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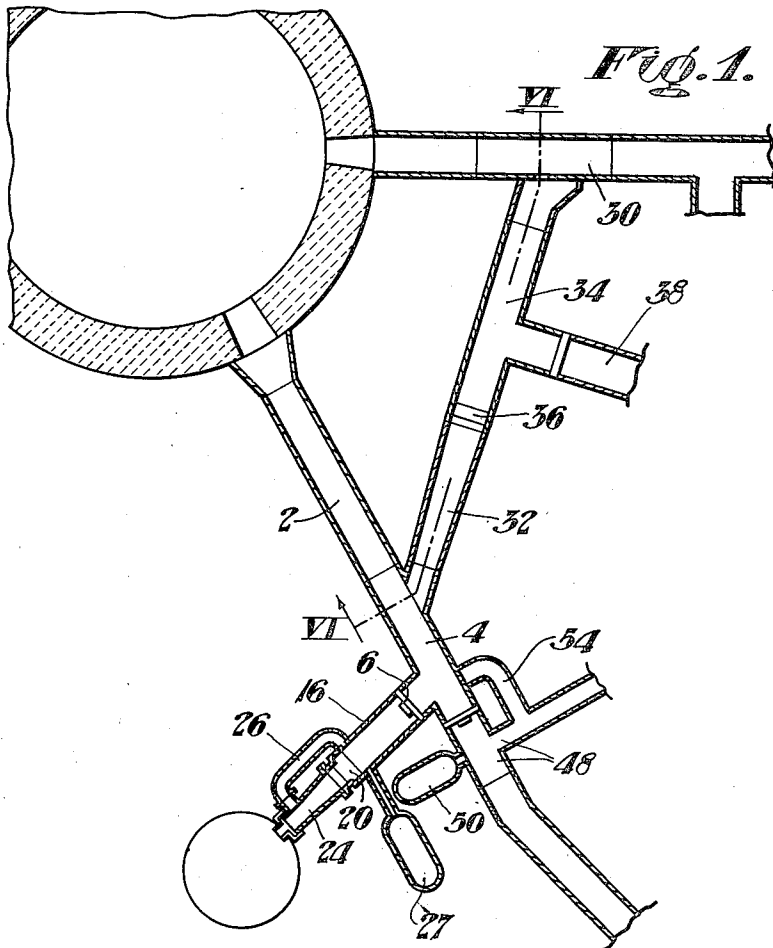
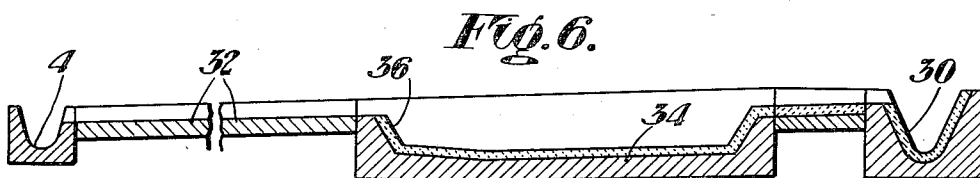
J. W. FORSYTHE ET AL

2,139,949

APPARATUS FOR HANDLING MOLTEN SLAG

Filed Dec. 5, 1936

4 Sheets-Sheet 1



Inventors:
JOHN W. FORSYTHE and
WILLIAM STEWART.
by: *Usina & Rauber*
their Attorneys.

