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TREATMENT OF SLAG

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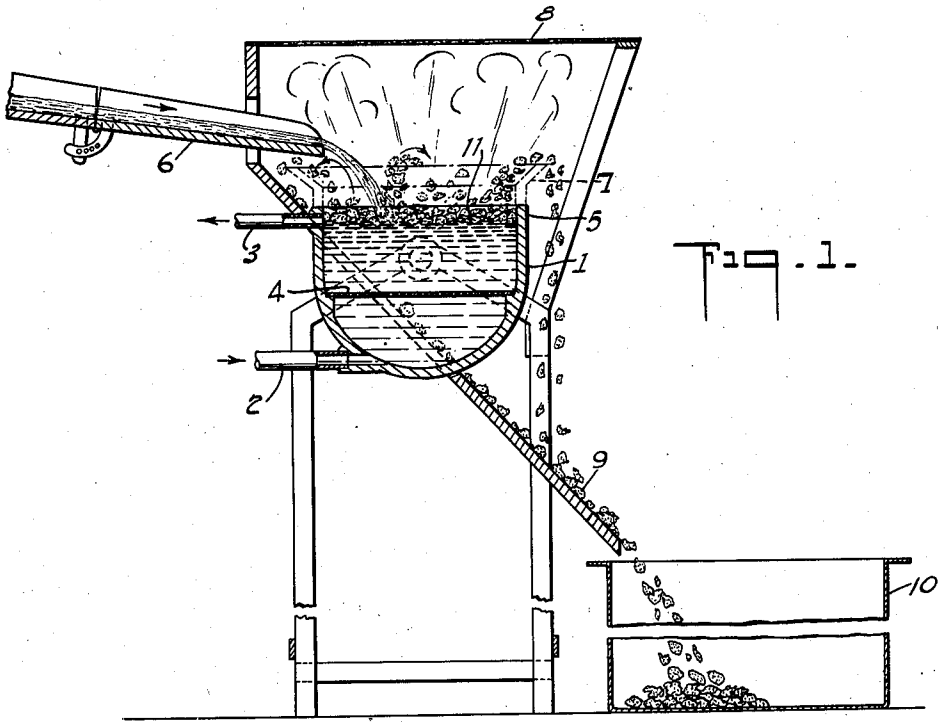
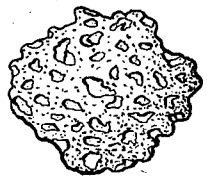


Fig. 1.

Fig. 2.



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TREATMENT OF SLAG

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4 Claims. (Cl. 49—14)

This invention pertains to improvements in treating blast furnace slag and the like so as to puff the slag. An object is to produce the slag in lumps that are light and friable, but yet strong, and that are substantially dry. A further object is to control the desired product to obtain substantial uniformity, yet with sufficient flexibility of treatment as to vary within limits the characteristics of different products. It is desired particularly to obtain porous slag in masses or chunks of considerable size that are both light and strong. An object also is to simplify the necessary apparatus. These and other objects more fully appear from the following illustrative description of this invention.

Heretofore it has been proposed to quench molten slag in water, as by plunging the slag into water, or by endeavoring to flow slag along the surface of water. The products, however, have been sandy in some instances, or else frothy and weak; moreover they have been lacking in desired uniformity.

In the description of the present invention, reference is had to an illustration of preferred practice thereof, taken with the accompanying drawing and with the novel features particularly pointed out in the appended claims. In the drawing, Fig. 1 illustrates the general structure of one form of apparatus adapted to carry out this invention; and Fig. 2 illustrates the product obtained by this invention.

In broad aspects of this invention, various novel improvements are accomplished by injecting steam into a stream of molten slag and then, with diffusion and expansion of the steam as the slag congeals, cooling the slag slowly in relatively large masses. In preferred practice according to the principles of this invention, molten slag is run from a slight elevation directly upon the surface of a deep, quiet pool of water under substantially constant conditions. The product is immediately removed without substantial wetting and while steam permeates the mass.

Referring more particularly to the drawing of an illustrative embodiment of this invention, though the invention is not restricted thereto,

Fig. 1 shows a reservoir 1 to contain a relatively deep pool of water. As specific example, a round container about six feet in diameter and about five feed deep may be used. The reservoir contains means to maintain practically constant conditions during contact with molten slag. The particular means illustrated comprise a water inlet 2 near the bottom, with constant-level outlet, 3, near the top. Outlet 3 may be smaller than inlet 2. Another outlet, not shown, may be provided if different levels of the pool are desired. At an intermediate level, preferably near the middle, a perforated plate 4 fills the area of container 1. This is to minimize agitation and convection currents and to maintain practically uniform temperature slightly above outlet 3 and at the surface of the pool.

The rim of reservoir 1 extends slightly above outlet 3. Arranged to discharge upon the surface of the pool is a slag runner 6. This preferably is broad or flat, and inclined at a slight angle, which may however be adjusted to as great as 45° from the horizontal if desired. It is desirable under preferred practice of this invention that the runner deliver slag at only a slight distance, preferably about two to five inches or even of one to six inches, above the surface of the pool, and directly into the water. Known means may be provided to regulate the flow of slag. Rim 5 is adapted to receive a supplementary or higher rim 7, which may add as much as two feet, or less, height to container 1. As it is desirable, further, to be able to alter the angle of rim 7, or of rim 5, to the surface of the pool, container 1 is mounted on trunnions to facilitate desired tilting.

