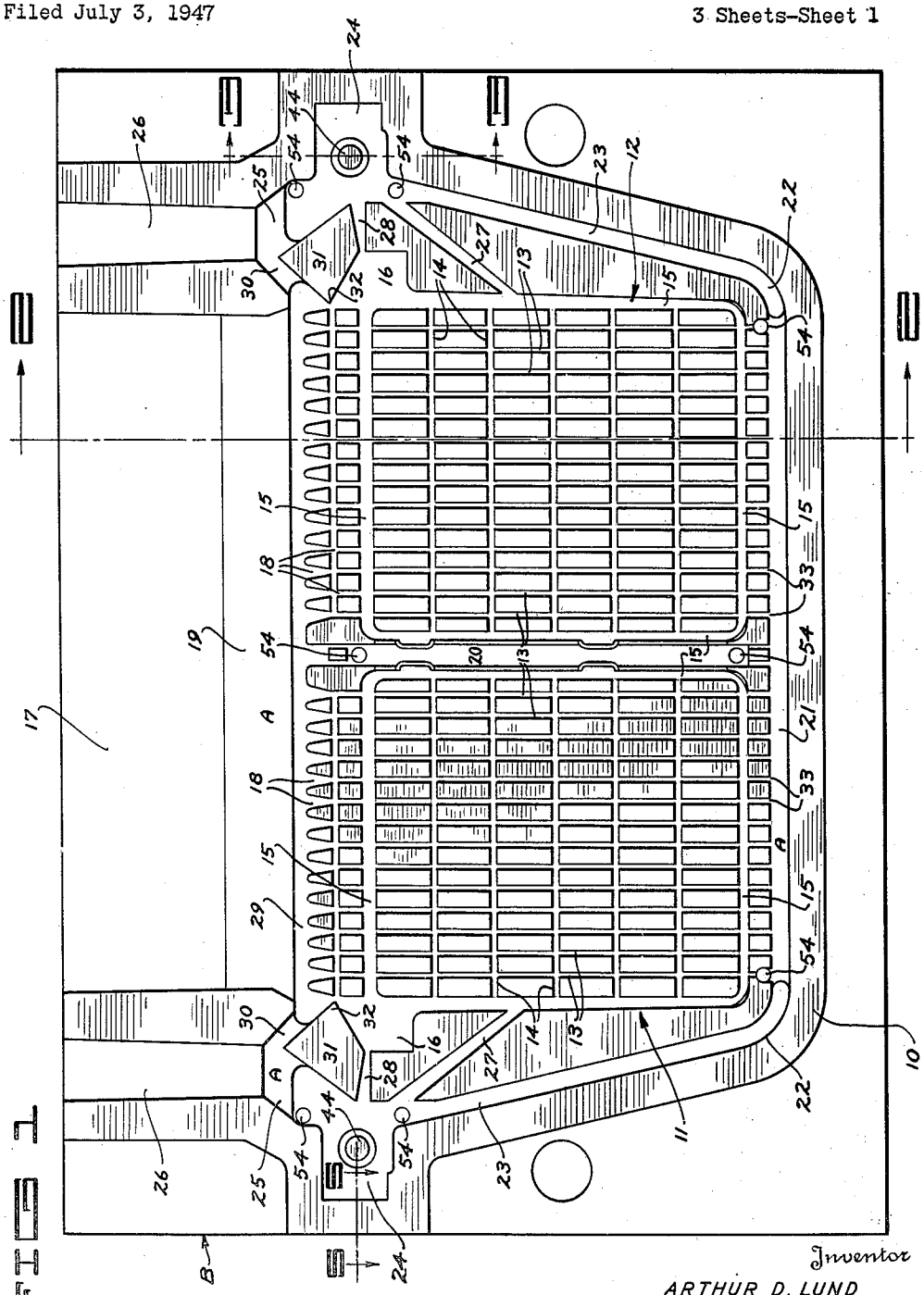
May 23, 1950 A. D. LUND 2,508,865

METAL CASTING MOLD

Filed July 3, 1947 3 Sheets-Sheet 1