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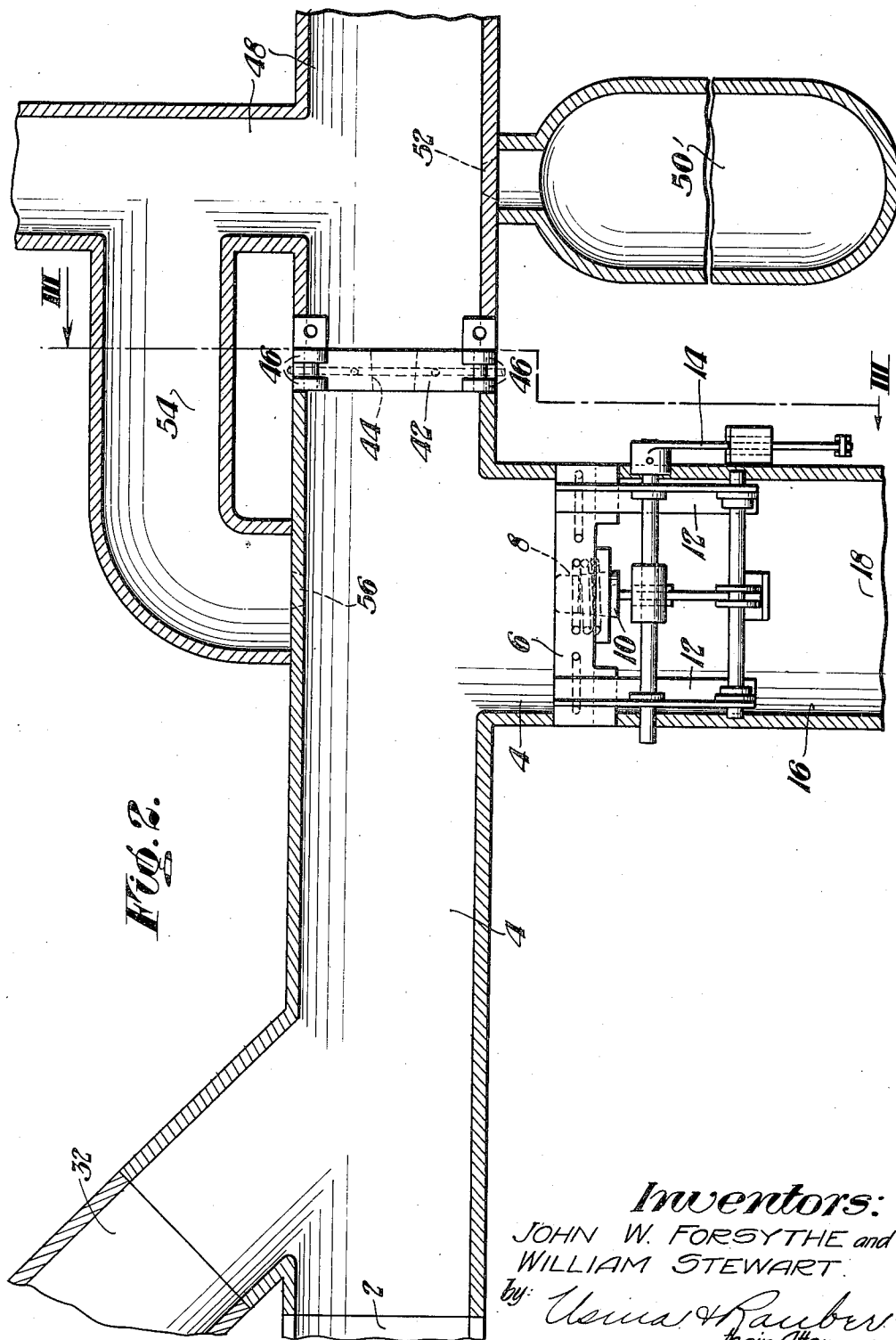
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APPARATUS FOR HANDLING MOLTEN SLAG

