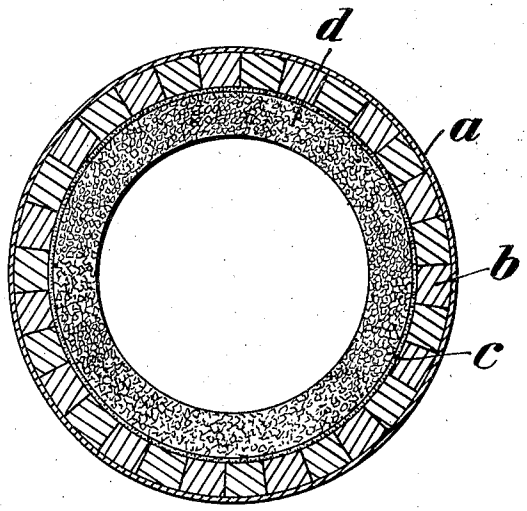
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PROCESS OF LINING FURNACES, CONVERTERS, AND THE LIKE

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EDUARD BONG, OF SUCHTELN, GERMANY.

PROCESS OF LINING FURNACES, CONVERTERS, AND THE LIKE.

Application filed July 3, 1922. Serial No. 572,709.

To all whom it may concern:

Be it known that I, EDUARD BONG, citizen of the German Republic, residing at Suchteln, Germany, have invented certain new and useful Improvements in Processes of Lining Furnaces, Converters, and the like, of which the following is a specification.

This invention relates to an improved process for providing cupolas, small converters and similar furnaces or apparatus with a refractory lining.

The lining of such furnaces or apparatus has hitherto been effected almost exclusively by means of refractory or fire bricks (chamotte or silica bricks). The brick lining has, however, the disadvantage that between the bricks joints or interstices are formed, which must be grouted with chamotte mortar. An arrangement of the bricks in such a manner that no interstices are formed between them is almost impossible for practical reasons.

The mortar employed for filling up the joints, which is intended to sinter or fuse the bricks together, tends to the formation of a slag, owing to its melting point being lower than that of the bricks and this slag attacks the edges of the bricks and causes quick wear.

To overcome this drawback the lining of moulded or shaped bricks has been provided with an inner or surface lining or dressing of refractory material, which is firmly fixed upon the brick lining by vigorous tamping. Finally the bricks have been omitted altogether and the furnace, converter or the like has been provided with a lining consisting of tamped refactory material only.

The material hitherto employed for that purpose was generally "clay-sand," which consists of natural deposits of rather fine quartz sand mixed with a certain percentage of clay. This finely granulated mass must be thoroughly moistened with water, to prepare it for tamping and after the lining is finished the water must again be removed by evaporation. Owing to the density and impermeability of the tamped mass this is very difficult and leads to the formation of cracks and fissures in the lining. Furthermore quick slagging of the clay-sand takes place.

The object of my invention is to employ a tamping material, which vitrifies when heated and which avoids the before mentioned disadvantages.

The tamping material as employed according to my invention consists, in contradistinction to the material hitherto employed, not of finely granulated materials, but of highly refractory quartz rock in pieces of 5–15 mm. in diameter, which are mixed with refractory binding agents, for instance triturated fire clay, in appropriate quantities.

As soon as the first melting process has been carried out in the furnace, a vitreous surface without any joints or fissures is formed upon the refractory lining or dressing and below this vitreous layer the tamping material is disposed in sintered condition, so that a melting of the lining owing to slagging is rendered considerably more difficult. In the same degree in which the greatly reduced melting of the lining furnace progresses, the sintering also proceeds and extends gradually to the layer of fire bricks.

As the entire inner furnace wall thus forms a uniform smooth vitrified surface, adhesion of the charges is rendered impossible and a smooth working of the furnace is ensured.

By the employment of coarse, sharp edged quartzite lumps, which during the tamping mesh and interlock, a very firm and solid structure is formed, which posesses a far higher resistance against mechanical wear than tamped layers consisting of finely granulated material.

It is, furthermore, obvious that this coarse material requires far less water for moistening in preparation for tamping, than the hitherto employed finely granulated material and that this water in the form of steam can escape far more easily when the lining is dried.

The sintering also takes place considerably quicker, so that the furnace is ready for service in a shorter time, which means a great saving in fuel. The tamped material according to this invention, owing to its composition, is far less liable to be chemically attacked, so that fusing owing to slagging takes place much slower during the melting process carried on in the furnace.

It has also been ascertained that expansion of the furnace lining does not take

place, as in consequence of the selection of the materials to be mixed a compensation is brought about, inasmuch as the expansion of the quartzite rubble is about equal to the contraction of the plastic binding agent mixed with it, so that a change in the volume and the formation of cracks and fissures in consequence thereof are prevented.

