May 8, 1923. 1,454,647

S. McFARLAND

CASTING APPARATUS

Filed Jan. 13, 1920

FIG. I.

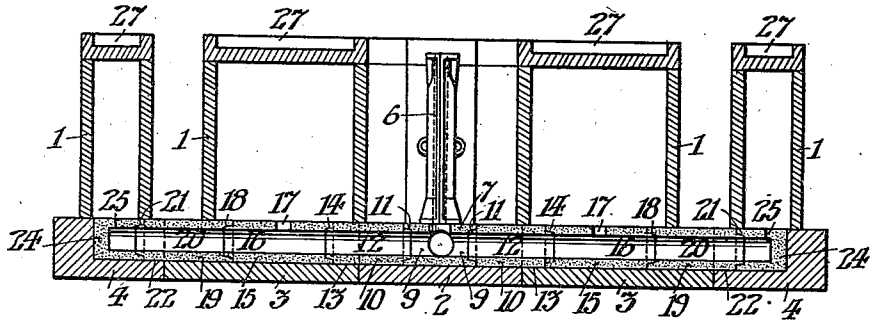


FIG. II.

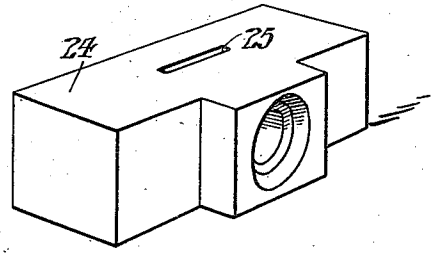
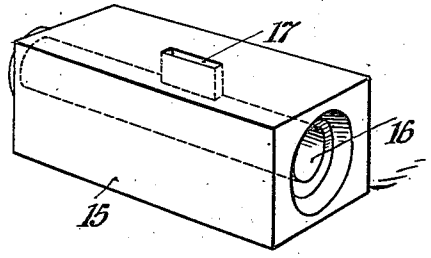


FIG. III.



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UNITED STATES PATENT OFFICE.

SAMUEL McFARLAND, OF COATESVILLE, PENNSYLVANIA.

CASTING APPARATUS.

Application filed January 13, 1920. Serial No. 351,095.

To all whom it may concern:

Be it known that I, SAMUEL McFARLAND, a citizen of the United States, residing at Coatesville, in the county of Chester and State of Pennsylvania, have invented a certain new and useful Improvement in Casting Apparatus, whereof the following is a specification, reference being had to the accompanying drawing.

My invention relates to means for casting ingots, and particularly to improvements in the runners, and nozzle bricks of refractory material, which are used to line channel passageways for molten metal in bottom sprue plates for such molds.

It is customary to mount such a mold upon a bottom sprue plate, with the greatest dimension of the mold extending vertically and to provide a passageway for molten metal terminating in a cylindrical restricted orifice intermediate of the sides of the mold. The inevitable effects of such ordinary practice are, first, that the molten metal which first reaches the mold is forcefully sprayed upon the comparatively cold walls of the mold and, second, that as the metal continues to flow into the mold from said orifice, the entire mass of metal in the mold is unduly agitated; so that portions of the mass of metal in the mold of different temperatures are mixed. Some results of such irregular distribution and disturbance of the metal are that the outer surface of the ingot thus formed is rough and irregular; the ingot is not of uniform density or quality, and a longer time is required for solidification than if the metal were quietly and uniformly delivered to the mold.

Therefore, it is an object of my invention to provide means to direct molten metal into a mold, and particularly a mold for casting ingots of steel, in such a way that the metal is quietly and uniformly distributed to all parts of the mold, so as to form an ingot which has a substantially smooth surface and is of uniform texture.

As hereinafter described; my invention includes the provision of a runner for molten metal terminating in a nozzle brick having an orifice which is unrestricted, in the sense that the flow of molten metal therethrough is at approximately the same rate as the flow through the runner, and such orifice, instead of being cylindrical, is oblong, so that the metal is delivered therethrough in a flat stream, instead of a round jet. However, said orifice is, of course, laterally restricted, in one of its transverse dimensions with respect to the other, to produce such oblong form, in order to produce such a flat stream. Some advantages of the employment of such means in delivering molten steel to the ordinary molds aforesaid, are, first, that the molten metal is quietly injected at the base of the mold, instead of being spattered upon its walls and as the flow of metal continues the mold is gradually uniformly filled with the minimum amount of disturbance of the mass of metal already in the mold; so that the metal begins to solidify at once and an ingot of smooth exterior and uniform composition and quality is cast.