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METAL CASTING MOLD

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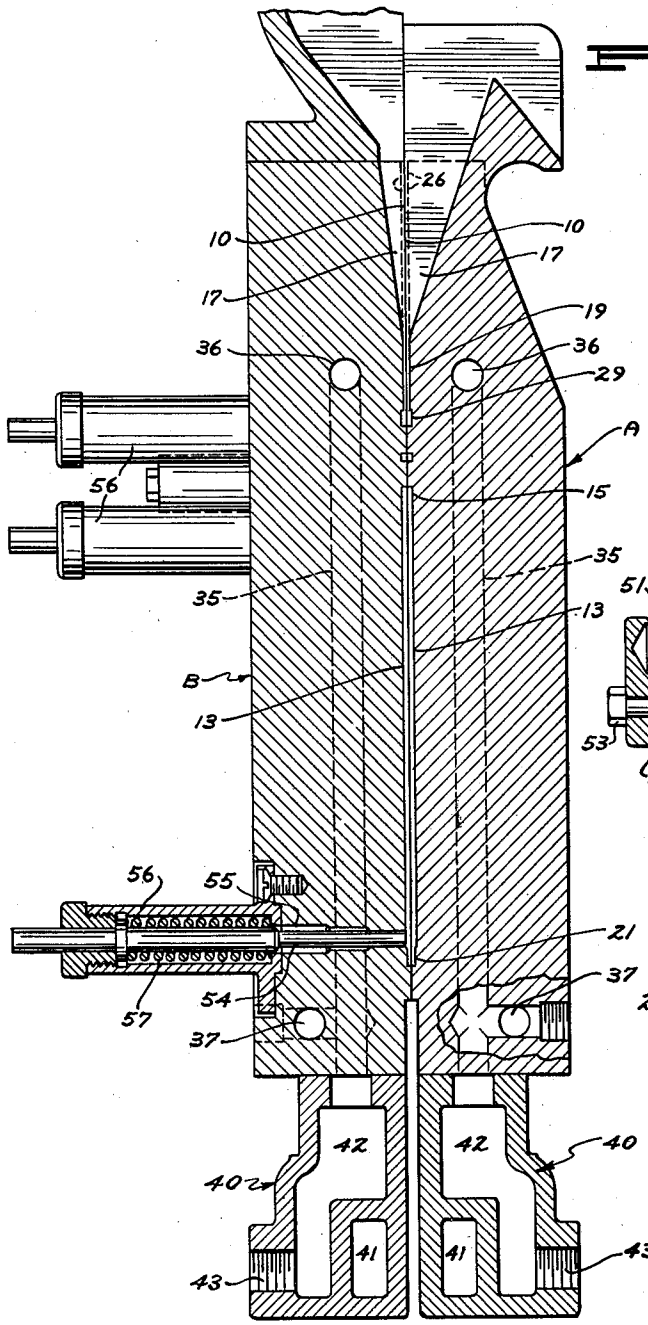