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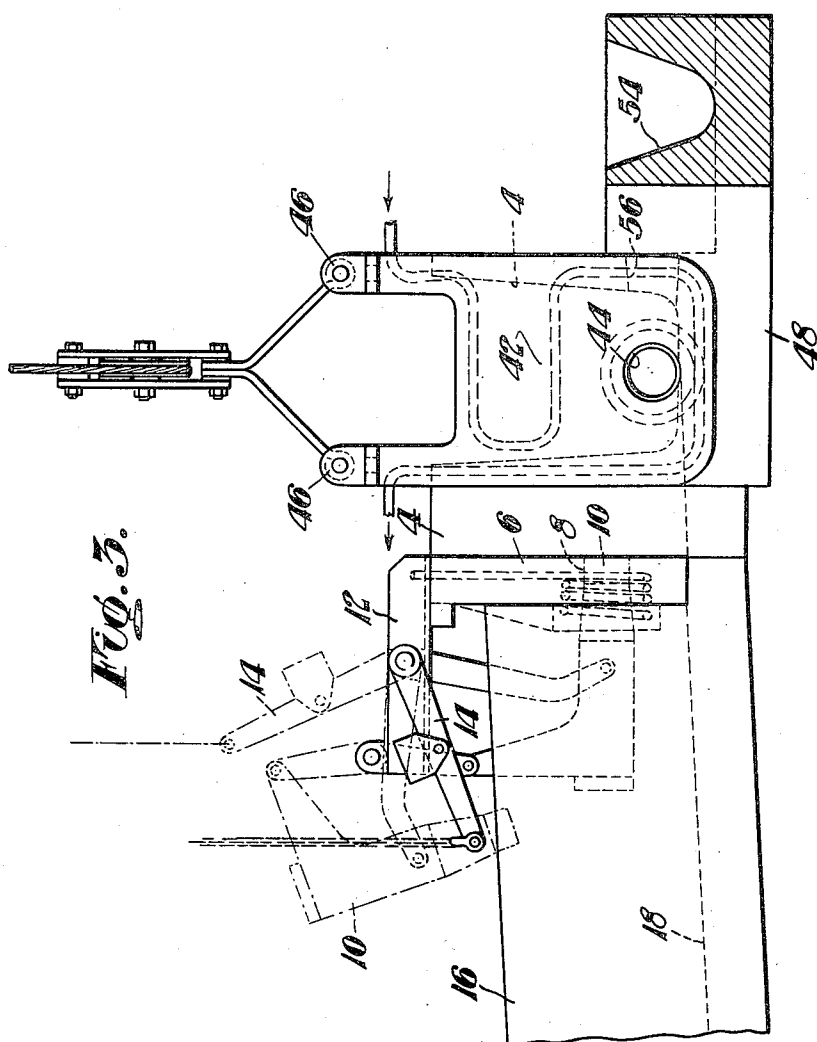
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WILLIAM STEWART.
by: *Usina & Rauber*
their Attorneys.

