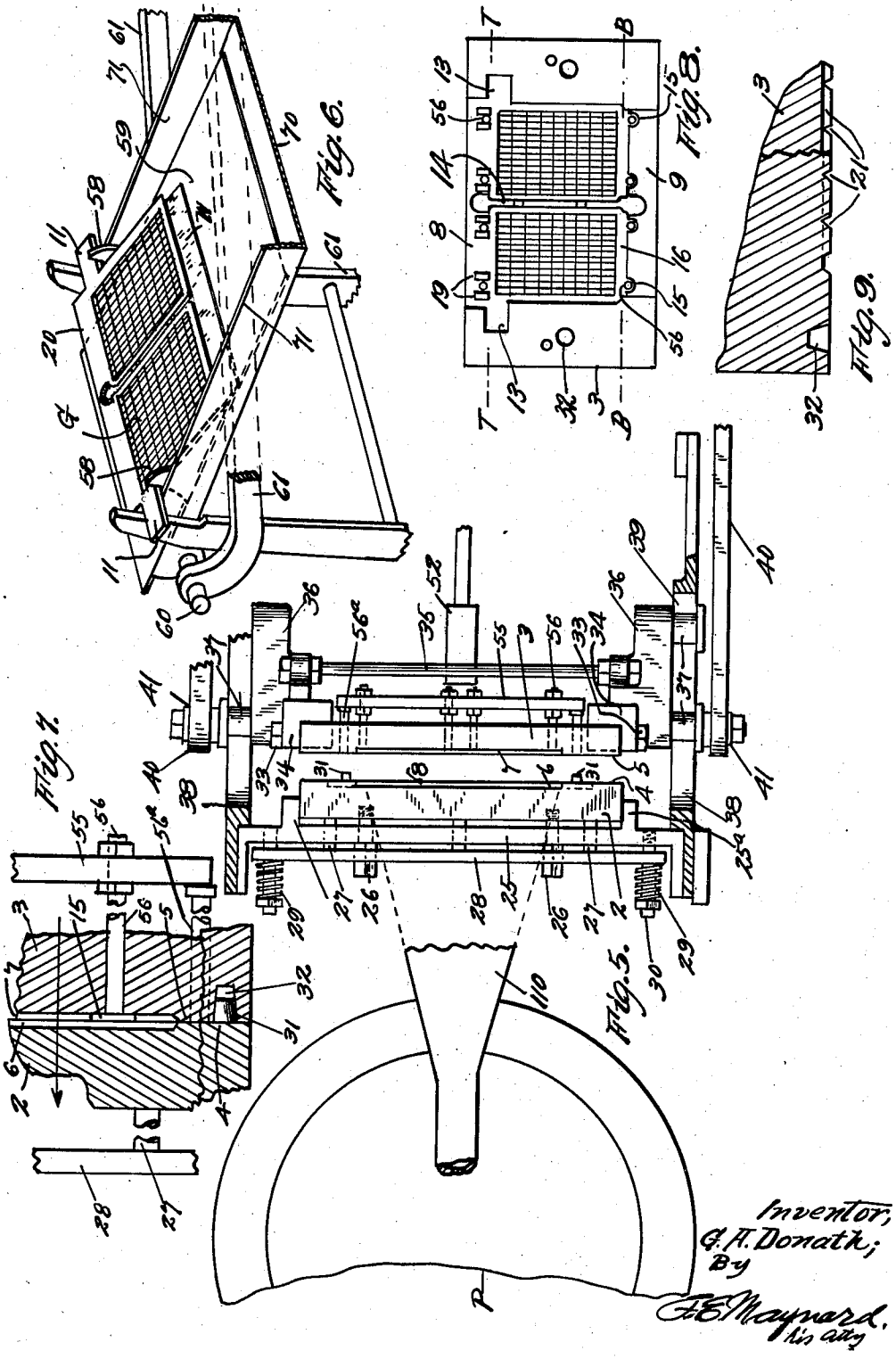
Fig. 3.