FIG 2

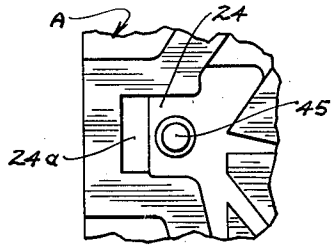

FIG 6

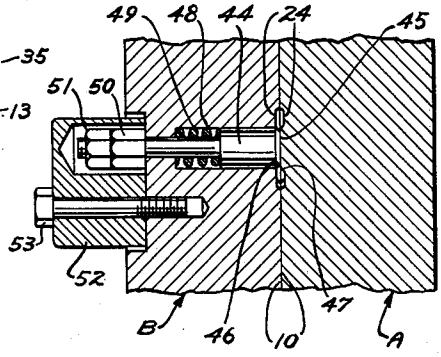

FIG 3

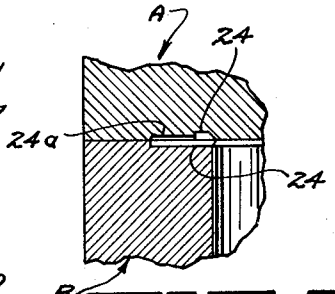

FIG 5

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METAL CASTING MOLD

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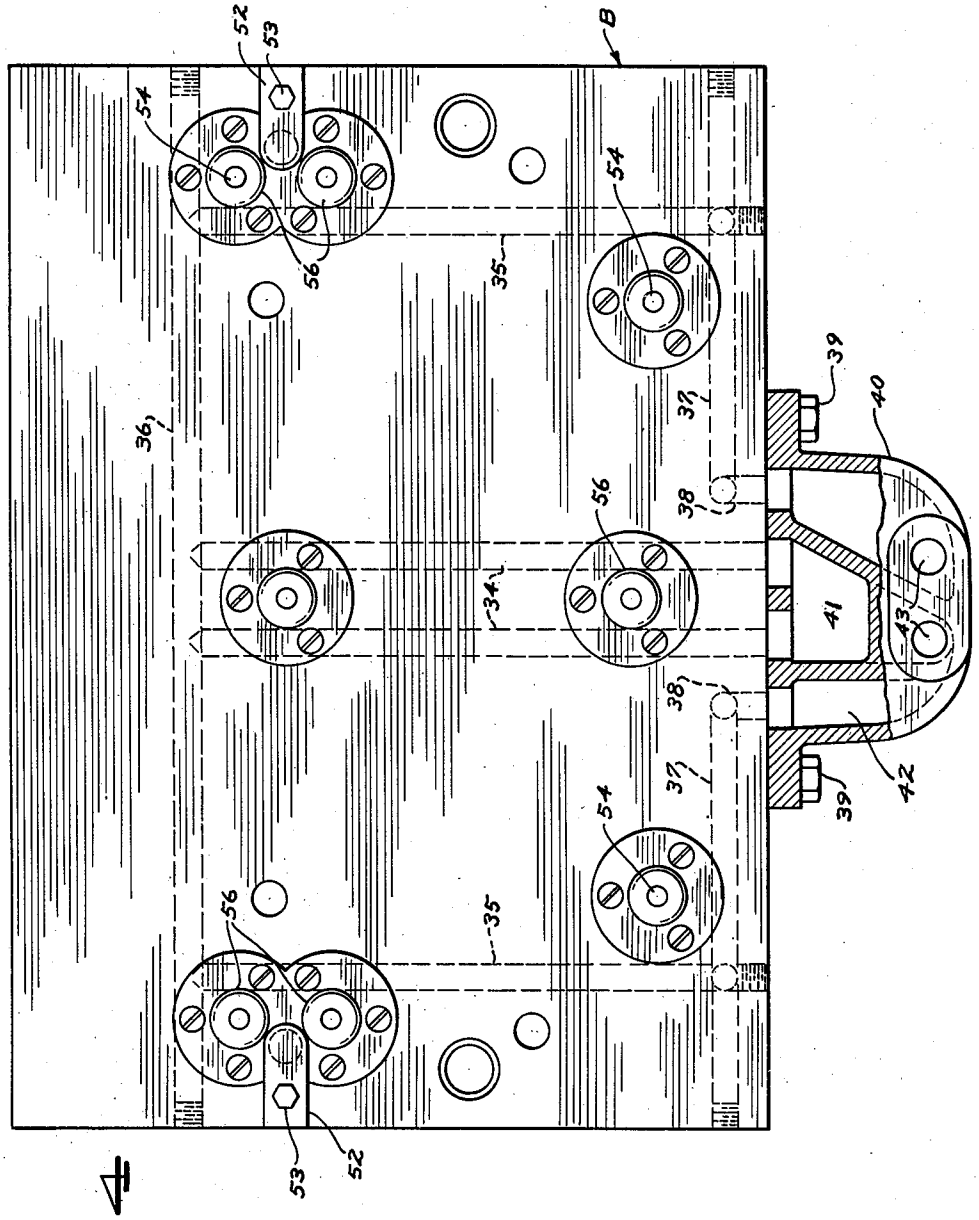

FIG 4

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UNITED STATES PATENT OFFICE

2,508,865

METAL CASTING MOLD

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Application July 3, 1947, Serial No. 758,825

6 Claims. (Cl. 22—153)

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This invention relates to improvements in metal casting molds for casting storage battery grid plates.

The molds are particularly designed for use in connection with automatic grid casting machines such as described in my co-pending application for Grid plate casting machine, Serial No. 748,679, filed May 17th, 1947, and of which this application is a continuation in part. The present invention further has features in common with my prior Patent No. 2,194,092, issued March 19th, 1940, and reference is invited thereto for some details which will be only briefly referred to herein, since they form no part of the present invention.

In such machines two molds are used and they have on their meeting surfaces the usual intaglio or matrix indentations into which the molten metal is poured while the molds are together and which are shaped to properly form the grid plates as the metal hardens. In practice the molds are relatively movable and the metal is poured each time they come together, and as the molds are then separated the cast plates drop therefrom upon a conveyor by which they are removed from the machine.