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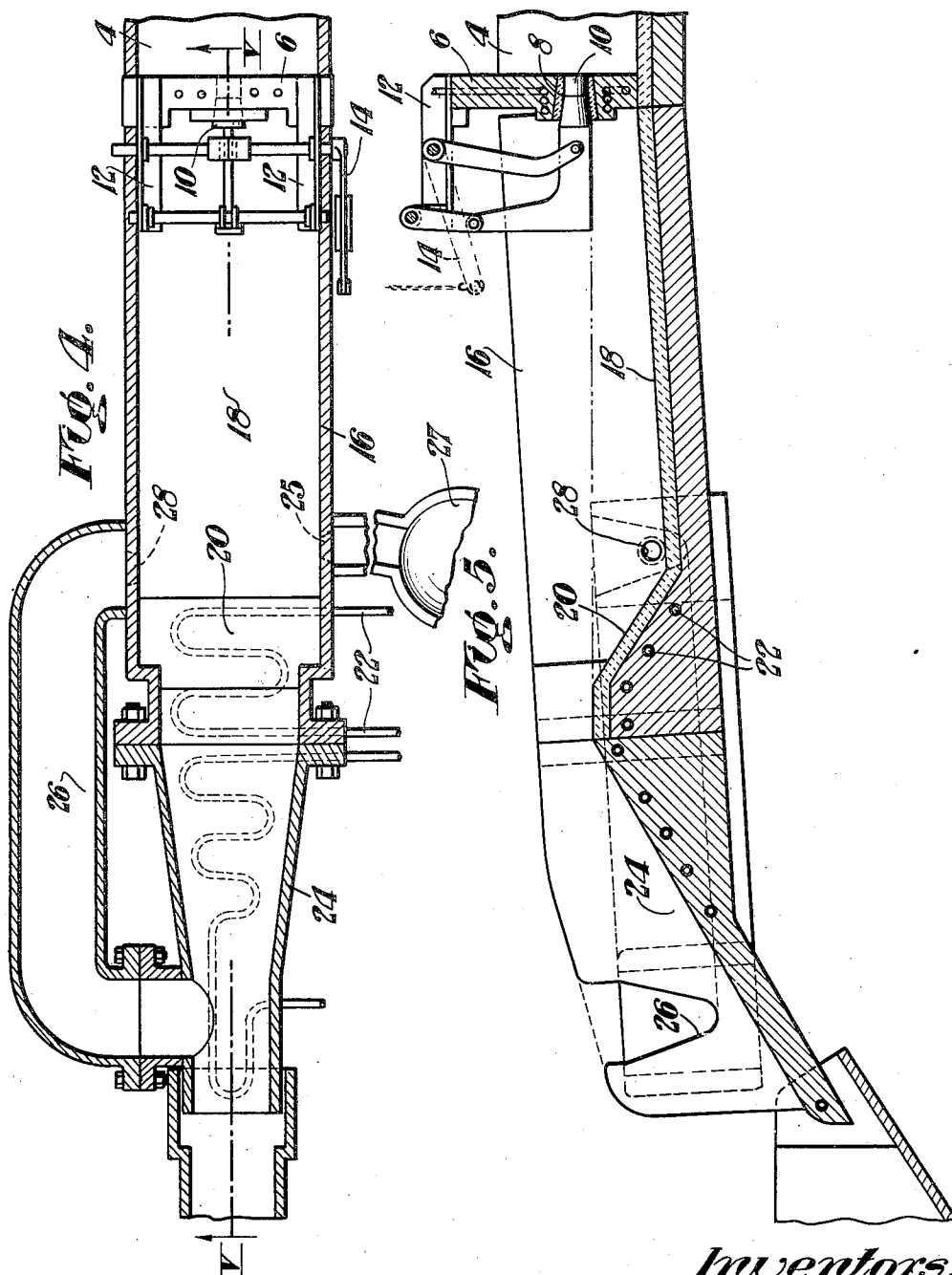
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WILLIAM STEWART.
by: *Usina & Rauber*
their Attorneys.

UNITED STATES PATENT OFFICE

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APPARATUS FOR HANDLING MOLTEN SLAG

John W. Forsythe, Wilkinsburg, and William
Stewart, North Braddock, Pa.

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5 Claims. (Cl. 266—38)

This invention relates to an apparatus for flowing molten blast furnace slag directly from a blast furnace to a granulation or other processing apparatus, and has for one of its objects the provision of a novel control of the slag as it is flowing to the processing machine, whereby a substantially uniform and continuous flow of slag is delivered to the processing machine.

Another object is to provide means for removing entrained iron from the molten slag during its travel to the processing machine.

Another object is to provide a method and apparatus for eliminating "stickers" in slag ladles.

The above and further objects will become apparent from the following description and by reference to the accompanying drawings, in which:

Figure 1 is a plan of the preferred embodiment of my invention;

Figure 2 is an enlarged plan of a portion of the apparatus shown in Figure 1;

Figure 3 is a section taken on line III—III of Figure 2;

Figure 4 is an enlarged plan of a portion of the apparatus shown in Figure 1;

Figure 5 is a section taken on the line V—V of Figure 4; and

Figure 6 is a section taken on the line VI—VI of Figure 1.