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AUTOMATIC BATTERY GRID CASTING AND TRIMMING MACHINE

Filed April 5, 1937 3 Sheets-Sheet 3



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2,156,379

# UNITED STATES PATENT OFFICE

2,156,379

## AUTOMATIC BATTERY GRID CASTING AND TRIMMING MACHINE

George A. Donath, Los Angeles, Calif.

Application April 5, 1937, Serial No. 135,125

10 Claims. (Cl. 29—2)

This invention is a machine having a power driven molding or casting means for grids for storage batteries and for the automatic discharge and transfer of the cast grids from the mold to an incorporated, automatic trimming means, and to a combined grid rack.

An object of the invention is to provide a self-contained machine power driven to greatly facilitate quantity production of lead grids for storage batteries, or other desired flat-form products, or other pieces of various structural form. An object is to produce finished, that is, trimmed grids ready for application of the plastic oxide, with the minimum of hand labor in the making.

A further object is to provide a simple, compact, practical, low-cost, substantial and reliable power machine for economical production costs. Another object is to provide a machine which will enable uninterrupted operation for the repeated, rapid use of a mold mechanism for successive reception of molten charges of lead, and the effective and highly satisfactory casting of each charge to form a grid which is singularly perfect in structure, that is, free from objectional defects in these grill or lattice form of plates.

Also an object is to provide, in one machine, for the step of performing such trimming of the castings as may be needed as they issue from the mold. A purpose is to provide an automatic-action mold; that is, a mold comprising coordinate sections having relational movement and means to actuate the same for casting and discharge sequences.

Another purpose is to provide for the automatic pumping of the molten lead to the mold matrix chamber.

The invention consists of certain advancements in this art as set forth in the ensuing disclosure and having, with the above, additional objects, and advantages, as hereinafter developed, and whose construction, combination and details of means, and the manner of operation, and the steps of the process, will be made manifest in the description of the annexed illustrative apparatus; it being understood that modifications, variations and adaptations may be resorted to within the scope, principle and spirit of the invention as it is more directly claimed hereinbelow.

Fig. 1 is a perspective of a fragment of a grilled grid. Fig. 2 is a sectional elevation of the machine; transversely on an oblique plane about parallel to and in front of trimming mechanism, and the trimming mechanism being in open position. Fig. 3 is a broken-away side elevation; showing the mold and the trimming die open. Fig. 4 is a detail of the cast ejecting hammer. Fig. 5 is a plan of the open mold structure. Fig. 6 is a perspective of a fragment of the grid control and transfer means. Fig. 7 is a sectional plan of a fragment of the closed mold sections and ejector means. Fig. 8 is a face view of the movable section to show its matrix and Fig. 9 is a full-size section of a fragment of the same to show the matrix recess.

A pair of mold blocks or sections 2 and 3, Fig. 5, are provided with plane meeting faces 4 and 5 in each of which is provided a shallow recess 6—7 forming a half chamber which is completed when the sections 2—3 are closed face to face. It is understood that these sections are readily interchangeable in the machine for casting various forms of products; especially flat pieces. The mold here is designed for grid casts, Fig. 1, which are quite thin and have vertical side bars 10 with lateral ears 11 at the top corners; each cast here including a pair of grids G connected by central webs 12, Fig. 2.

The mold has a sprue mouth 8, Fig. 3, and a longitudinal bottom vent 9, lateral lug pockets 13, and a central parting strip 14, Fig. 8, to separate the near grid bars of the twin grid recesses. To insure that each successive cast will positively adhere to the movable section 3 this is devised with a set of sockets 15, Figs. 7 and 8, positioned along the bottom channel 16 in which the bottom bar 17 of the grid cast is molded along the top of the foot vent 9, this being somewhat thinner than the bar 17, Fig. 1. Along the sprue mouth 8 is a series of small fillers 19 about which the dead-head 20 of the cast G will cling to insure that the cast will come away from the stationary or base mold part 2; the features 15—19 being omitted therefrom.

Each mold section face is milled or cut out as desired to provide interstices 21, Fig. 9, for crossed lattice filaments 22 of the grid G.