It is the primary object of my present invention to provide an improved mold wherein the molten metal is poured at the center of and across the matrix surfaces, and flows downwardly and then outwardly and upwardly in such manner as to exhaust the air from the said surfaces and enable the mold to be quickly filled without the formation of any air bubbles or other imperfections in the cast plate. It may here be explained that each cast plate or panel comprises what will ultimately become two complete storage battery grids, which are united in the casting process by suitable surrounding frame parts, which at the proper time in the course of the manufacturing operation are trimmed off and parted to divide the grids. In accordance with my present invention, I direct the molten metal down at the center of the matrix surfaces so that it flows immediately into the portion thereof which form the grids themselves and then flows outwardly and upwardly as the molds fill to complete certain parts of the frame by which the grids are held together until trimmed as above. I thus secure the distinct advantage over previous molds in that the metal first entering the molds pushes out the air from the grid surfaces and warms them so that the balance of the charge necessary to complete the filling will enter all of the various crevices in the matrix surfaces and fill them completely and form perfect grids.

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Another object of my invention is to generally improve mold structures of this kind and to bring about certain advantages which will be described in more detail in the course of the following specifications, wherein reference is had to the accompanying drawings in which—

Fig. 1 is a face view of a mold embodying my invention and showing the matrix surfaces thereof.

Fig. 2 is a vertical cross sectional view through a complementary pair of molds embodying my invention showing the water manifolds connected thereto and certain details of the means for stripping the plates from the molds as they separate. This view is taken substantially along the line 2—2 in Fig. 1.

Fig. 3 is a fragmentary vertical sectional view along the line 3—3 in Fig. 1.

Fig. 4 is an outside elevational view of the mold appearing at the left in Fig. 2.

Fig. 5 is a detail cross sectional view taken along the zone indicated at 5—5 in Fig. 1.

Fig. 6 is a detail view of a portion of the working face of the stationary mold.

Referring now more particularly and by reference characters to the drawing I have shown therein a pair of complementing molds, indicated generally at A and B, and for convenience will here refer to them as stationary and movable molds, respectively, since they are so arranged in the casting machine of my co-pending application hereinabove identified. It will be understood, however, that as far as material to the present invention it is only necessary that the molds move together to mate their casting surfaces, as seen in Fig. 2 while the metal is being poured and is cooling, and then that the molds separate far enough so that the cast plates may drop from between them.

The molds A and B are rectangular blocks of suitable mold metal and having mating working faces 10 which meet closely when the molds close, except for some parts which are slightly cut away for relief in accordance with usual practice, and it is in these mold faces that the intaglio or matrix surfaces are formed. These complementary matrix surfaces are designated generally at 11 and 12 and are spaced apart and each provided with a network of grooves 13 and 14 for forming the vertical and horizontal wires and ribs or cross bars of the completed grid. The surfaces 11 and 12 form the two battery grids in the single cast panel or plate as aforesaid, and the sur-

rounding channels 15 in the matrixes form the frame for the completed grids while the lateral extensions 16 form the lugs by which the grids are subsequently secured to the battery terminals, as will be understood by those skilled in the art.

The molten metal in filling the molds is poured into upwardly flaring mouth surfaces 17 which extend across substantially the full width of the matrix surfaces 11 and 12. A series of "islands" in the working faces form upwardly flaring streamers or grooves 18 which are aligned with the grooves 13 forming the wires, so as to flow the metal directly thereinto. The size of the streamers is greater than that of the wire forming grooves so as to pass the metal rapidly and carry the necessary added volume for filling the cross grooves 14 between the wires. Above the streamers 18, and across the full width of the mouth 17 is a channel 19 which forms a pouring gate and attention is called (see Fig. 2) to the point that this gate is thinner than the matrix surfaces 11 and 12. The purpose will presently appear.

There is also cast around the completed grids a frame which holds them together as they are handled through various operations, and this frame once its purpose is served, is trimmed off as scrap. To form this frame the working faces of the molds each has a center channel 20, a lower channel 21 merging at its ends through rounded corner channels 22 with upwardly and outwardly flaring risers or riser channels 23 which at upper ends enter lug forming recesses 24. These recesses 24 form oppositely projecting lugs at upper corners of the cast plate for handling. The recesses 24 in turn communicate through angular recesses 25 with upwardly extending exhaust risers or vent channels 26 which open through the upper end of the mold to each side of the filling mouth 17. Additionally angular bracing rib forming channels 27 join the recesses 24 to the side channels 15 and shorter channels 28 join the recesses 24 with the grid lug recesses 16. An upper frame channel 29 extends across the top of the streamers 18 to substantially complete the scrap framing of the plate.

