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F. C. W. TIMM.

METHOD OF PRESERVING THE INNER WALLS OF FURNACES.

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Fig. 1.

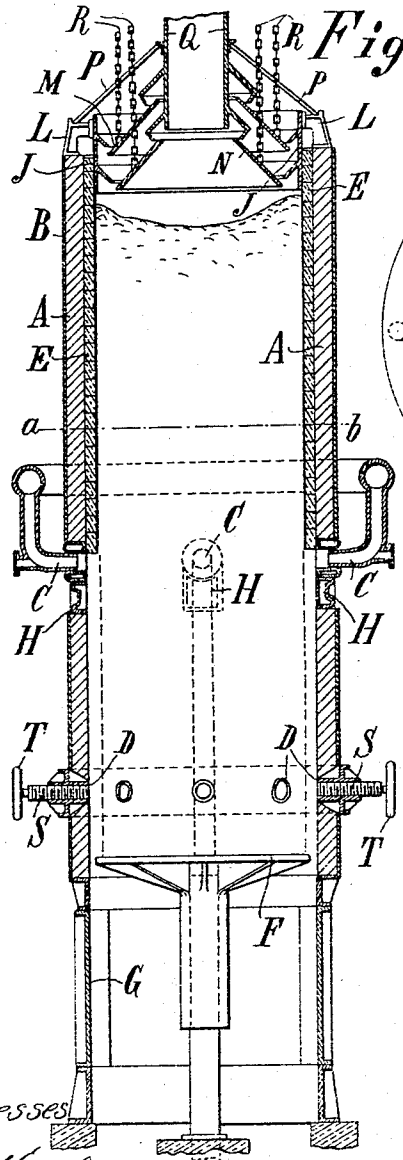
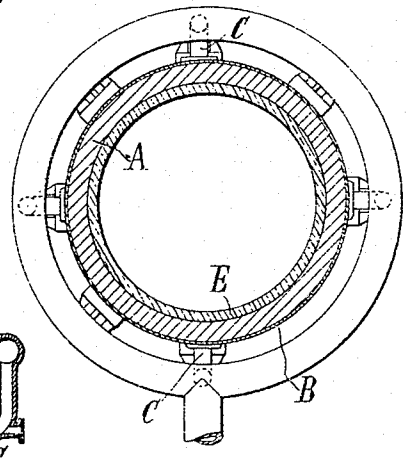


Fig. 2.



Witnesses
C. D. Kester
James L. Norris, Jr.

Inventor
Friedrich C. W. Timm
By James L. Norris.
Atty

UNITED STATES PATENT OFFICE.

FRIEDRICH CARL WILHELM TIMM, OF HAMBURG, GERMANY.

METHOD OF PRESERVING THE INNER WALLS OF FURNACES.

No. 812,619. Specification of Letters Patent. Patented Feb. 13, 1906.

Application filed April 21, 1905. Serial No. 256,823.

To all whom it may concern:

Be it known that I, FRIEDRICH CARL WILHELM TIMM, engineer, a citizen of the German Empire, residing at Hamburg, Germany, have invented certain new and useful Improvements in Methods of Preserving the Inner Walls of Furnaces, of which the following is a specification.

The maintaining of the durability of the fireproof inner lining of reducing, smelting, burning, and sintering furnaces often causes very great difficulty when materials are being treated which in a soft or molten state eat into and disintegrate the lining. In many cases the cooling is applied from outside in the shape of water-jackets or by spraying, together with a specially-thick structure of lining. The mean temperature of the lining is lowered by the cooling, and its mechanical solidity is thereby increased, and by lessening the pores the disintegration is made difficult. These methods are, however, frequently insufficient, and the idea of applying the method of continuously-working or perpetual furnaces had therefore to be abandoned notwithstanding that otherwise in many processes everything was favorable. The present method allows of the furnace being worked uninterruptedly under the most difficult conditions and with a perfect preservation of the inner lining, it being at the same time avoided that the mass be made impure by disintegrated lining.

The method will be understood by reference to the accompanying drawings, in which—

Figure 1 is a vertical cross-section. Fig. 2 is a horizontal section on line *a b* of Fig. 1.