The outer-most side bars 10 of a twin-grid cast are true-finished in the mold but the top dead-head 20 is cut off along the line T—T to form a finished top bar 23, Fig. 2, and the vent waste W is cut off along the line B—B, Fig. 1, to trim the bottom bar 17, parallel with the top bar 23. No other trimming is required.

The section 2 of the mold is movably mounted in vertical position in a transverse wall 25 of a suitable frame and has fixed guide and stop horns 26 Fig. 5, sliding through the wall and abutting it to limit the out-push effort of a set of push pins 27 working through the wall and confined between the back of the section 2 and the near

face of a universal bar 28 which seats on expansion springs 29 mounted on screw posts 30 in the wall 25. These springs form a yieldable support for the bar 28 and the push pins 27 which press the section 2 out to the normal casting plane, as determined by the stop horns 26. The section 2 works between fixed, side guide ribs 25a of the wall 25. The face 4 of the section 2 has accurate register with its cooperative section 3 by means of dowel pins 31 and their holes 32 in mold part 3.

Mold section 3 is bolted at 33 in side pillars 34 which are cross-connected, as by a rod 35, and have parallel foot pieces 36 provided with pairs of rollers 37 at right angles to the pillars. This assembly constitutes a mold carriage which is slidable, to and from the base mold section 2, in frame runways which have horizontal portions 38 to bring the carriage mold 3 vertically true with the base mold 2 for casting function, and have upwardly inclined rear portions 39 whereby to tilt the matrix face of the section 3 outwardly at the bottom, Fig. 3, to facilitate shedding of the adhering cast down onto a coordinate transfer means, later described.

The carriage 36 is reciprocated by suitable means shown here as including a pair of links 40 connected at 41 thereto and at 42 to the upper ends of rocker levers 43 pivoted at 44 on opposite, side frame parts 45, Fig. 2. The lower ends of the levers 43 have cam rollers 46 engaged, controlled and operated by suitable cams 47, a right and a left of which are fixed on a cam shaft 48. The cams 47 function to reciprocate the carriage mold inward to close the mold parts, then dwell while molten metal is poured into the matrix and for a cooling period, and then to retract the mold block 3 to the open inclined position Fig. 3, for a period long enough for its cast to be ejected (as later described) all in one turn of the cam shaft 48, which is continuously turning at a desired speed for a process cycle.

The shaft 48 is motivated as by a suitable reduction connection 50 from a power driven shaft 51.

It will be seen that when the carriage block 3 is advanced into plane against the base mold 2 the latter block will compensate yieldably on its springs 29 and the mold faces 4—5 will accurately meet as the sections 2—3 dowel together.

Just as the mold section 3 is moved outward to the limit with the hardened cast adhering to its matrix face an ejector hammer 52 is tripped by a spur 53, Fig. 4, which is fixed to a shaft 54 on which the hammer is loosely pivoted. As the hammer falls freely it impinges against the back of an ejector plate 55 having upper and lower sets of ejector pins 56 slidably passing through the section 3 at such positions as to hit spots 15a, on the grid, formed at the sockets 15, Fig. 8, in the matrix, and at 20a, Fig. 1, in the dead-head 20. Thus the cast is dislodged and falls onto and between a pair of hooks 58 fixed at the sides of a receiver leaf 59 which is hinged at its upper end on a cross-bar 60 which is mounted in the upper ends of a pair of arms 61 which are fixed on the shaft 54 so that this is oscillated, just as the arms 61 are moved up to position under the mold 3, Fig. 3, to place the leaf hooks 58 under the open mold 3 to receive the ejected cast.

The width of the said cast is such that it will hang on the hooks 58, and between them, while the leaf 59 and arms 61 are being lowered by action of their control cam 62, Fig. 2. This cam is fixed on shaft 48 and engages a roller 63 on a lever 64 which is pivoted on one end at 65; its swinging end being connected at 66 to an upstanding link 67, Fig. 3, attaching to one arm 61. A spring 68 anchored to frame part 69 acts to pull up the levers 61 and lever 64 and hold roller 63 against its actuating cam 62.