Attention is called at this point to the upwardly and outwardly flaring or extending channels 30 which join the channel 29 or upper corners of the matrix surfaces 11 and 12 to the lower ends of the vent channels 26, and to the shape of the islands 31, formed between the recesses 16 and 24 and channels 25, 28 and 30, which is such that corners 32 project inwardly almost to the islands forming the streamers 18 at the extremities of the matrix surfaces.

Connecting the lower ends of the wires 13 and lower channel 21 are a series of lower streamers 33.

In operation a charge of molten metal, sufficient to fill all the matrix surfaces and scrap frame channels etc., is poured into the mouth 17 and is directed downwardly by the streamers 18 through the matrix surfaces, and pours through the lower streamers 33 into the lower channel 21. The aforesaid corners 32 prevent the metal from flowing outward into the lug forming recesses and connecting channels and as a result these are left free of metal at the outset. As the metal pours it forces the air ahead of it from the matrix surfaces and this air is directed upwardly and outwardly by the metal which rises in the risers 23 as the filling continues and the weight of the following metal forces the first

ahead. The air is finally ejected through the exhaust or vent channels 26. The first metal flowing through the matrix surfaces also warms them, so that they fill readily and completely by the balance of the charge resulting in the formation of a perfect pair of grids. As the metal rises through the lateral corner portions of the mold it finally joins through the channels 30.

This feed of the metal is important since it is the latter, hottest part of the metal charge which fills the pre-warmed and evacuated matrix surfaces 11 and 12, where the greatest casting perfection is required.

The feed gate 19 is thinner than the balance of the matrix surfaces so that the metal in this gate channel representing the greatest bulk or mass of metal of the whole plate will cool as rapidly as the balance of the casting. For a similar reason the channel 21 is also shallow so that the lower scrap frame bar here formed will cool rapidly, and in fact more rapidly than other frame parts. This is of value since it is upon this lower edge that the casting drops onto the conveyor, as the molds are separated, and damage to the edge is prevented by this rapid cooling and hardening. The channels 25 are also shallower than the matrix depth to retard the metal flow as it rises finally to the vent channels 26, and it may here be noted that the usual smoke or mold treatment material will be wiped out of the channels 26 so that the metal will rise or flash only slightly into these channels.

For cooling the castings the molds each have a pair of center, vertical bores 34 and outwardly spaced side bores 35 joined at upper ends to the center bores 34 by a transverse bore 36. At lower end the bores 35 communicate with inwardly directed bores 37 which terminate in downwardly opening bores 38 opening through the bottom of the mold. Over the four open lower ends of the bores 34 and 38 are secured, for each mold by cap screws 39, manifolds 40 each having a chamber 41 which communicates with the bores 34 and a chamber 42 which communicates with the bores 38. Tapped openings 43 provide means by which water or other cooling fluid may be piped into one of the manifold chambers and out through the other to thus circulate through the bores 34, 35, 36, 37 and 38 as will be readily understood.

Openings are formed in the panel lugs in the recesses 24, for locating the panels during certain operations, by means of plungers 44 (Fig. 3) which project from the working face of the movable mold B into contact with boss-like anvil surfaces 45 in the recesses 24 in the stationary mold A. It will be noted that the extremities of the plungers 44 are beveled off at 46 while the anvils 45 are similarly but more sharply beveled at 47. Thus while these parts will form the necessary openings through the lugs, they will pull free of the metal without any tendency to cause the lugs to stick to either mold. Each of the plungers 44 is slidable through an opening 48 in the mold B and is braced against an expansion coil spring 49 which urges the plunger toward mold A. This movement is limited and accurately adjusted by a stop nut 50, and lock nut 51, which contact the mold and are so adjusted that, as the molds come together, the plunger bears with spring induced pressure on the anvil 45. A cap 52 is held by a stud 53 over these nuts.

As the molds separate following each filling the cooled casting is carried by the movable mold B out of the stationary mold and to then positively eject the castings from the movable mold I pro-

vide knock-out pins 54 at strategically spaced locations about the matrix surfaces 11 and 12 of the movable mold. These knock-out pins are slidably mounted through openings 55 in the mold and into cages 56 secured thereto, springs 57 being arranged to normally hold the pins flush at their ends with the matrix surfaces (Fig. 2). As the mold B moves away from the stationary mold the pins 54 are arranged to strike stops (not shown) which thrust them out into the matrix surfaces and so push the castings clear.