An adjunct of further used, though not indispensable, is screen 8 which may be positioned above container 1 so as to restrain the flight of pieces of slag that may be thrown from the surface of the pool. Further, an apron 9 preferably is mounted around container 1 and sloped downwardly to a bin or car 10 for gradual removal of puffed slag.

In operation, water under suitable control is led into the bottom of container 1 through inlet 2 and gradually moves upwardly in the pool through distributor 4 to constant-level outlet 3. Regulation preferably is to maintain a large mass of water at constant level, under uniform temperature, and at the surface approaching boiling temperature. A stream of molten slag at desired rate flows from chute 6 upon the surface of the pool, but because of the slight height, rate of flow, and the condition, size and depth of the pool, and substantial absence of agitation of the water, the slag is not at all, or but scarcely, submerged. The molten slag striking directly the surface of the pool generates steam, explosively, so that steam quickly penetrates the sheet of molten slag as it first starts to congeal. During this interval, force of the steam throws the mass of slag upwardly from the water. Much of the product is thrown clear from the rim into apron

9, while apparently steam continues to permeate the mass, as during its passage congelation continues. Apron 9 is advantageous in prolonging this period of expansion and hardening.

With rim 5, and more effectively with use of the higher auxiliary rim 7 the flying slag is confined to a limited area so that the surface above the pool becomes filled with expanding masses of slag, 11. The effect is somewhat that of a blanket and of distributing means for the incoming slag. Thus incoming slag is in effect fed into an atmosphere of steam of relatively considerable quantity and force, and heat is retained in the blanketing slag for a relatively long period of time for penetration and expansion of the steam. The extent of sudden surface chilling, if any, is relatively small, but rather the attainment of porosity is extensive. The pores become large, but the cell walls become relatively strong rather than unduly brittle. The walls evidently undergo something of annealing action. The masses within the rim gradually heave up over the rim and fall continuously, annealing or completing their hardening relatively slowly before delivery from apron 9. To a considerable degree the stream of molten slag has been subjected to sudden, if not explosive, permeation by steam, followed by a relatively long period at high temperature for expansion and slow uniform congelation of the wall structure. It is contemplated that other gas than steam may be used, followed by similar slow curing at elevated temperature.

Flexibility of control exists in variation of rate and temperature of water brought to the surface of the pool; also in the angle and the height of chute. Further and particularly important control is effected through use of the higher supplementary rim 7, for by its use a somewhat harder slag product is obtained, and masses of smaller size and greater hardness.

The product is strong, uniform, dry and light or porous. It contains only about one tenth of one percent of moisture as formed, with perhaps one percent as an extreme upper limit. In size it ranges in chunks from about three inches to about nine inches, the largest masses resulting from the least fall or submergence, combined with slow cooling. Such masses are strong though so light as to weigh only three or four pounds per cubic foot.

According to the patent statutes, I have explained the principles and operation of my invention in what I now consider to represent its best embodiments, but it is understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically illustrated and described.

What is claimed is:

1. A process to produce porous chunks of slag, comprising flowing a stream of molten slag with minimum loss of heat directly upon the surface of a relatively deep pool of water, so that the slag is permeated by steam and gradually expanded and hardened thereby and flies in the form of chunks from the surface, confining the flying slag to a limited area above the surface of the pool, whereby the newly formed expanding chunks are blanketed by previously expanded chunks, for maintaining a warm atmosphere on all sides of the flying chunks to prolong congelation and facilitate puffing and pore-forming action in the hardening chunks of flying slag.

2. A process to produce porous chunks of slag, comprising providing a relatively deep pool of water, feeding a stream of molten slag with minimum loss of heat directly upon the surface from an elevation up to about six inches so that the slag is permeated by steam and gradually expanded and hardened thereby and flies in the form of chunks from the surface, confining the flying slag to a limited area above the surface of the pool, whereby the newly formed expanding chunks are blanketed by previously expanded chunks for maintaining a warm atmosphere on all sides of the flying masses to prolong congelation and facilitate puffing and pore-promoting action in the hardening masses of flying slag, and then collecting the expanded masses in a dry, cooler atmosphere while introducing a supply of water substantially below the surface of the pool in quantity and manner to promote uniform temperature at the surface.

3. Apparatus for producing porous chunks of slag, comprising a reservoir having an outlet to maintain constant level of liquid, means to distribute a supply of water below the liquid level, means to feed molten slag directly upon the surface of the water from a height up to about six inches, and means to confine the slag comprising a rim above the surface of water within a limited distance from the slag feed to promote heat blanketing of expanding masses and gradual discharge of slag accumulating above the liquid.

4. Apparatus for producing porous chunks of slag, comprising a reservoir having an outlet to maintain constant level of liquid, means to distribute a supply of water below the liquid level, means to feed molten slag directly upon the surface of the water from a height up to about six inches, and an outwardly flaring rim above the surface of water to promote heat blanketing of expanding masses and gradual discharge of slag accumulating above the liquid, and means to change the angle between the liquid surface and the flaring rim.

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