The detachment of the inner lining or dressing of the tamped material from the fire brick underneath, which is necessary when the furnace is to be relined, is very difficult, as the two sinter and fuse together. According to this invention this detachment is greatly facilitated by providing between the fire brick lining and the tamped material a protective or insulating layer, which allows the steam generated during the drying to pass. Preferably this protective layer consists of a black lead or graphite coating of about 1–2 mm. thickness applied to the fire brick lining and which separates it from the tamped material. It has been ascertained by practical experience that a thin coating of black lead, which may be applied in any suitable manner, enables a surprisingly easy removal of the tamped material from the fire bricks without damaging the fire bricks of the lining.

The accompanying drawing shows a cross-section of the improved lining applied to a furnace of the type described. In said drawing, *a* indicates the furnace casing, *b* the fire-brick lining, *c* the protective layer of graphite and *d* the tamped material.

Besides the advantage that the last traces of the tamped material may easily be removed from the fire brick by chipping it off with a chisel by hand or by means of compressed air chisel, the following further advantages may be mentioned:

The refractory bricks are owing to their porosity particularly adapted to attract the moisture remaining in the tamped material and to conduct it away towards the outside. This is further facilitated by the fact that the outer row of the lining bricks is usually arranged at some distance from the sheet iron shell, this space serving as a conduit for the vapours generated during the drying of the lining. The remaining portion of the moisture escapes into the interior of the furnace, when the furnace is dried by a wood or coke fire prior to be taken into service.

The hitherto employed furnace lining consisting solely of tamped material shows compared with this construction the disadvantage that the moisture can only and with great difficulty escape towards the furnace shell, particularly as the hitherto employed material owing to its fine structure is far less permeable to vapours or gases.

When not employing an insulating layer it was necessary after repeated repairs of the tamped material to remove the entire lining, which disadvantage is effectively avoided by the described process, because owing to the provision of the insulating layer the wear scarcely reaches the fire bricks, whereby a considerably longer life of the costly fire brick lining is ensured.

Although I have particularly described my invention with reference to a cupola, it will be readily understood that all the advantages specified may also equally well be obtained, when the process is properly applied to converters, metal melting furnaces, gas generators, foundry ladles, furnace outlet gutters, rotary furnaces, coke-oven doors and for highly refractory linings or coverings generally.

It will be understood that I do not limit myself to any particular composition of the tamping material, but that that may vary according to the article for which the lining is destined.

What I claim as my invention and desire to secure by United States Letters Patent is:—

1. The improved process for lining furnaces and the like, which consists in fitting them with moulded fire bricks, coating said fire bricks with an insulating layer and applying an inner layer consisting of tamped quartzite rubble mixed with fire clay.

2. The improved process for lining furnaces and the like, which consists in fitting them with moulded fire bricks, applying a thin layer of graphite to said bricks and tamping a mass consisting of quartzite rubble mixed with triturated fire clay in the damp state upon said layer of graphite.

3. The process for lining furnaces and the like, which comprises fitting them with fire bricks, coating the fire bricks with an insulating layer, and tamping a layer of refractory material against the insulating layer; substantially as described.

4. The process for lining furnaces and the like, which comprises fitting them with fire bricks, applying a layer of graphite to the fire bricks, and tamping a layer of refractory material against the insulating layer; substantially as described.

5. In a furnace or the like, a lining which comprises an outer layer of fire bricks, and an inner layer of refractory material tamped against the fire brick layer and consisting of pieces of quartzite rubble bound together by a refractory binding agent; substantially as described.

6. In a furnace or the like, a lining which comprises an outer layer of fire bricks, and an inner layer of refractory material tamped against the fire brick layer and consisting of quartzite bound together by triturated fire clay; substantially as described.

7. In a furnace or the like, a lining which comprises an outer layer of fire bricks, a layer of insulating material applied thereto,

and an inner layer of tamped refractory material consisting of pieces of quartzite rubble bound together by a refractory binding agent; substantially as described.

8. In a furnace or the like, a lining which comprises an outer layer of fire bricks, a layer of graphite applied thereto, and an inner layer of tamped refractory material consisting of pieces of quartzite rubble bound together by a refractory binding agent; substantially as described.

9. In a furnace or the like, a lining which comprises an outer layer of fire bricks, a layer of graphite applied thereto, and an inner layer of quartzite bound together with triturated fire clay; substantially as described.

10. In a furnace or the like, a lining which comprises an outer layer of fire bricks, a layer of insulating material applied thereto, and an inner layer of quartzite bound together with triturated fire clay; substantially as described.

In testimony whereof I affix my signature.

EDUARD BONG.