I have found it convenient to illustrate the invention herein claimed, in conjunction with a bottom sprue plate formed of separable sections, which is the subject matter of my copending application for Letters Patent of the United States, Serial No. 351,239. However, it is to be understood that my present invention is not limited to any such embodiment but includes the various novel features of construction and arrangement hereinafter more definitely specified.

In the drawing; Fig. I is a vertical sectional view of a pouring group of ingot molds which are respectively mounted upon separable sections of a sprue plate having complementary channels lined with refractory bricks forming a runner and nozzles for molten metal embodying my invention.

Fig. II is a perspective view of one of the terminal nozzle bricks of the runner shown in Fig. I.

Fig. III is a perspective view of one of the intermediate nozzle bricks of the runner shown in Fig. I.

Referring to Fig. I; the similar ingot molds 1 are mounted upon the bottom sprue plate consisting of a number of separable sections 2, 3 and 4, in a pouring group; the individual molds being symmetrically disposed in relation to the central vertical runner 6. Said runner 6 is conveniently formed as a hollow iron column, having a central passageway for molten metal, lined with refractory material, and is detachably set in registry with the central distributing brick of refractory material 7 which is mounted in a recess in said plate section 2. Said brick 7 has radial outlets 9 leading to similar runners including respective bricks of refractory material 10 conveniently having annular

flanges 11 fitting into corresponding recesses in said central brick 7, and enclosing passageways 12 complementary to said outlets 9. Said bricks 10 extend in channels in said sprue plate section 2 and into channels 13 in said sprue plate sections 3, so as to bridge the joints between said plate sections 2 and 3; and have annular flanges 14 extending into the latter. Said channels 13 are further lined with the refractory bricks 15, which are recessed to receive said flanges 14 and enclose passageways 16 complementary to said passageways 12. Said bricks 15 have respective nozzle orifices 17 which are oblong, as above contemplated, and of substantially the same proportions as the cross dimensions of the inside of the molds 1 which they are intended to supply. However, as shown in Fig. III said nozzle 17 is of substantially less area than the area of said passageway 16. For instance, I find it convenient to employ a nozzle opening which is three-quarters of an inch wide and eight inches long, to deliver molten steel into a mold having the inside cross dimensions of twenty-two inches by sixty-eight inches, and which is eighty inches high, and it may be observed that the cylindrical passageway 16 is of approximately the diameter of the greatest dimension of said nozzle orifice 17.

Said bricks 15 have annular flanges 18, and said channels 13 in said sprue plate sections 3 are further lined by the refractory bricks 19 having recesses fitting said flanges 18. Said bricks 19 enclose passageways 20 complementary to said passageways 16. Said bricks 19 also have annular flanges 21 and extend in channels 22 in said sprue plate sections 4, complementary to said channels 13 in said plate sections 3; so that said bricks 19 bridge the joints between said plate sections 3 and 4.

Each of the radial runners comprising said bricks 10, 15 and 19, has a terminal nozzle brick 24, which is recessed to fit the flange 21 of the adjacent brick 19 and is held in the channel 22 in its section 4. Each of said terminal bricks 24 has a nozzle 25 of the oblong configuration above contemplated, through which the molten metal is delivered to the mold 1 resting upon the respective sprue plate section 4.