Referring more particularly to the accompanying drawings, the numeral 2 indicates a slag runner which is connected to the cinder notch of a blast-furnace. The slag runner 2 empties into a main settling basin 4 which allows the major portion of the entrained iron to settle and which is provided with a plurality of outlets, a stationary fluid-cooled dam-plate 6 being secured to one of the outlets thereof. The dam-plate 6 is held tightly against the main settling basin 4 and is provided with an orifice 8. The size of the orifice 8 may be varied to permit any desired maximum rate of flow to the processing machine. The orifice 8 and the dam-plate 6 are so positioned that the orifice 8 is located sufficiently above the bottom surface of the main settling basin 4 to assure retention of the settled iron therein. The orifice 8 is adapted to be closed by any suitable means, such as a stopper 10, which preferably is pivotally secured between arms 12 that are secured to the top of the dam-plate 6. The motion of the stopper 10 is controlled by a lever 14 which can be moved by any external force to readily and tightly seal the orifice 8 when desired.

The orifice 8 is provided to readily regulate the rate of flow of light hot slag which is contained

in the main settling basin 4 to an auxiliary basin 16 that is placed against the back of the dam-plate 6. The auxiliary basin 16 is adapted to maintain the slag therein at a level which is below the orifice 8. The auxiliary basin 16 has an inner downwardly sloping bottom surface 18 which is terminated by a flow retarding member 20 that preferably is integral with said bottom surface. Any molten metal remaining in the slag from the main settling basin 4 settles and accumulates in the auxiliary basin 16. After the volume of slag required to fill the auxiliary basin 16 has accumulated therein, the uniform slag flow, continuing through the orifice 8, causes a similar flow of slag over the member 20. This flow of slag is received in a runner 24 which conducts the slag to a granulating or other processing machine (not shown). The flow of the slag into and, consequently, out of the auxiliary basin 16 is regulated by varying the position of the stopper 10 in relation to the orifice 8 so that the flow of slag to the processing machine is directly controlled.

As the flow retarding member 20 is preferably cooled, means, such as pipes 22 through which cooling fluid can be circulated, are cast integral with the member 20 and can prevent this member from being excessively burnt by contacting hot slag. The runner 24 is also preferably fluid-cooled. Any molten iron that settles from the slag and accumulates in the auxiliary basin 16 can be withdrawn therefrom by removing the plugging material which, for ordinary use, is present in an aperture 25 in the auxiliary basin 16. When the aperture 25 is opened, any liquid in the auxiliary basin 16 flows to a catch basin 27 connected thereto.

The accumulation and removal of the entrained iron from the slag not only means that a considerable amount of iron (which may average about one ton per day) is thereby saved but also means that the slag, being substantially iron-free, does not stick to the slag ladles. Heretofore, iron contained in the slag settled out in the slag ladles and frequently caused what are termed "stickers". The removal of these "stickers" involved considerable amounts of time and labor necessary to knock out or chip these "stickers" from the ladles. Moreover, even with careful workmanship, ladles were damaged and in many instances early destruction of the ladles resulted due to the formation of these "stickers".

In order to provide means for completely draining the auxiliary basin 16, a by-pass slag runner 26 is butted against the side of the auxiliary basin 16 immediately below an aperture 28 there-

through. The aperture 28 is located at the lowest portion of the bottom surface 18 and is ordinarily closed with fire clay, or other suitable material, as it is desired to force the slag to accumulate and settle in the auxiliary basin 16 before passing to the granulating machine.

The iron flows from the blast furnace through a main iron runner 30. The latter portion of the cast flowing from the blast furnace contains a high percentage of slag and, in some instances, it is desirable to use the slag carried by the iron. Means, such as an auxiliary slag runner 32, connect to the main iron runner 30 so that the last portion of the cast can be diverted therefrom, if desired. The connection between the main iron runner 30 and the auxiliary slag runner 32 is ordinarily closed by means of fire clay or the like. When the auxiliary slag runner 32 is to be used, the connection between it and the main iron runner 30 is opened and suitable means, such as a fire clay dam, are used to obstruct the main iron runner 30 and divert the slag and iron mixture into the auxiliary slag runner 32.