A is the shaft of the furnace of fireproof material and which is inclosed in a casing B of metal. The material to be burned or smelted and the combustible substance (coke) are filled into the shaft from above. The air for combustion is fed through the nozzle C. Underneath the latter collects the melted or softened material, which is covered exteriorly with a crust and by continuous cooling gradually hardens or sets in the under part of the shaft. In this condition the block of finished material appears before the openings D. Through these openings spindles S are from time to time inserted by means of hand-wheels T and which spindles firmly hold the block with the rest of the contents of the furnace over same above D. Thereupon the ram F is lowered and the under part of the block is removed through the doors G, the ram F being then again pressed against the block and the spindles S drawn back. After closing the doors G the ram F is given a slow downward movement corresponding to the extent necessitated by the continuous burning process before the twyers. The movement of the ram can be effected hydraulically or by racks, screws, or the like, and the spindles S, serving for holding the contents of the furnace, can be replaced by any other suitable device.

The peculiarity of the present method consists in the melted contents of the furnace being allowed no opportunity of combining with the fireproof furnace-wall A. In order to effect this, an inclosure E of bricks is arranged between the walls A and the ring J, held by the brackets L. The manner of carrying this out is as follows: Supposing the known stone formation to be 25 by 12 by 6.5 centimeters, a ring of twelve centimeters height is fitted against the furnace-walls. Stone on stone is then laid round same, each one of which contacts with the wall A on a surface of twelve centimeters height and twenty-five centimeters length circumferential measurement. Against this ring the charge is thrown into the interior in such quantities that the contents of the furnaces lies flush with the upper edge of the ring, the said contents having been thus raised twelve centimeters. Thereupon another ring of twelve centimeters height is built on the previous one, and the furnace is again charged as before, the same thing being continued uninterruptedly or with intervals, according as to the level of the contents of the furnace being lowered by the working of the fire. In this way the charge arrives at the twyers without having come into contact with the walls A over same. The single rings form in their totality an inner protective casing E, which keeps the contents of the furnace separated from the lining proper. This perfect cover is, however, partly destroyed before the twyers C by inserting hand or machine tools through the latter, making holes in the casing E, through which the air can have access to the charge. Seeing the casing E is constantly moving downward and the tools are constantly making holes in same, it will be clear that the said casing must have slits underneath the level of the twyers and running parallel to its axis. In order, however, that no injurious contact of the fluid or softened mass can take place with the wall A through these slits, cooling-boxes H are ar-

ranged underneath the twyers C, and which reach so far downward that the mass lying before same solidifies, welding together both edges of the slit. Through the twyers C the progress of the fire can be observed and the lowering of the finished contents in the lower part of the furnace, as also the charging from the mouth of same can be regulated accordingly, as previously described.

In order to extract the waste gases, a taking-off apparatus is arranged, the construction of which, having regard to the construction of the casing E, differs from the apparatus usually used in blast-furnaces. A cylindrical ring J is secured to the furnace or the top platform by means of several brackets L. Several rods P, supported on the brackets, carry the carrying-off pipe Q for the waste gases. The charge, in the form of separate layers or mixed, is thrown to the top bell apparatus M and guided by alternately raising and lowering same, as also the bell apparatus N by means of the chains R in the interior of the furnace in the same manner as in any other taking-off apparatus. The chains R, secured to the bells, lead to levers (not shown) which effect the raising or lowering in the usual way. The distance between the ring J and the casing E is the same as the thickness of the protective casing. The stones forming the latter are constantly set on each other, so that the lining is perfectly closed up to about the level of the mouth. If the casing is then lowered for a certain distance, owing to the working of the furnace, a new layer is added. In this way the part of the casing behind the ring T prevents the escape of gas.

As regards the nature of the stones used for forming the protective lining it may be mentioned that they can consist of the known fireproof materials of a suitable consistency for the particular purpose or of the raw material of the charge itself. The latter can be used when the mass is solidified or when it is desired that there should be an entire absence of foreign bodies. Where it is a question, for instance, of the production of silicid of iron of high percentage, it is advantageous to use briquets out of easily-reducible ores with strong silicious additions and with powdered coke. The ore briquets and heating-coke are filled in the interior of the protective casing, while the latter likewise consist of ore briquets.

The protective casing enables the use of blasts rich in oxygen, whereby a silicid of iron of high percentage is obtained, while without the casing the wear of the fireproof inner lining would be too great, owing to the high temperature and acid slag. For this reason silicid of iron of the higher percentages is even today obtained by electric-flame arcs.

It is not necessary that the protective casing should be made of stones of finished form. It might be preferable to insert an annular metal templet or ring in the furnace and to fill the charge inside same, while the intermediate space between templet or ring and inner lining A is filled up by stamping a suitable material in same. For example, said material may be of the same character from which the lining-bricks are formed, and in this way a protective case E is likewise obtained.