The construction and arrangement above described is such that molten metal poured down said central runner 6 is radially distributed at the bottom thereof through said runners including bricks having the nozzles 17 and 25 and in such manner that the molds 1 in registry with said nozzles are gradually filled from the bottom up. As above noted the construction and arrangement of the nozzle aforesaid is such that the molten metal is quietly and uniformly distributed to all parts of the mold, so as to form an ingot which has a substantially smooth surface and is of uniform texture, because the molten metal is quietly injected through said nozzle orifice in a flat stream, instead of being spattered upon the mold walls. It may be observed that the metal begins to flow through said orifices into the empty molds in the direction of the length of the orifices, so that the metal flows in that direction along the bottom of the mold until it encounters a vertical opposite wall of the mold which, thereupon, deflects the inflowing stream of metal backward, but without spattering it, and the mass of inflowing metal is thus kept quietly moving until the bottom of the mold is covered therewith and, thereafter, while the mass of metal in the mold increases from the bottom toward the top thereof until the desired quantity has been injected. Such operation, which is imposed by the construction and arrangement of my invention shown and described, is thus distinguished from the operation of an ordinary nozzle jet, which is of substantially uniform transverse dimensions, in that with such an ordinary jet the molten steel initially gushes upwardly into the empty mold, above the bottom of the latter, falls backward upon the bottom plate, and spatters and congeals so that the following stream must pour up over the top of a bridge ridge thus formed around the orifice, with such action as to cause the steel to splash the sides of the mold where it congeals and adheres, so that, the mass of steel subsequently rising to that splashed level does not merge into the splashed steel, but leaves the latter as a lamination or blister upon the surface of the ingot, as distinguished from an ingot formed by the employment of my invention, with a substantially smooth surface, instead of being rough and irregular as is characteristic of such ordinary ingots. As shown; each of said molds 1 is provided with a removable cover 27, but those covers are preferably removed before each pouring operation so as to enable the operator to see when the molds are filled. However, said covers are replaced when the molds are filled, so that the metal at the upper end of the ingot is not unduly chilled, by contact with the atmosphere, but is cooled at substantially the same rate as the other portions of the ingot.

Although I have found it convenient to show one-half of a pouring group which includes eight ingot molds, it is to be understood that my invention is equally applicable to pouring groups of other numbers of molds, and to even a single mold, with the advantageous result above contemplated.

Therefore, I do not desire to limit myself to the precise details of construction and arrangement herein set forth, as it is obvious that various modifications may be made therein without departing from the essen-

tial features of my invention, as defined in the appended claims.

I claim:

1. The combination with an ingot mold, including a vertically disposed tube enclosing a space which is substantially rectangular but oblong, in a horizontal plane; of a bottom sprue plate supporting said mold and having a channel beneath said mold; and a conduit for molten metal extending in said channel and including a hollow brick of refractory material having, centrally located within said space, a nozzle orifice which is oblong horizontally, more than twice as long as it is wide, and has substantially parallel side walls; said orifice being disposed with its longest horizontal dimension substantially parallel with the longest horizontal dimension of said mold; whereby molten metal is delivered to said mold in a substantially flat stream, and in coaxial relation with said mold tube.

2. The combination with an ingot mold, including a vertically disposed tube enclosing a space which is substantially rectangular but oblong, in a horizontal plane; of a bottom sprue plate supporting said mold and having a channel; and a conduit for molten metal extending in said channel and including a hollow brick of refractory material having, centrally located within said space, a nozzle orifice which is oblong horizontally and has substantially parallel side walls; said orifice being disposed with its longest horizontal dimension substantially parallel with the longest horizontal dimension of said mold; whereby molten metal is delivered to said mold in a substantially flat stream, and in coaxial relation with said mold tube.

3. In casting apparatus; a hollow brick of refractory material enclosing a cylindrical passageway for molten metal, and having a transversely restricted nozzle orifice, opening laterally from said passageway; said orifice being longer in the direction of the length of said passageway than in the direction transverse thereto.

4. In casting apparatus; a hollow brick of refractory material enclosing a passageway for molten metal, and having a transversely restricted nozzle orifice, opening laterally from said passageway; said orifice being longer in the direction of the length of said passageway than in the direction transverse thereto.

5. In casting apparatus; a hollow brick of refractory material having a cylindrical passageway for molten metal entirely through it, with means at each end thereof for registration with a complementary brick, and having a transversely restricted nozzle orifice opening laterally from said passageway; said orifice being longer in the direction of the length of said passageway than in the direction transverse thereto, and of substantially less area than the area of said passageway.

6. In casting apparatus; a hollow brick of refractory material having a passageway for molten metal entirely through it, with means at each end thereof for registration with a complementary brick, and having a transversely restricted nozzle orifice opening laterally from said passageway; said orifice being longer in the direction of the length of said passageway than in the direction transverse thereto, and of substantially less area than the area of said passageway.

7. In casting apparatus; a hollow brick of refractory material having a passageway for molten metal entirely through it, and having a transversely restricted nozzle orifice opening laterally from said passageway; said orifice being longer in the direction of the length of said passageway than in the direction transverse thereto, and of substantially less area than the area of said passageway.

In testimony whereof, I have hereunto signed my name at Coatesville, Pennsylvania, this 24th day of November, 1919.

SAMUEL McFARLAND.

Witnesses:
ERNEST L. BRICKER,
R. B. SMITH.