UNITED STATES PATENT OFFICE.

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COMPOSITION FOR REFRACTORY FURNACE LININGS AND BOTTOMS.

SPECIFICATION forming part of Letters Patent No. 256,607, dated April 18, 1882.

Application filed September 24, 1881. (No specimens.) Patented in England June 17, 1881, in France October 7, 1881, and in Belgium October 8, 1881.

To all whom it may concern:

Be it known that I, ALEXANDER EDWIN TUCKER, of Rhymney Iron Works, South Wales, a subject of the Queen of Great Britain and Ireland, have invented certain new and useful Improvements in a Composition to be Used for Refractory Furnace Linings and Bottoms, which are fully described in the following specification.

Heretofore silicious converter or furnace bottoms and linings have been formed by moistening ganister or ground sandstone with water and ramming or molding it into the form and position required. Tuyeres in like manner are formed from refractory clay moistened with water and pressed into suitable molds.

The above methods have the following disadvantages: In ordinary ganister there is little material for yielding a plastic mass. Consequently when the water with which the material has been mixed is evaporated the resulting mass is somewhat friable, and therefore less suited to resist the abrasive action of the blast and agitated molten metal than a denser and more compact material would be. Moreover, when the addition of clay or similar material is made to increase the plasticity of the mass, the refractoriness of the whole is lowered, and hence it is less capable of resisting chemical action. The rapid wearing away of the linings and bottoms not only necessitates rapid renewal and lower yields, but also the production of a quantity of cinder, which retards the conversion of the iron and requires much labor for its removal.

The object of my invention is to obtain a material in which the cement joining its particles together shall be infusible, and which material therefore is far more coherent and harder and offers greater resistance to the mechanical action of the blast and iron than water-made ganister. I secure this result by using coal or wood tar, or any heavy-oil residue or similar hydrocarbon compound, instead of water. The tar or hydrocarbon compounds are mixed with the ganister or fire-clay in such proportions as to form a thoroughly plastic mass. I always greatly prefer to use tar when it is readily obtainable. Thus in applying my invention to the making of bottoms for Bessemer converters I take tar, which I prefer to have been boiled to free it from water and light volatile oils, in order that the bottom, when made, may be more quickly dried, and so have less tendency to split by the undue generation of gas in the converter. The tar at 20° centigrade should have about the same consistency as ordinary treacle at 20° centigrade, which consistency I obtain by boiling with solid pitch or bituminous coal crushed flour fine, or simply prolonging the boiling. I prefer, however, the use of bituminous coal. I then mix such tar, made hot, with about ten times its weight of finely-ground ganister, such as is ordinarily used for making bottoms and linings, under edge runners, or other suitable mixing apparatus, until the mass has a tendency to flake and naturally cohere. In the making of bottoms I then ram such mixture round either tuyeres or iron pins. The latter being equal in number and diameter to the blast-holes required, I find it far best to use for the purpose red-hot iron rammers, and when using pins the rammers should be provided with holes in them through which the pins pass in ramming, by which means the holes are rendered more durable. When the bottom is completed it is dried at a temperature of about 100° centigrade for some twelve hours in suitable ovens, the heat is gradually increased to a dull redness and continued at this point until no more combustible vapors are evolved. The bottoms should be covered by a heavy, loose, iron plate.

In making Bessemer tuyeres I use either finely-ground ganister or dry refractory silicious fire-clay and mix it in a pug or other mill intimately with tar, &c. I then ram or press it into a tuyere-mold provided with tuyere-hole rods in the usual way. In making tuyeres I use the smallest quantity of tar which will give plasticity, and I prefer to use split cast-iron tuyere-molds in which the tuyere when molded is taken to the stove and then fired at a low red heat for about forty-eight hours. I find it useful in order to prevent the tuyere from sticking to the mold to have a very thin sheet-iron or thick paper casing between the tuyere and the mold.

The tuyere may be used either directly after its first burning, or may be removed from the drying-oven, taken out of its mold, and subjected to a high heat in an ordinary fire-brick kiln.

The use of the iron mold in the drying-oven is not absolutely necessary, though it prevents the tuyere being distorted, particularly if heavy petroleum oils be used as the mixing medium instead of tar.

I employ in the manufacture of refractory bricks the same mixtures and methods of manufacture that I employ for the manufacture of tuyeres. The molds are preferably formed in four or six pieces fastened together with bolts and wedges. Burning in the molds for twelve to twenty-four hours at a red heat is generally sufficient for bricks, even of large size. They may, however, if they are to be exposed to very high heats, be afterward fired without the mold at a white heat in a fire-brick kiln.

In making Bessemer converter-linings and the hearths of Siemens furnaces the mixture before described may be either rammed or slurried. When the mixture is to be slurried—that is, thrown in either on the hearth of a Siemens furnace or the belly of a Bessemer converter placed horizontally or between an iron pattern and the shell of a converter without there being in either of these cases any subsequent ramming—the proportion of the tar or similar mixing medium is increased, so as to make with the ground silicious material a mass which, when piled up in a heap, has a tendency to run down and spread. A converter-lining may, however, be conveniently made by ramming the mixture, such as has been described as used for bottoms, between the converter-shell and a wooden or iron mold.

I have found as a result of some months practical working that a converter-bottom made with water and ganister in the usual way will only last from ten to thirteen blows, while the average is less, and that in the same converter and in the same charge of iron bottoms made and prepared from my compound will last from twenty to thirty-five blows, this alone representing an economy for a pair of converters of ten to fifteen thousand dollars a year.

I am aware that it has been proposed to render fire-clay for furnaces non-conducting and porous by mixing it with sawdust and viscous substances—such as tar and sugar—and burning it at the temperature of melting cast-iron, and this I do not claim, as I do not use sawdust or similar material in my process; nor do I burn the mixture at the heat of melting cast-iron; nor do I render the material porous, light, and non-conducting, my object being, on the contrary, to produce a dense, hard, heavy, coked mass, which cannot be done if such a substance as sawdust be introduced and then burned out at a high temperature.

What I claim, and desire to secure by Letters Patent in the United States, is—

The herein-described composition for lining Bessemer converters and furnaces, and for the making of converter-bottoms, tuyeres, and refractory bricks, the same consisting of ground ganister or sandstone, or similar ground silicious material mixed with tar or similar hydrocarbons, preferably with the addition of a little coal-dust, in the proportions and manner herein described.

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