

UNITED STATES PATENT OFFICE.

PATRICK MEEHAN, OF LOWELLVILLE, OHIO.

APPARATUS FOR HANDLING BLAST-FURNACE SLAG.

SPECIFICATION forming part of Letters Patent No. 689,981, dated December 31, 1901.

Application filed January 24, 1901. Serial No. 44,520. (No model.)

To all whom it may concern:

Be it known that I, PATRICK MEEHAN, a resident of Lowellville, in the county of Mahoning and State of Ohio, have invented a new and useful Improvement in Apparatus for Handling Blast-Furnace Slag; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to apparatus for handling blast-furnace slag.

In the operation of a blast-furnace for the manufacture of iron each time the furnace is tapped to draw off the molten metal a quantity of slag is discharged after the molten metal has been drawn off. This slag is in a substantially molten condition, and when it comes from the furnace it has to be carried off in runners or ladles to a suitable distance from the furnace, where it may cool and where it will be out of the way when the next tap takes place and will not interfere with or inconvenience those employed about the furnace. In cases where the slag is conveyed by runners to a point where water is applied to it from hose to cool and harden it the application of the water generates great clouds of steam, which is very dangerous and annoying to the workmen in charge, while at the same time the slag hardens in a continuous mass, and it has to be broken up before it can be handled and loaded onto cars. Where it is handled in ladles and loaded onto cars in its fused state, it sets or hardens in the cars and when discharged therefrom is in the form of large molded blocks.

The object of my invention is to provide a form of apparatus by means of which the slag as it comes from the furnace is cooled and separated into particles of a size conveniently handled and is conveyed in such shape to the cars without the difficulties and inconveniences of the old ways of handling same.

To these ends my invention comprises, generally stated, an inclosed reservoir with a steam-outlet, runners for conveying the slag to said reservoir, and means for cooling and breaking up the slag as it enters said reservoir, together with means for conveying it therefrom, all as fully hereinafter set forth and claimed.

To enable others skilled in the art to make and use my invention, I will describe the same

more fully, referring to the accompanying drawings, in which—

Figure 1 is a side view in elevation, partly in section and partly broken away. Fig. 2 is a plan view, partly broken away. Fig. 3 is an enlarged side view of a portion of the conveyer. Fig. 4 is an enlarged face view of same. Fig. 5 is an enlarged detail of the guide-plate. Fig. 6 is an enlarged view of one of the runners and nozzle.

Like numerals indicate like parts in the several figures of the drawings.

The numeral 2 designates a suitable reservoir or receptacle formed of iron or steel plates riveted or otherwise secured to each other to form a strong durable structure, preferably circular in form. The top 3 of the reservoir 2 is slightly conical and is provided with an opening, to which the pipe or stack 4 is connected. The reservoir 2 may be located conveniently near the blast-furnace and is preferably arranged below the level of the ground or furnace floor or at least the main portion of said reservoir, the stack extending to any suitable height. The bottom 5 is inclined, and at its lower end is the outlet 6, controlled by the dam or door 7. Connected to the door 7 are the rods 8, which are threaded, as at 9, at their upper ends and extend through the top 3. The pinions 10, having the nuts 12, engage the threaded ends 9 of the rods 8. These pinions 10 are supported by the bracket 13, and they mesh with the pinion 14. This pinion 14 is mounted on a vertical bearing in the bracket 13, and on the same bearing is the bevel-pinion 15, which is engaged by the bevel-pinion 16 on the shaft 17. A hand-wheel 18 is provided for operating the shaft 17, which through the mechanism described will impart simultaneously rotary movement in the same direction to the pinions 10.

Connected to the reservoir 2 is the casing 19, which contains the conveyer 20. Journalled at the upper and lower ends of the casing 19 are the shafts 21, to which are secured the disks 22, having the sprockets 23, projecting out radially therefrom. The endless chain of the conveyer 20 is composed of the long links 24, connected by the double links 25. The pans or buckets 26 are carried by the links 24, said pans having the studs 27,

which enter openings 28 in said links, and the studs 29, which enter slots 30 in said links, to permit of the tilting of said pans, as will more fully hereinafter appear. The links of the conveyer-chain are not engaged by the sprockets 23; but said sprockets are arranged within the chain in such a manner that they only engage with the pans themselves at or adjacent to each end thereof or at points intermediate of the studs. By this construction the engagement of the sprockets is with the pans alone and the strain and wear and tear on the chain are greatly reduced.

At the upper end of the casing 19 is the opening 31, through which the slag is discharged into the chute 32. This chute 32 is hinged to the casing, as at 33, so that its angle of incline may be changed or it may be lowered down out of the way when desired. A cable or chain is connected to the outer end of said chute, said cable passing up and over a pulley 34. Hinged or pivoted to the chute 32 is the guide-plate 35, said guide-plate having the counterweighted arm 36 connected thereto, so as to hold said plate normally in the position shown in full lines, Fig. 5. The guide-plate 35 is in the path of the pan as it approaches the chute, and said plate is lifted by said pan and drops back into position to guide the contents of the pan as it is dumped into the chute 32. A car 37 is arranged in position to receive the slag as it passes from the chute 32.

At one side of the reservoir 2 are the runners 38, leading into said reservoir. Below said runners and in line therewith are the nozzles 39, preferably flaring outwardly. These nozzles are connected up by pipes 40 to a suitable water, steam, or other fluid supply.

