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EUROPEAN PATENT APPLICATION

(21) Application number: 84200072.1

(51) Int. Cl.³: **C 21 B 7/10**

(22) Date of filing: 20.01.84

(30) Priority: 27.01.83 FI 830290

(43) Date of publication of application:
12.09.84 Bulletin 84/37

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

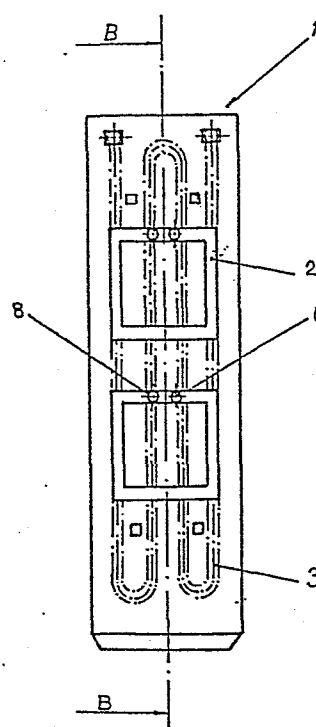
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(54) Method for the rearrangement of damaged cooling in a blast furnace.

(57) The invention relates to a method for the rearrangement of damaged cooling, especially in cast-iron cooling boxes (1) of a blast furnace. Grooves (2) for new cooling pipes (6) are made on the exterior surface of the boxes, the pipes (6) are installed in the grooves (2) with the aid of a suitable mix, and the cooling-water circulation is connected to pass via the new pipes (6).



Method for the rearrangement of damaged cooling in a blast furnace

The present invention relates to a method for the rearrangement of damaged cooling in a blast furnace. The method is of the type disclosed in the preamble of Claim 1.

In blast furnaces, cooling has a primary effect on the durability of the furnace, since practice has shown that, while the cooling functions, the durability of the refractory lining on the interior surface of the blast-furnace shaft is good, but if the cooling for one reason or another stops functioning even partly, there results a rapid wearing of the refractory lining owing to both chemical reactions and mechanical wear. One cooling system commonly used at present comprises a cooling box cast from cast-iron, inside which there is a cooling-pipe system installed in place at the casting stage, cooling water being circulated in the pipe system. Conventionally there are, on that side of the cooling box which faces the shaft, pocket-like depressions, in which bricks are laid. Such cooling boxes are installed around the entire circumference of the lower part of the shaft, and when the system is in order, the cooling effect achieved with them is good.

In cases in which it has been observed that the cooling has decreased or stopped, attempts have been made to repair the damage in one way or another, for the stopping and basic repairing of the blast-furnace is very expensive. When the cooling is not functioning there results, as mentioned above, strong wear of the refractory brickwork inside the bosh of the blast furnace, the wearing being often so rapid that also the cast-iron cooling box is often in part worn before the damage is noticed. In practice, the consequences

are worst when a highly elevated temperature has caused the steel mantle of the blast furnace to heat up to such a degree that the steel mantle has lost its strength, and if this occurs at several points on the blast-furnace circumference, the result may be that the steel mantle buckles, which for its part necessitates full repairs of the blast furnace.

When it has been noticed that the cooling efficiency of the cast-iron cooling boxes has decreased or that the cooling has absolutely stopped, attempts have been made to prevent damage by, for example, providing cooling on the outer steel mantle of the blast furnace or by installing new cooling boxes over the cooling boxes in place by hot-shearing open the steel mantle of the blast furnace and by thereafter installing the boxes in place. The repairing or at least partial replacing of the cooling boxes is an alternative that easily comes to mind, but in practice such a procedure is not successful, for the refractory brickwork of the blast-furnace bosh prevents the hot-shearing of the thick cast-iron piece.

