

# UNITED STATES PATENT OFFICE.

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## MANUFACTURE OF FURNACE-LININGS.

SPECIFICATION forming part of Letters Patent No. 273,917, dated March 13, 1883.

Application filed November 23, 1882. (No specimens.)

*To all whom it may concern:*

Be it known that I, HERMANN ÜLSMANN, a citizen of the German Empire, residing at Königshütte, in the Kingdom of Prussia and German Empire, have invented new and useful Improvements in the Manufacture of Furnace-Linings, Fire-Bricks, &c., of which the following is a specification.

The object of this invention is to increase the cohesion or strength of purely basic fire-proof materials manufactured from natural or artificial caustic alkaline earths, or their carbonates, such as lime or magnesia, either alone or in combination.

Heretofore the process of dead-burning and "slagging" of the alkaline earths was effected by long or repeated burning at the highest temperatures, or by mixing with watery solutions of caustic alkalies or carbonates or chlorides thereof, or of the alkaline earths. Instead of these watery solutions, I now use the ferrous alkaline earths, such as exist in nature—for instance, magnesium ferric carbonate—or such as can be produced artificially, or I add to the alkaline earths iron in a metallic or oxidized condition, or as carbonate chloride, or in another suitable combination in form of small fragments or powder. On exposing the mixture to a high temperature the alkaline earths combine very readily with the corresponding oxides, and while they lose all the carbonic acid which they may contain, they are converted thereby, with considerable shrinkage, into a very hard splintery, granular, brittle mass, which, like the natural magnesium ferric carbonates and like the roasted spathic iron ore, crumbles into small pieces. The brittleness of this slagged mass and its tendency to fall into pieces facilitate its reduction for the subsequent operations, in which it is important that only a portion should be ground fine, while another portion, dependent upon the purpose to which the mass is to be applied, should be left in granules of from 0.039 to 0.19 inch in size, or even larger, and with the sharpest possible corners or edges, in order to produce therefrom, with the admixture of suitable binding materials, coarse-grained bricks and other articles of a similar grain in the fracture as those prepared

from burned and pulverized fire-clay, which resist all the varying influences of heat and cold.

The binding material which I employ consists of an intimate mixture of finely-pulverized anhydrous alkaline carbonates—such as soda or potash, either alone or in combination—with tar free from water, or other hydrocarbon of a viscous nature in the cold or warm state. By the addition of this mixture to the above-described slagged and reduced alkaline earths a plastic mass is obtained which, when warmed, can be readily pressed in the form of bricks, pipes, or vessels, and which can be applied directly as lining for metallurgical apparatuses. The admixture of caustic alkalies or of alkaline compounds which contain water of hydration, or which have a tendency to take up water from the air, have in this case a detrimental action, because the strength of the bricks or of the stamped lining is liable to be impaired thereby at the subsequent burning. By the methods heretofore employed for the manufacture of basic fire-proof materials, in which watery solutions of caustic alkali or alkaline carbonates, either alone or combined, with the subsequent admixture of tar are used, no satisfactory results can be obtained as regards the strength and durability of the products, because the tar alone affords a binding material of but little strength under the influence of heat, and because the water contained in the alkaline solutions forms hydrates with the alkaline earths and alkalies, the decomposition of which, under the influence of heat, when being burned, renders the fire-proof material loose. It is also not sufficient to add to the fundamental mass of alkaline earths or their carbonates only one per cent. or a small percentage of alkaline carbonates or caustic alkalies as binding material; but it requires an ample addition of alkaline carbonates for this purpose. I have found that at least five per cent. of the alkaline carbonates must be added to ninety-five per cent. of the dead-burned slagged fundamental mass in order to obtain a good result. The quantity of tar employed should not be greater than actually necessary for uniting the warmed mass under pressing or stamping to a solid mass. It may be one-



tenth of the weight of the fundamental mass of dead-burned alkaline earths; but the proportion depends essentially upon the degree of toughness or fluidity of the tar.

5 For the purpose of burning and slagging the alkaline earths, reverberatory or shaft furnaces can be used; but care must be taken that no ashy constituents containing silicic acid are added, and also that the highest possible temperature be employed, while quench-  
10 ing with water must be avoided.

If the bricks, pipes, vessels, or other articles produced in the manner above described are to be burned before they are used, they must  
15 be piled in the furnace with pieces of previously-burned material placed beneath and between them in such a manner that the same, when softening, as the tar becomes fluid in the heat, cannot sink together. The furnaces or kilns  
20 must afford a high temperature and must have a basic floor when used for lime bricks.

Fragments of burned material, or of used linings of the above nature, can be ground and re-formed by the addition of tar and reburn-  
25 ing. If the dead-burning and slagging of the alkaline earths is effected with addition of chlorides of the alkaline earths or the alkalis with or without the admixture of fluor-spar, it is advisable to introduce steam at the dead-  
30 burning in order to drive off the chlorine. The dead-burning can be accelerated by the addition of small quantities of caustic alkalies or their carbonates.

I am aware that refractory brick has been  
35 produced by a mixture of newly-burned lime with tar. In this manufacture magnesia limestone is used, containing, before calcination, from five to seven per cent. of silica and from

three to four per cent. of alumina and iron oxide. This material, after burning, is mixed  
40 with tar, or tar and creosote, in a mortar-mill preparatory to its being pressed in molds.

By my invention I avoid the presence of silica, and for a binding material tar or some similar hydrocarbon mingled with alkaline carbon-  
45 ates free from water is employed.

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

1. The compound for basic furnace-linings, fire-brick, and other articles, consisting of a  
50 fundamental mass prepared by dead-burning and slagging alkaline earths—such as lime or magnesia—in the presence of iron or oxide or other combination thereof free from silicic acid, and of a mixture prepared of hydrocar-  
55 bons free from water and of a viscous nature, with alkaline carbonates free from water.

2. The within-described process for manufacturing basic fire-proof materials by first  
60 dead-burning and slagging the alkaline earths with admixture of iron or other combination thereof free from silicic acid, then comminuting the fundamental mass thus obtained, then  
65 adding thereto a mixture of tar or other similar hydrocarbon with alkaline carbonates free from water, and, finally, molding, pressing, or stamping the compound into the required forms.

In testimony whereof I have hereunto set my hand in the presence of two subscribing wit-  
70 nesses.

HERMANN ÜLSMANN.

Witnesses:

EDUARD FEUERSTEIN,  
WICHHELM DÜRROEST.