The slag runner 32 has a downwardly sloping bottom surface 34 and a flow retarding member 36 adjacent the lowest portion of the bottom surface 34 so that the flow of slag through the slag runner 32 is retarded. The slag runner 32 carries any slag flowing by the member 36 to the main settling basin 4. Any molten iron which settles from the slag at the member 36 can be withdrawn when desired to a catch basin 38 which is connected to the slag runner 32 at its lowest portion and which is ordinarily closed with fire clay.

There is provided at the end of the main settling basin a movable dam-plate 42 which controls the volume of slag required to form a pool in the main settling basin 4. The dam-plate 42 has upwardly extending arms 46 to which is attached means for vertically moving the same. The top edge of this dam-plate between the arms 46 is lower than the top rim of the main settling basin, so as to provide an overflow in case too large a volume of slag collects in the main settling basin; preferably, it is also slightly lower than the top of the dam 36 so as to prevent a back flow into the iron runner 30 when slag is taken therefrom.

Prior to casting of the furnace, the dam-plate 42 is preferably sealed at the joints with fire clay and at the end of the cast or wherever the slag flow to the main settling basin 4 is excessive and of such volume that the apparatus is not adapted to handle it, or the process machine is not operating, the dam-plate 42 is raised and the excessive slag and iron permitted to run thereunder into the slag ladle runner 48. This dam-plate 42 is preferably fluid-cooled and is provided with an aperture 44 therethrough near the bottom thereof. This aperture is ordinarily sealed by fire clay or other suitable material and is removed to open the aperture only at the finish of a flush or cast so as to permit the iron that may have settled in the bottom of the basin to run out. A catch-basin 50 is preferably connected to the ladle runner 48 adjacent the dam-plate 42. The catch-basin 50 is adapted to be connected to the ladle runner 48 by means of an aperture 52, normally closed by any suitable plugging material.

When it is desired to withdraw accumulated molten iron from the main settling basin 4, a dam is built in the ladle runner 48 behind the aperture 52 and then the plugging material in the aperture 44 is removed. This permits any

iron accumulated in the main settling basin 4 to flow through the aperture 44 and the dam in the ladle runner 48 forces the molten iron to flow into the catch-basin 50, from which it can be removed as desired.

In order to provide additional means for completely draining the main settling basin 4, a by-pass slag runner 54 butts against the main settling basin 4 and is connected to the ladle runner 48. An aperture 56, normally having plugging material therein, extends through the main settling basin 4 immediately above the place at which the by-pass slag runner 54 butts so that by removing the plugging material from the aperture 56 all of the heavy molten material present in the main settling basin 4 flows out through the aperture 56.

By arranging the apparatus which controls the flow of slag to the processing machine, in the above described manner, a regulated, steady flow of slag thereto is obtained. The main settling basin 4 is adapted to force the slag to settle and accumulate so that only a portion thereof flows to the auxiliary basin 16. In the auxiliary basin 16, the slag again tends to accumulate and a further portion of the molten iron present therein settles out and a volume of the slag overflows the member 20 and reaches the processing machine.

It will be appreciated that the invention is not limited to the specific form illustrated and described but is actually defined by the appended claims.

We claim:

1. Apparatus for controlling the flow of hot slag from a blast-furnace, said apparatus comprising a main settling basin, a slag runner extending between said blast-furnace and said main settling basin, a stationary dam-plate having an orifice therein secured across an outlet of said main settling basin, a stopper adapted to close said orifice, an auxiliary basin connected to the rear of said stationary dam-plate and provided with an inner downwardly sloping bottom surface, a flow-retarding member integral with said bottom surface, means adapted to receive the overflow from said member and conduct it to a processing machine, a vertically movable dam secured across a second outlet of said main settling basin, a ladle runner connected to the rear of said movable dam and a catch-basin connected to said ladle runner and a second catch basin connected to the lowest portion of said auxiliary basin.