Attention is called to the formation of the lug forming recesses 24 in the stationary mold A. As shown the depth of the outer extremities of these recesses indicated at 24a, is less than that of the balance of the recesses so that the outer portions of the lugs themselves will be reduced in thickness. Actually, these outer portions 24a of the recesses will remain the same in all molds regardless of the thickness of the plates cast by the molds, so that the outer ends of all plate lugs will be of the same thickness, and, of course, in the case of the thinnest plates cast there may be no offset or reduction in the lug recess depth as will be understood.

It will be thus seen that the plates regardless of thickness may pass at the lug ends through a stripping or feeding zone of constant size, as pointed out in my prior co-pending application for Automatic plate trimming machine, Serial Number 703,799, filed October 17th, 1946.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described my invention, what I claim to be new and desire to protect by Letters Patent is:

1. A battery grid plate casting mold having an intaglio matrix surface forming a substantially rectangular casting cavity shaped to form the grid plates and a filling gate extending across substantially the full width of the cavity, the said cavity also including riser channels extending upwardly from the lower corners of the cavity and opening through the top of the mold so that air driven ahead of metal pouring through the gate and down through the cavity may escape, the mold also having lateral recesses extending outward from the channels to form handling lugs on the completed casting, and the outer portions of said recesses being of lesser depth than the inner portions to correspondingly reduce the thickness of the outer ends of said lugs.

2. A battery grid plate casting mold having an intaglio matrix surface forming a substantially rectangular casting cavity shaped to form the grid plates and a filling gate extending across substantially the full width of the cavity, the said cavity also including riser channels extending upwardly in diverging relation from the lower corners of the cavity and opening through the upper part of the mold whereby the metal poured down into the cavity may drive the air ahead as it fills the cavity and finally rises in said channels, and the mold having other channels connecting the upper corners of the cavity to the riser channels and edge portions formed by said channels and projecting toward the path of metal flowing down through said filling gate to divert the metal into the cavity until it is completely filled.

3. A battery grid plate casting mold having an intaglio matrix surface forming a substantially rectangular casting cavity shaped to form the grid plates and a filling gate extending across substantially the full width of the cavity, the said cavity also including riser channels extending upwardly in diverging relation from the lower corners of the cavity and opening through the upper part of the mold whereby the metal poured down into the cavity may drive the air ahead as it fills the cavity and finally rises in said channels, and the mold having also three angularly related channels connecting the sides and upper corners of the cavity to the riser channels.

4. A battery grid plate casting mold having an intaglio matrix surface forming a substantially rectangular casting cavity shaped to form the grid plates and a filling gate extending across substantially the full width of the cavity, the said cavity also including riser channels extending upwardly from the lower corners of the cavity along the sides of the cavity and opening through the upper part of the mold whereby the metal poured down into the cavity through the filling gate may drive the air ahead as the metal fills the cavity and finally rises into said channels, and the riser channels having portions of reduced depth as compared to their overall depth to retard the upward flow of the metal and ensure the complete filling of the casting cavity.

5. A battery grid plate casting mold having an intaglio matrix surface forming a substantially rectangular casting cavity shaped to form the grid plates and a filling gate extending across substantially the full width of the cavity, the said cavity also including riser channels extending upwardly from the lower corners of the cavity along the sides of the cavity and opening through the upper part of the mold whereby the metal poured down into the cavity through the filling gate may drive the air ahead as the metal fills the cavity and finally rises into said channels, and the riser channels having portions of reduced depth as compared to their overall depth to retard the upward flow of the metal and ensure the complete filling of the casting cavity, the said retarding portions of the channels being located above the level of and communicating with the upper corners of the casting cavity.

6. A battery grid plate casting mold having an intaglio matrix surface forming a substantially rectangular casting cavity shaped to form the grid plates and a filling gate extending across substantially the full width of the cavity, the said cavity also including riser channels extending upwardly from the lower part of the cavity and a cross channel across the bottom of the cavity connecting the cavity and riser channels, and the filling gate and cross channel being both of lesser depth than the cavity whereby to accelerate the cooling of the metal in the gate and this channel.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,317,333	Sturges	Sept. 30, 1919
1,490,482	Reardon	Apr. 15, 1924
1,581,790	Davis	Apr. 20, 1926
1,927,384	Bauer	Sept. 19, 1933
2,194,092	Lund	Mar. 19, 1940
2,218,612	Lockwood	Oct. 22, 1940
2,315,071	McWane	Mar. 30, 1943