One very noteworthy factor in repairing the cooling is the time. If the repairs take a very long time, and especially if the blast furnace has to be cooled to a low temperature, these steps mean considerable productional losses, since bringing the blast furnace into full production conditions takes several days. It is clear that complete basic repairs, in which, for example, the refractory lining is completely remade and, furthermore, the cooling boxes are replaced, are an even more expensive procedure, which is to be avoided by all means. As was mentioned above, the cutting of the cooling boxes by hot-shearing is a work stage which will not succeed, for the refractory lining behind the cooling box complicates the cutting. On the other hand, the space

available is very small, and after the blast furnace has been stopped the furnace temperature is still about 200 °C, in addition to which the time available for the work is in general quite limited, since the longer the work lasts, the greater are the productional losses to be expected.

The object of the present invention is to avoid the disadvantages of the above-mentioned known repairing methods and to provide a method by means of which the cooling of a blast furnace can be restored at least in part in a very rapid but simple manner. The characteristics of the method are given in the accompanying claims.

The invention is described below in greater detail with reference to the accompanying figures illustrating the principle, in which

Figure 1 depicts one alternative intended for carrying out the method according to the invention,
Figure 2 depicts section A-A in Figure 1,
Figure 3 depicts a second alternative of the method according to the invention,
Figure 4 depicts section B-B in Figure 3,
Figure 5 depicts a third alternative of the same method, and
Figure 6 depicts section C-C in Figure 5.

The basic idea of the invention is that suitable grooves are worked on the outer surface of the cooling box by, for example, grinding or by some other similar method, the grooves extending approximately to the level at which the previous cooling pipe system has been. In these grooves there are installed, by means of a suitable mix, new cooling pipes, which are connected to the water-circulating mechanism and which thus restore the cooling of the blast furnace to its previous stage, or at least to a substantial degree,

whereby full repairs of the blast furnace can be avoided. Since the method according to the invention is relatively rapid to carry out, long stoppages, which cause productional losses, are also avoided.

Figure 1 shows a cooling box 1, which thus consists of a cast-iron piece inside which there is cast a cooling-pipe system 3. On the outer side of this piece there are worked, by means of the mechanism 4, 5 depicted by way of example in Figure 1, grooves 2, in which new cooling pipes can be installed, the pipes being fastened in the grooves by means of a suitable, heat conductive mix, in addition to which it is necessary in practice only to connect the circulating-water system to the said pipes.

Figure 2 depicts a vertical section of the cooling box according to Figure 1, the structure being visible also from the rear side of the cooling box 1. On that side which faces the bosh there are, as mentioned previously, depressions 7 for bricks. In other words, the bricklaying is started by laying bricks first in the depressions 7. The new cooling pipe 6 has been drawn in the cross sectional figure by an uninterrupted line and the old pipe, which has at this stage already been worked off, is indicated in Figure 2 by dotted lines. The work blade is indicated by numeral 5 by way of reference.

In Figures 3 and 4, the corresponding parts are indicated by the same reference numerals. The difference as compared with the embodiment shown in Figures 1 and 2 is that, in the embodiment of Figures 3 and 4, the grooves have been ground to a square shape and the new cooling elements have, in a manner corresponding to that in Figures 1 and 2, been embedded into the ground grooves and fastened to their bottom. The cooling-water inlet pipe 6 and respectively the

outlet pipe 8 are situated next to each other, in other words, the cooling pipe makes a full round. Otherwise, the embodiment depicted in Figures 3 and 4 corresponds fully to the embodiment depicted in Figures 1 and 2.

Figures 5 and 6 depict an embodiment fully corresponding to the embodiment depicted in Figures 3 and 4, but the cooling element has in this case been installed in a circular groove, which has been ground by means of a specific tool suitable for this purpose.

The cooling efficiency achieved using the embodiment depicted in Figures 1 and 2 substantially corresponds to the efficiency of the original cooling system, whereas the circular installation of the cooling element depicted in Figures 5 and 6 produces a 50-percent cooling efficiency as compared with the original cooling. Even a 50-percent efficiency is highly significant, for it has been observed in practice that by means of it full repairs can be postponed even several years.