When my improved apparatus is in use, the slag as it is drawn from the blast-furnace is conducted by the runners 38 into the reservoir 2. At the same time water is supplied to the nozzles 39, and as the slag drops into the reservoir from the runners the water strikes the slag with sufficient force to break it up and separate it, while at the same time it cools the slag, so that it drops to the bottom of the reservoir in comparatively small particles. Owing to the inclined bottom 5 the slag so divided passes to the lower end of the reservoir, where the outlet 6 is located. When it is desired to remove the slag, the hand-wheel 18 is rotated sufficiently to raise the door 7, allowing the broken slag and water to pass into the casing 19. Power is then applied to drive upper shaft 21. The sprockets 23, engaging the pans, impart movement to the endless conveyer, and each pan as it reaches the bottom of the casing 19 scoops up a portion of the slag admitted to said casing by the opening of the door 7. The pans as they are filled pass up until they reach the sprockets at the upper end of the casing, where they are engaged by said sprockets, and at the proper moment they are tilted, as shown in Fig. 3, sufficiently to discharge their

contents into the chute 32, the guide-plate 35 preventing the escape of the slag between the casing and said chute. The steam created by the discharge of water on the hot slag as it enters the reservoir escapes through the stack 4, so that all the danger and inconvenience attending the old manner of handling the slag are done away with and the confusion occasioned thereby is avoided. In the working of the apparatus the reservoir may be filled at night, the gate to the conveyer being closed. In the morning when the conveyer is put in operation the gate is raised sufficiently to permit a quantity of slag to enter the casing to be removed by the conveyer. The amount admitted may be regulated so as to prevent the clogging up of the conveyer by the admission of a greater quantity than said conveyer can handle. When the gate is closed, the slag admitted to the reservoir cannot enter the casing and clog up the conveyer.

The reservoir may be located adjacent to the furnace, and as the greater part of it is below ground it does not reach any appreciable height.

The apparatus may be easily operated, and the slag when dumped into the cars is cooled and of such size as to be conveniently handled, so that the necessity of breaking it up by hand after cooling is avoided and the number of workmen greatly reduced.

What I claim, and desire to secure by Letters Patent, is—

1. In apparatus for handling slag, a closed reservoir having an inlet for the slag near its top and an outlet for the same at the bottom, means for forcing water against the entering slag, and a stack leading from the top of said reservoir.

2. In apparatus for handling slag, a closed reservoir having an inlet for the slag, means for breaking up and cooling said entering slag, said reservoir having an inclined bottom and an outlet at the lower end thereof, and a conveyer arranged in operative position with reference to said outlet.

3. In apparatus for handling slag, a closed reservoir having an inlet for the slag, means for breaking up and cooling the entering slag, said reservoir having an inclined bottom and an outlet at the lower end thereof, a casing communicating with said reservoir through said outlet, and a conveyer adapted to convey said slag therefrom.

4. In apparatus for handling slag, a reservoir having an inlet for the slag, means for breaking up and cooling said slag, said reservoir having an inclined bottom and an opening at the lower end thereof, a gate for said opening, and a conveyer adapted to convey said slag therefrom.

5. In apparatus for handling slag, a reservoir having an inlet for the slag, means for breaking up and cooling the entering slag, said reservoir having an inclined bottom and an outlet at the lower end thereof, a gate, a

threaded rod connected to said gate, a nut engaging said rod, means for rotating said nut, and a conveyer arranged to convey the slag from said outlet.

- 5 6. In apparatus for handling slag, a reservoir having an inlet for the slag, means for breaking up and cooling the entering slag, said reservoir having an inclined bottom and an outlet at the lower end thereof, a gate, 10 threaded rods connected to said gate, nuts engaging said rods, pinions connected to said nuts, a main pinion meshing with both said first-named pinions, connections between said main pinion and a lower shaft, and a conveyer 15 arranged to convey the slag from said outlet.

7. In apparatus for handling slag, a closed reservoir having an inlet for the slag, means for breaking up and cooling the entering slag, said reservoir having an inclined bottom and 20 an outlet at the lower end thereof, said outlet leading into a suitable casing, a chain conveyer in said casing, pans on said conveyer adapted to receive the slag, and means for discharging said slag at the desired point.

- 25 8. In apparatus for handling slag, a reservoir having an inlet for the slag, said reservoir having an inclined bottom and an outlet at the lower end thereof, said outlet leading into a suitable casing, a chain conveyer in 30 said casing, pans on said conveyer adapted to receive the slag, and means for discharging said slag through an opening in said casing, a chute adjacent to said opening, and a swinging guide-plate in the path of said pans.

9. In apparatus for handling slag, a reservoir having an inlet for the slag, said reservoir having an inclined bottom and an outlet at the lower end thereof, said outlet leading into a suitable casing, a chain conveyer in said casing, tilting pans on said conveyer 35 adapted to receive the slag, shafts at the upper and lower ends of said casing, sprockets carried by said shafts adapted to engage said pans, and the sprockets on the upper shaft engaging said pans at the discharging-point, 40 said casing having an opening at the upper end thereof through which said slag is discharged.

10. In apparatus for handling slag, a reservoir having an inlet for the slag, said reservoir having an inclined bottom and an outlet 50 at the lower end thereof, said outlet leading into a suitable casing, a chain conveyer in said casing, tilting pans on said conveyer adapted to receive the slag, shafts at the upper and lower ends of said casing, sprockets 55 carried by said shafts adapted to engage said pans at points intermediate of the ends thereof, the sprockets on the upper shaft engaging said pans at the discharging-point, and said 60 casing having an opening at the upper end thereof through which said slag is discharged.

In testimony whereof I, the said PATRICK MEEHAN, have hereunto set my hand.

PATRICK MEEHAN.

Witnesses:

ROBT. D. TOTTEN,
ROBERT C. TOTTEN.