For the proper working with the casing it is important to gage its thickness correctly. The essence of the casing lies in its acting as a part of the inner lining A, or, in other words, that the furnace is about the same as another one for a shorter working duration would be with a lining of a thickness of A plus E.

Every lining wears away to such extent that the upper surface, which is exposed to the fire and the chemical action, softens up to a given depth. This layer is then removed either by mechanical friction during the descent of the charge or by melting away or by the simultaneous action of both factors. For this reason places become soft which were previously sufficiently solid when they lay sufficiently deep under the surface. Such a place exists where the lining A and the protective casing E come in contact.

The protective casing is attached on the inside during its movement through the furnace. Its thickness must, however, be sufficient to prevent any combining with the lining A. The correct thickness of the protective casing is therefore essential for the proper working of the process, since where the casing is too weak there is a danger of a partial fusing of same with the wall A, while in the case of a too-thick casing too great a mass moves unnecessarily through the fire.

The use of the casing makes it possible to work with blasts rich in oxygen. The temperatures occurring are so high, especially when the blast is preheated, that the fireproof lining is soon injured, even in smelting materials not corrosive, when the usual method of lining is used; but by letting a protective casing of a thickness corresponding to the temperature and the chemical action pass through the furnace the casing is subject to wear, but the lining A proper is preserved.

It is by no means always necessary to provide the furnace with a wall A of fireproof stones. Instead of this under certain circumstances the usual water-jacket may be used with advantage. The process is then present when the material is drawn off from the furnace in a fluid instead of a solid state. There is then no solid connection of the casing underneath the twyers with the content of the furnace, and the casing can p through the furnace at a less speed than of the material to be smelted. In such

the casing is usually clamped in the under part of the furnace and is then treated in regard to the charges in the same way as the ordinary immovable lining of the furnace. From time to time, however, the casing is allowed to descend with the contents of the furnace, it being then again fastened and the charge delivered and tapped the same as in known furnaces. The piercing of the casing before the twyers takes place exactly as above described. In this modification of the process the casing preferably receives a greater thickness, which disappears in the fire zone gradually to a permissible degree, whereupon the protective casing is moved downward.

For the method of working as explained coke is assumed to be the combustible material with the charge; but this can in many cases be deviated from and combustible material in the form of powdered coal-dust, gaseous, or sprayed fluid combustible material can be used. The nature of the combustible material is not essential for the process, since it is only a question of the combustion being effected within the furnace.

The protective casing used in the present process differs essentially from a protective coating applied to a cement furnace notwithstanding that a certain exterior similarity exists. The walls of periodically-driven cement furnaces are smeared with mud or slime before charging or a protective lining may be placed in cylindrical furnaces of unbaked bricks for Portland cement in a similar way to what is above described, the charge consisting of unbaked bricks and coke. Such furnaces are about twelve meters high and are so built that the fire zone lies 1.2 to two meters from the top, so that the cooling off of the burned clinkers takes place at a height of 10.8 to ten meters. Below at the drawing-off opening for the cold clinkers the air for combustion enters and rises vertically, thus cooling the contents and heating itself and burns the coke in the fire zone.

The necessity of drawing solid masses out of the furnace, the long cooling-chamber, the vertical manner of feeding the air in the zone of combustion, and the impossibility of handling such materials which are attacked in a fluid or pasty state (underneath the fire zone) by the oxygen of the combustible air represents the difference between the method for cement furnaces and the present process.

In order to increase the protective action of the lining, it may consist of a material which decomposes in heat under absorption of the latter. In this way a greater reduction of temperature from inside to outside is obtained. As an example of this modification suppose the furnace process lays it down that lime must form a part of the protective agent. If, then, this is chosen in the form of carbonate of lime, the heat necessary for driving out the carbonic acid forms an additional protection with regard to the lining consisting of burnt lime.

Having thus declared the nature of my said invention and in what manner it is to be performed, I declare that what I claim is—

1. A method of preserving inner walls of shaft-furnaces, which consists in building up against the inner wall of said furnace during the charge thereof, a gravity-movable casing, and then piercing said casing in front of the twyers as the said casing lowers so that means to sustain combustion can pass through the openings into the interior of the casing.

2. A method of preserving inner walls of shaft-furnaces which consists in building up against the inner wall of the furnace during the charge thereof, a gravity-movable lining, piercing said lining as the said lining lowers so that means to sustain combustion can pass into the interior of the furnace and adding to the lining at the top thereof when the lining lowers.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

FRIEDRICH CARL WILHELM TIMM.

Witnesses:

ERNEST H. L. MUMMENHOFF,

OTTO W. HELLMRICH.