The method according to the invention has been in trial use, during which it has been observed that the making of two circular grooves according to the invention and the installation of the cooling pipe in the grooves takes a little over 24 hours, which is a very tolerable period in terms of a productional stoppage. If the cooling of several cooling boxes has to be repaired in a blast furnace, it means that, if a moderate repair period is desired, several grinding tools must be used for the work, working on each groove simultaneously. As the blast furnace has previously been repaired thoroughly at intervals of 5-6 years, and as, by the method according to the invention, a lengthening of up to several years is achieved in the interval between thorough repairs, the invention is a great step forward

financially in the said field. In practice the savings amount to millions, even tens of millions of Finnish marks.

It should be pointed out that the method according to the invention can, of course, be used also for other components similar to blast-furnace cooling boxes, since the object of use does not, of course, decide the practicability of the method according to the invention.

Claims

1. A method for the rearrangement of damaged cooling, especially in a blast furnace in which the cooling is effected by means of cooling pipes (3) embedded in a cast-iron cooling box (1), circulating cooling water being directed into the pipes, characterized in that on the exterior surface of the cooling boxes (1) grooves (2) are made in situ, new cooling pipes (6) being installed in the grooves by means of a suitable mix and the cooling-water circulation being connected to the pipes.
2. A method according to Claim 1, characterized in that the grooves are made by grinding on the exterior surface of the cooling box (1) substantially parallel grooves (2) for new cooling pipes (6).
3. A method according to Claim 1 or 2, characterized in that the grooves (2) are made in the shape of a square or a circle.