The lower end of the leaf 59 slides on the bottom of a trough 70 fixed in the frame structure and a grid dislodged by the hammer 52 from the mold 3 is caught on the hooks 58 at the top of the leaf. Cam 62 now acts to depress the connected levers 64—61 and the hooks 58 move down between the side flanges 71 of the trough 70 and the lugs 11 of the grid are deposited on the said flanges in a position just in front of a pair of upright transfer arms 72 fixed on a rock shaft 73 mounted in the main frame, Fig. 3. As soon as the grid hooks 11 rest on the trough flanges 71 the arms 72 are pulled forward by a spring 74 connected to a lever 75 of shaft 73, against a cam 76 supporting a roller 78, Fig. 2, carried by a thrust link 79 connected to one of the levers 72. Cam 76 is contoured to time the motion of the pusher arms 72 so as to advance the interposed grid cast along the trough 70 down into a now open trimming mechanism arranged at the discharge, lower end of the transfer trough.

The trimming means includes a transverse, stationary platen 80 mounted on and between the frame sides 45 in an inclined position from the foot of the trough and presenting a plane, top face 81 which has longitudinal, side die inserts 82 spaced a distance from top corner to bottom corner to fix the cut width of a grid cast between lines T—T and B—B.

As a cast grid is pushed from the trough 70 the grid falls onto the platen face 81 and slides against the lug stopping posts 83, Fig. 2, which are slidably mounted in the platen 80 and are pressed downward by their springs 84, on to a bench 85 fixed on the outer ends of bracket arms 86 pivoted at 87 on legs 88 fixed on the bottom of the platen block 80. The brackets 86 have rollers 89 pressed by the springs 84 to cams 90, fixed on the cam shaft 48.

Cooperative with the fixed platen 80 is a shearing head and cast flattener. This includes a transverse slide body 91 having sliding support on columns 92 preferably fixed to the ends of the platen block 80; this assembly being removably bolted at 93 to the frame parts 45, whereby to provide for ready interchange of this mechanism as a unit, for variation of machine products. The body 91 is attached at its ends to connecting rods 94 of eccentrics 95 fixed to the cam shaft 48.

When the grid cast has lodged on the platen posts 83 the trimming head or body 91 moves down and thrusts a presser plate 96 down onto the presented grid-cast on face 81 and the body 91 continues its down stroke so as to move its attached punch or shearing strips 97 against the grid along lines T—T and B—B to shear off the excess dead-head 20 and the vent plug W along the fixed die bars 82. The presser plate 96 has fixed bolts 98 slidable in holes therefor in the slide body 91 and is yieldably out-thrust by suitable springs 99. The presser plate 96 is apertured at 100 for clearance of the adjacent lug receiving posts 83 of the platen. The closed presser plate 96 flattens the interposed grid on the platen 80 and the grid is trimmed at the same time. The pusher or transfer arms 72 are now moved out to the far end of the trough 70 for another grid cast.

Meanwhile the lug stops 83 of the platen are retracted by their springs 84 as the cams 90 permit so that when the trimming head is moved out by its eccentrics 95 the flattened and trimmed

grid cast slips from the platen 80 and the cast falls onto an inclined chute 101 and thence to a pair of spaced rack rails 102 on which the grids hang by their lugs 11, Fig. 2. The grids hanging on the rack are advanced as a lot by a packer including a pair of ram rods 103 working in a cross-plate 104 of the frame and connected to the shaft 73, Fig. 3, as by arms 75.

The hammer 52 is restored to a ready position by means of a jack post 105, pivotally connected at 106 to the trimmer body 91, when the latter moves outward. The jack 105 is pulled by a spring 107 against the shaft 54 so as to pass under a strike pin 108 fixed in the hub of the hammer 52 on the shaft 54, Fig. 4. While the hammer is elevated by the upwardly moved jack 105 the rock shaft 54 is turned (note arrow, Fig. 4) by the upwardly moving transfer levers 61 so that the trip spur fixed to the shaft 54 will engage the said jack 105 and push it from the strike pin 108 and allow the hammer to fall in the regular cycle sequence.