2. Apparatus for controlling the flow of hot slag from a blast-furnace, said apparatus comprising a main settling basin provided with a plurality of outlets, a slag runner extending between said blast-furnace and said main settling basin, a stationary dam-plate having an orifice therein secured across an outlet of said main settling basin, a stopper pivotally secured to said dam-plate and adapted to close said orifice, an auxiliary settling basin connected to the rear of said stationary dam-plate and provided with an inner downwardly sloping bottom surface, a flow-retarding member integral with said bottom surface, means adapted to receive the overflow from said member and conduct it to a processing machine, a by-pass runner butted against said auxiliary basin and connected to said means, a vertically movable dam secured across a second outlet of said main settling basin, a ladle runner connected to the rear of said movable dam and a catch-basin connected to said ladle runner and

a second catch basin connected to the lowest portion of said auxiliary basin.

5 3. Apparatus for controlling the flow of hot slag from a blast-furnace having an iron and a cinder notch to a processing machine, said apparatus comprising a slag runner extending from said cinder notch, a main settling basin connected to and lower than said slag runner and provided with a plurality of outlets, a stationary fluid-cooled dam-plate having an orifice secured to an outlet of said main settling basin, a stopper pivotally secured to said stationary dam-plate and adapted to close said orifice, an auxiliary settling basin having an inner downwardly sloping bottom surface connected to the rear of said dam, a fluid-cooled flow-retarding member integral with said bottom surface, a refractory lined catch-basin connected to said bottom surface, means connecting the top of said member to said processing machine, a by-pass runner secured to said means and butted against the lowest portion of said bottom surface, a vertically movable fluid-cooled dam having an orifice secured to an outlet of said main settling basin, a ladle 15 runner connected to the rear of said movable dam, a catch-basin connected to said ladle runner, and a by-pass runner butted against said main settling basin and extending to said ladle runner.

30 4. Apparatus for controlling the flow of hot slag from a blast-furnace having an iron and a cinder notch to a processing machine, said apparatus comprising a slag runner extending from said cinder notch, a main settling basin connected to and lower than said slag runner and provided with a plurality of outlets, a stationary fluid-cooled dam-plate having an orifice there-through positioned across an outlet of said main settling basin, a stopper pivotally secured to

said stationary dam-plate and adapted to close said orifice, an auxiliary settling basin having an inner downwardly sloping bottom surface connected to the rear of said dam, a fluid-cooled flow-retarding member integral with said bottom surface, a refractory lined catch-basin connected to said bottom surface, means connecting the top of said member to said processing machine, a by-pass runner secured to said means and butted against the lowest portion of said bottom surface, a main iron runner connected to said iron notch, a runner connected between said main iron runner and said main settling basin, a vertically movable fluid-cooled dam-plate having an orifice near its bottom secured to an outlet of said main settling basin, a ladle runner connected to the rear of said movable dam, a catch basin connected to said ladle runner, and a by-pass runner butted against said main settling basin and extending to said ladle runner.

5. The combination with a blast furnace, of apparatus for separating entrained iron from slag to prevent consequent adhesion between the settled iron and the slag ladle, said apparatus including a main settling basin, a main slag runner extending between said blast furnace and said main settling basin, an iron runner, an auxiliary slag runner extending from said iron runner to said main settling basin, means associated with said auxiliary slag runner for withdrawing the settled iron from the slag as it passes therethrough to said main settling basin, means for withdrawing the settled iron from the slag in said main settling basin, and means for conducting the accumulated slag in said main settling basin to a processing machine.

JOHN W. FORSYTHE.
WILLIAM STEWART.