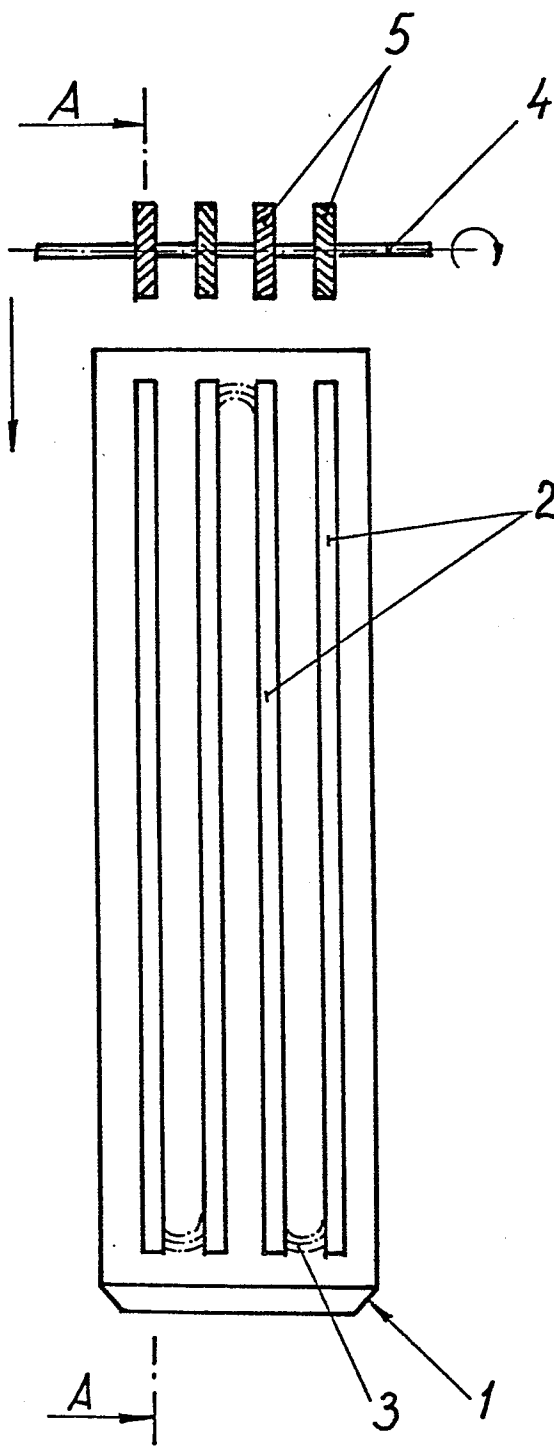


Fig 1

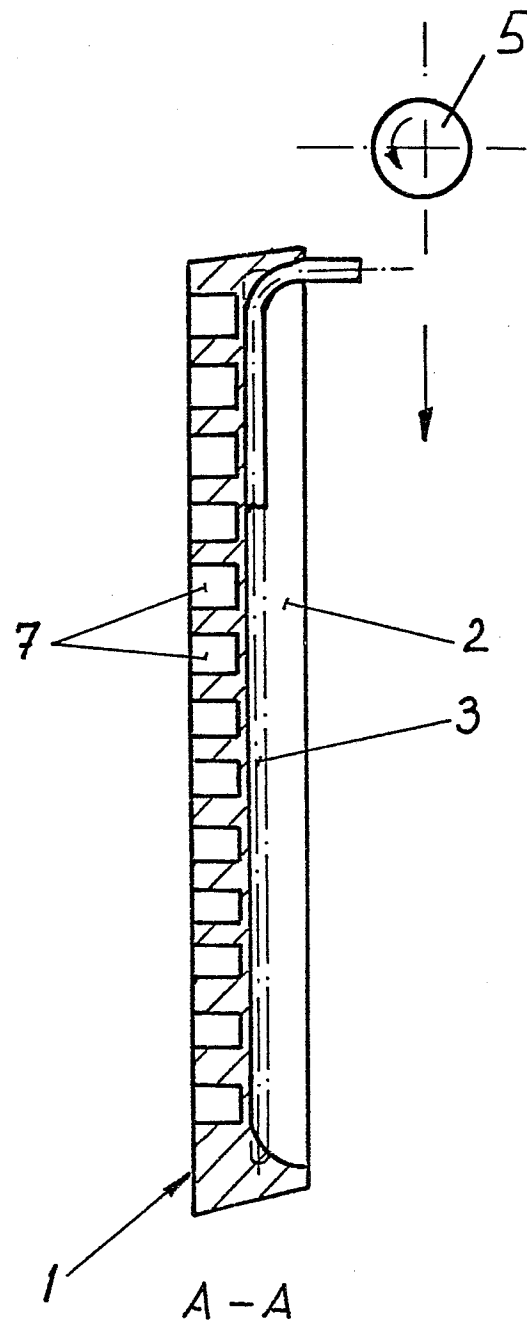