Thus, the casting step, the transferring, the platen feeding, the flattening and trimming, the platen clearing, and the racking functions are all closely and correctly timed by control means all of which are fixed on the single, driven cam shaft 48.

While the molten metal may be poured into the sprue mouth 8 of the closed mold by hand or other ladle contrivance, means are here shown for automatically serving the melt to the mold. An elongated goose-neck 110 dips at one end into a conventional, lead melting pot P and has a pivot in the form of a cross-bar 111 mounted in the swinging ends of a pair of arms 112 which are fixed on a hollow shaft 113, Fig. 3, journaled in side bearings 114 fixed to the frame brackets 25.

The shaft 113 has a hand lever 115 fixed to one end and by which it may be rocked at will to swing the arms 112 up from end rests 116 in the bearing 114, whereby to lift the goose-neck end with its associated parts, from the melt in the pot so that they may not freeze as the melt cools, after a desired run of the machine. A suitable form of bolt 117 may serve to fasten the lifting arms 112 to a bearing 114 during working periods of the casting machine. When the arms 112 are turned up to elevate the goose-neck 110 the latter will rest on buttress prongs 118 for that purpose on the ends of the arms.

At pivot 111 the goose-neck bends forwardly over the levers or arms 112 and then inclines in the form of a discharge spout 110a which is widened enough to about equal the length of the mold mouth 8, Fig. 5. The spout has a clean-out lid 110b.

The hollow shaft 113 is disposed just below the spout 110a and is provided with gas jet holes whereby to serve as a gas burner to heat the spout.

The pot end of the goose-neck 110 communicates with a pump cylinder 120 having inlet holes 121 for the hot melt and a piston 122 reciprocates in the cylinder to force the melt up the goose-neck to be discharged into the closed mold. A check valve 123 prevents the resurge of the melt as the piston moves on the suction stroke. Intermittent action of the piston is effected automatically by a sectional piston rod 124 pivotally connected to the piston 122 and jointed at 125 to the swinging end of a link 126 fulcrummed at its lower end on the bend of the goose-neck. The forward end of the rod 124 inclines down toward the base mold 2 and has a set of spaced ears 127—128, the latter adjustable.

The movable mold carrier 36 has a pair of upright bearings 129 in which is fixed a transverse, strike-bar 130 which has lost motion between the spaced ears 127—128 for a portion of the to and fro sweep of the carrier 36. During the outermost portion of the opening action of the mold carrier the bar 130 strikes the ear 128 of the rod 124 and pulls it over in a direction to draw the pump piston up for intake of melt into the cylinder 121. As the carrier starts its closing movement toward mold section 2 the bar 130 plays along the ear space without action on the rod 124, but as the mold block 3 comes into engagement with and represses the yieldable section 2 the bar 130 strikes the rod ear 127 and thus moves the piston 122 down and forces a load of melt up the goose-neck and displaces a hot charge from the spout 110a into the now closed mold. On the next out-shift of the mold carrier 36 the piston rod is retracted for a new cycle.

Push-back rods 56a are slidable in the section 3 and engage the near face of the mold 2 as the section 3 is moved to closed position. At this time the outer ends of the rods 56a engage and push the ejector plate 55 outward to position shown in Fig. 5, ready for the hammer blow.

What is claimed is:

1. A machine of the class described including a mold with laterally separable sections to form a vertical discharge space between coacting matrix faces of the sections, one of the sections forming a cast carrier separating the cast from the other section, means including a carriage and a cam track therefor for shifting the carrier section in upright position to a cast shedding position with the cast slightly tilted from the vertical at the discharge space, a receiver movable in upright position into the discharge space between the opened sections, means for ejecting the upright cast from the carrier so that it will fall onto the interposed receiver, a transfer mechanism to which the receiver passes the cast, and a cast trimming means having an inclined platen onto which the said mechanism catapults the casts successively and from which the trimmed grid gravitationally discharge, a main shaft, and mechanism driven thereby for automatically actuating and synchronizing the action of said carriage and said trimming means.