Fig 2

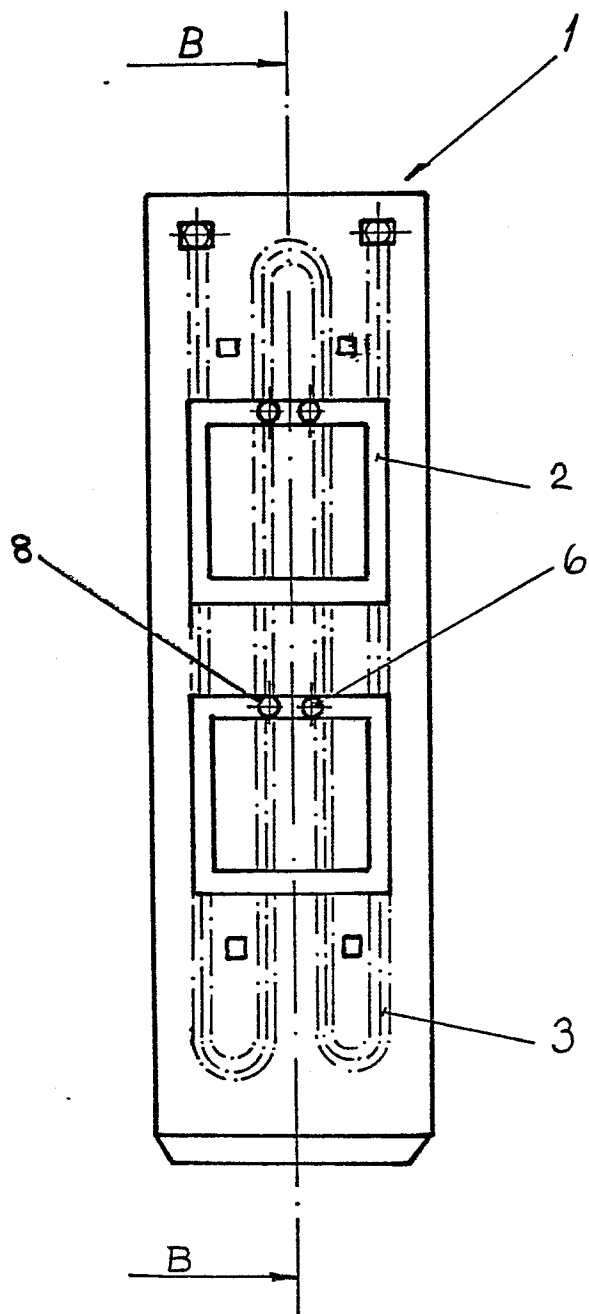
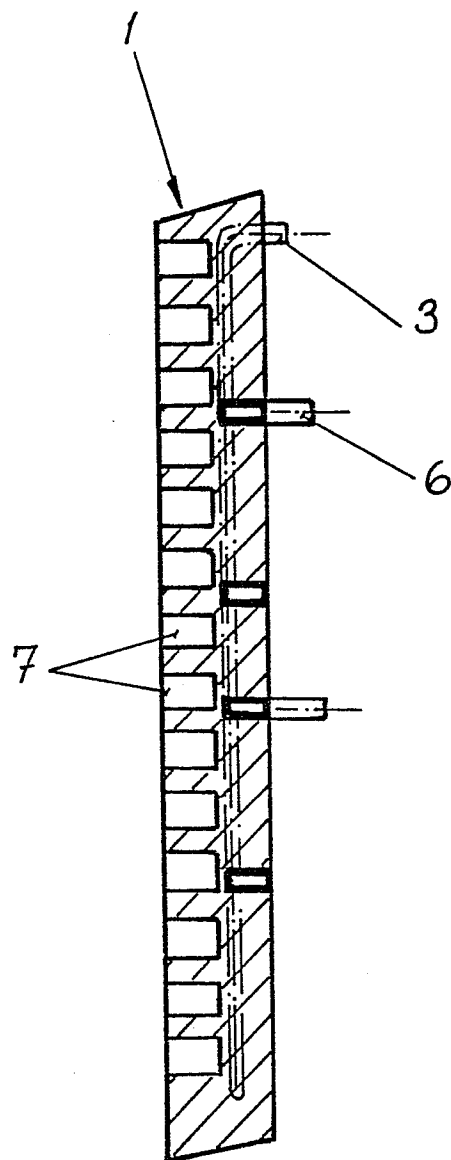


Fig 3



B - B

Fig 4

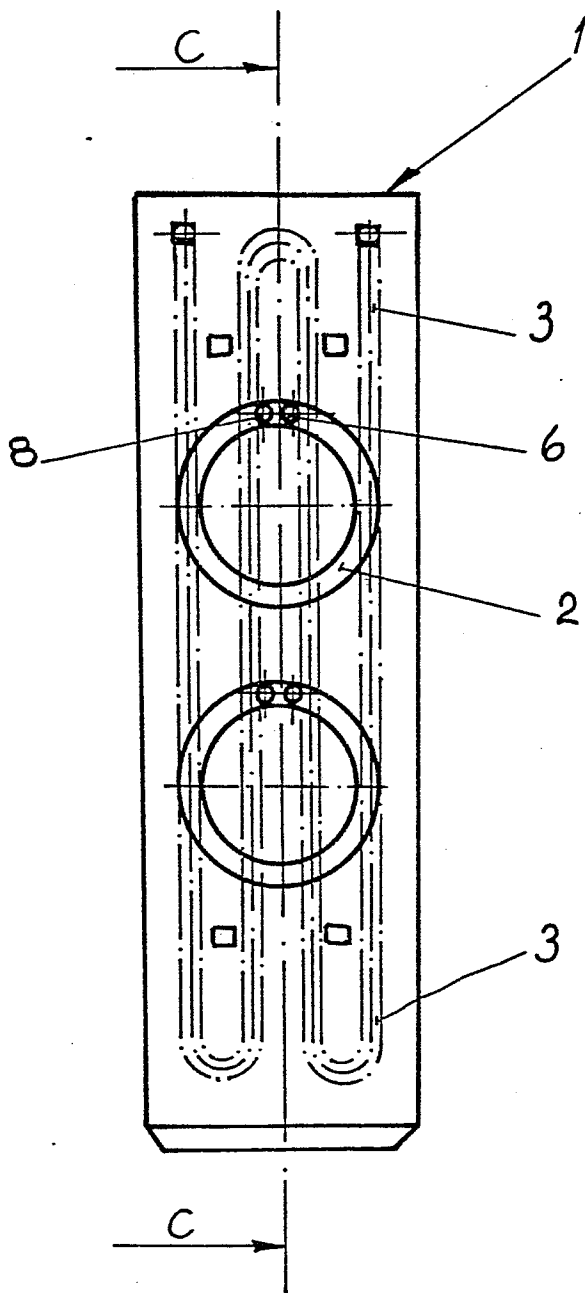


Fig 5

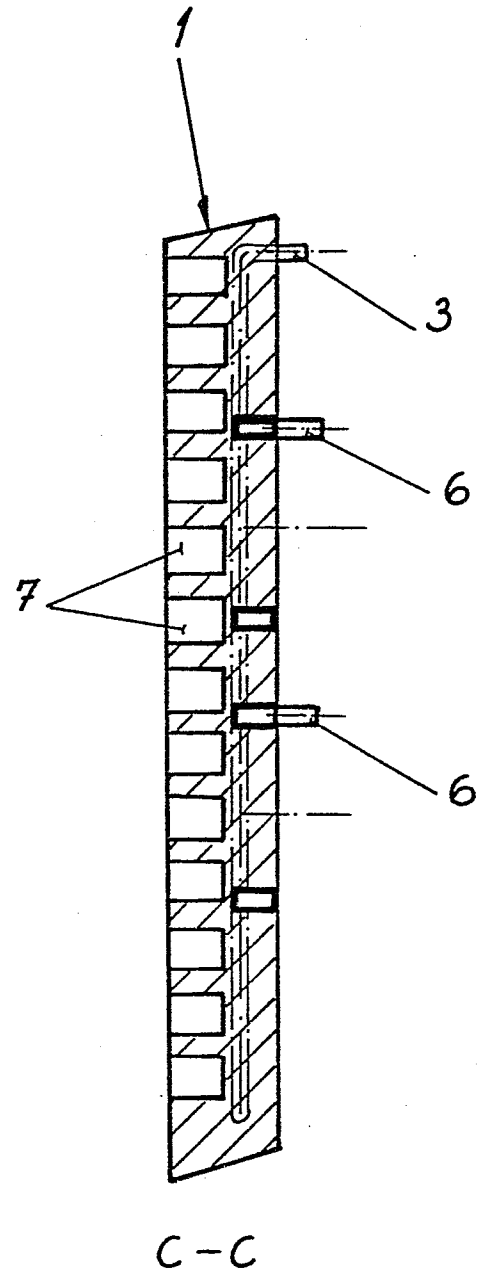


Fig 6



European Patent
Office

EUROPEAN SEARCH REPORT

0118136

Application number

EP 84 20 0072

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
A	US-A-3 379 427 (B.N. ZHEREBIN et al.)		C 21 B 7/10
A	US-A-4 071 230 (A.V. ZHERDEV et al.)		
A	FR-A-2 386 795 (L. & C. STEINMÜLLER)		
A	Patent Abstracts of Japan vol. 5, no. 45, 25 March 1981 & JP-A-56-211		
A	Patent Abstracts of Japan vol. 5, no. 188, 27 November 1981 & JP-A-56-112407		
A	Patent Abstracts of Japan vol. 6, no. 90, 27 May 1982 & JP-A-57-19309		C 21 B 7/10
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 04-05-1984	Examiner SUTOR W
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