2. An automatic grid making machine including a basal mold section, and a movable mold section, a carriage to which the movable section is fixed with its matrix face vertical; cam tracks on which the carriage has slidable, guided movement to tilt the face of the movable section downward when open, and means for reciprocating the carriage and a trimming means operatively combined with the carriage and having a platen face tilted in the same general direction as the tilted face of the opened mold section, and means for automatically passing a casting from the said section in the same generally inclined position to the platen face.

3. An automatic grid casting and trimming machine having, in combination, relatively horizontally movable mutual mold sections, means for closing and opening the relation of the sections, means for ejecting the cast from the mold section to which it adheres, a receiver below the mold sections and moveable into upright position between the same when open, a means mechanically synchronized with the mold section movement for trimming the castings in succession, a

conveyor below the receiver to transfer casts therefrom to the trimmer and to which trimmer they gravitate from the conveyor.

4. A casting machine having, in combination, molding means, means for opening one section of the mold to an upright position from a complementary, basal section of the mold, a device to eject a cast from the open mold section, a receiver onto which an ejected cast gravitates in upright position, transfer means for advancing casts from the receiver, and means mechanically combined and synchronized with the mold and onto which the casts are gravitated by said mechanism for trimming the casts in succession.

5. A casting machine having, in combination, a sectional upright molding means, means for automatically horizontally shifting one section in an upright position for opening and closing the mold means, the shiftable section having means to cause adherence of the cooled cast thereto, means for ejecting the cast from said section when this is in open position, a transfer means including a receiver movable into vertical position between the open sections and a device to automatically advance each ejected cast, and a trimming means to which each cast is delivered by the transfer means; all combined in train and having synchronized motions.

6. A grid casting machine having, in combination, upright cooperative mold sections having matrix faces meeting in a vertical plane, one section having means to cause adherence of the cooled cast thereto, means for opening the relation of the sections by bodily laterally shifting the latter section apart from the other to an upright position with its mold face tilted slightly downward, means for ejecting the cast from the section to which it adheres, means movable into upright position adjacent to the tilted face of the cast carrying section for receiving the ejected casts, a transfer device to which the cast is delivered by the receiver, and means for trimming each cast and to which the casts are delivered by said device, and a drive mechanism connecting and coordinating the action of the said mold operating means and the trimming means for complete automatic operation of the machine.

7. A machine as set forth in claim 6; said section operating means including a carriage and a cam track on which it is reciprocative and having a portion to tilt the carriage as it opens the mold section, and said trimming means having an inclined bed and a retractive cast support alined with, and to receive and hold casts from, the transfer means.

8. A machine as set forth in claim 6, and including a main shaft, and a mechanism actuated thereby for automatically operating the section operating means and the trimming means in synchronism; said section operating means including a carriage and a cam track to tilt it as the mold section is opened.

9. A grid casting machine having, in combination, cooperative upright mold sections having matrix faces meeting in a vertical plane, one section being movable bodily laterally from the other to an open position with its matrix face slightly inclined downward and having means to cause adherence of the cooled cast, a cast receiver movable into upright position between the upright open sections, an ejector mounted on said movable section, and means to actuate said ejector to discharge the cast in a nearly vertical position onto the receiver while the section is in open position, and a carriage carrying the movable section, and a cam track on which the carriage is reciprocated and by which its mold is tilted as to the opposite section and a transfer device cooperative with the receiver, and an alined trimming means to which the casts are advanced by said device, and mechanism including a main shaft for synchronizing and automatically actuating the trimming means and the movable mold section.

10. A casting machine having a pair of vertical mold sections with co-extensive meeting faces mutually forming a mold chamber substantially on a vertical plane, means for bodily laterally moving one of the sections in an upright position to an open, downwardly facing, slight inclination, a receiver having an oscillative device with grid receiving hooks movable upwardly to receiving position between the open sections, means for ejecting a cast adhering to the outmoved section to pass to the receiver hooks in upright position, a trimming means alined with the receiver for successive casts from the mold, a trough in which the receiver slides, and means for transferring the casts along the trough from the receiver to the trimming means, and mechanism operatively combined with the several means for synchronously motivating the same for automatic molding and trimming operation.

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