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(54) **Repair of blast furnace refractory walls.**

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FR-A-2 430 583
US-A-3 833 334

PATENT ABSTRACTS OF JAPAN, vol. 3, no. 100 (C-56), 24th August 1979, page 32C56

PATENT ABSTRACTS OF JAPAN, vol. 4, no. 22, (C-74), 23rd February 1980, page 16C74

PATENTS ABSTRACTS OF JAPAN, vol. 2, no. 136, 11th November 1978, page 2976C78

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Description

The present invention relates to a method and apparatus for making repairs in the refractory lining wall of a blast furnace.

As is well known in the iron and steel industry the inner wall of a blast furnace is composed of refractory bricks built up to line the inside of the steel shell of the blast furnace. The refractory lining becomes badly worn by contact with the charge and the molten iron in the furnace.

Various methods and means for repairing worn portions of the refractory lining wall have been heretofore proposed. Repair of the refractory lining wall of the blast furnace has, for example, been done by injecting refractory repair material into the spot to be repaired in the furnace while the furnace is hot run or is cold. These refractory repair materials can be classified into the heat setting, the hydraulic setting and the chemical setting. When the refractory material is injected into the furnace in hot running, one of the heat setting types is generally used, while when the refractory material is injected into the furnace when cold, one of the hydraulic setting types of the chemical setting types is preferable. In particular, the refractory material should have excellent fluidity so that it will not clog the pressure spraying machine or the hose connected thereto. Thus a refractory material of either the clay or the alumina type is usually used.

On the other hand, spraying of the furnace when cold is also carried out for the protection of the steel shell. In this case, a high alumina refractory, fire clay refractory or a light weight insulating refractory is used. In general, these refractories are composed of mixed powders having a particle size of less than 3 mm. They are required to have properties suited to pressure spraying.

Repair of the refractory wall is, however, often made difficult not only by the presence of the charge in the blast furnace but also by the fact that the worn refractory face is often so lacking in irregularities and so flat that when the damaged wall is repaired by any of the conventional repair methods using monolithic refractories the adherence of the material to the wall is so poor that it falls off the wall in a short time, making it impossible to obtain a repaired wall of high rehability.

US—A—3 833 334 discloses a repair apparatus for the tap hole in a steel vessel. The repair apparatus comprises an umbrella-type member having a first closed position and a second open position. In the second open position the umbrella-type member engages with the tap hole to seal the latter, and acts as a backing means for the refractory slurry which is forced into the tap hole to repair it.

FR—A—2 430 583 discloses a relining apparatus for a shaft furnace, such as a blast furnace, provided with a blowing pipe on its iron shell. The relining apparatus comprises a plurality of holding means penetrating into the furnace in the vicinity of an injection hole for the refractories.

JP—A—54-77207 discloses a method for repairing a furnace wall of a blast furnace. After detection of the damaged portion of the furnace wall and after the charged burden of the blast furnace has fallen down below the level of the damaged portion, a water-cooled injection pipe is inserted into the furnace from the outside thereof in order to spray the refractory material through the injection pipe so as to repair the refractory lining wall.

It is the principal object of the present invention to provide a method and apparatus for use in conjunction with the repair of the refractory wall of a blast furnace whereby a support member having the function of reinforcing studs can be easily formed on the refractory wall to support a refractory structure formed by injection or spraying.

It is another object of the invention to provide a method and apparatus whereby a support member having the function of reinforcing studs can be easily formed to have a plurality of stages, whereby the refractory repair material can be freely selected.

Other and further objects of the invention will become apparent to those skilled in the art from the following detailed description of the invention with reference to the annexed sheets of drawings, in which:

Figure 1 is a sectional view illustrating the repair method and apparatus of the present invention;

Fig. 2 is a perspective view of an embodiment of a tubular member with a plurality of slits at the forward end thereof;

Fig. 3 is a sectional view showing how the forward end of the tubular member of Fig. 2 is spread out in accordance with the repair method of the invention;

Fig. 4 is a rear view showing the completely spread out state of the forward end of the tubular member in the furnace;

Fig. 5 is a sectional view showing another embodiment of the repair method and apparatus of the invention;

Fig. 6 is a sectional view showing another embodiment of the repair method and apparatus of the invention;

Fig. 7 is a sectional view showing another embodiment of the repair method and apparatus of the invention;

Fig. 8 is a front view of the refractory wall showing another embodiment of the repair method and apparatus of the invention;

Fig. 9 is a sectional view showing another embodiment based on the principle of the invention;

Fig. 10 is a view explaining one aspect of Fig. 9;

Fig. 11 is a sectional view showing another embodiment of the invention;

Fig. 12 is a sectional view showing another embodiment of the invention;

Fig. 13 is a sectional view taken along the line A—A of Fig. 12; and

Fig. 14 is a view explaining another embodiment of the invention.

The present invention is directed to a method and apparatus for making repairs in the refractory wall of a blast furnace in which an opening is provided through the steel shell of the blast furnace where the refractory wall is worn, a guide bar member having an outwardly bending means is inserted into the opening to be held thereat, a tubular member having a plurality of slits in the axial direction at its forward end is fitted on the outside of the guide bar member and inserted into the opening under pressure so as to make the forward slit end of the tubular member spread out in a flower-petal manner in the furnace, and a repair material (referred to as "monolithic refractories" hereinafter) is injected to form a refractory structure including a supporting structure constituted by the fully developed flower-petal pieces.

The present invention will be described in detail with reference to the embodiments of the invention hereinbelow.

Fig. 1 is a sectional view showing the basic constituents of the apparatus for making repairs in the refractory wall of a blast furnace according to the invention.

Fig. 1 shows the steel shell 1 of the wall of a blast furnace and a refractory material 2 which lines the inside of the steel shell 1 and a charge 3. In the present invention, the steel shell 1 is provided with an opening 4 by drilling or piercing at the spot where the refractory wall is worn. The spot is located by the fact that the steel shell 1 becomes red hot where the refractory wall is damaged or by detecting it by some other means. It is understood that in the case where the refractory 2 remains to constitute the refractory wall 20 the opening 4 into the furnace should be made long enough to pass through the refractory wall 20 and reach the spot to be repaired.

Then a guide bar member (referred to as "guide member" hereinafter) 5 is introduced via the opening 4 into the furnace. The guide member 5 is provided at its forward tip with a plurality of bending means 6 and the guide member 5 is inserted into the furnace far enough for the bending means 6 to reach a predetermined depth from the steel shell 1 to be held thereat. In the embodiment illustrated in Fig. 1, a support means 7 which holds the guide member 5 is provided on the steel shell 1.

Next, a tubular member 8 having a plurality of slits at its forward tip is fitted around the outside of the guide member 5 and the guide member 5 is introduced under pressure while it is held at the predetermined position. As shown in the perspective view of Fig. 2, the tubular member 8 has a plurality of longitudinal slits 9 at its forward tip. The slits may be formed with or without gaps therebetween.

When the tubular member 8 with slits 9 is forced into the furnace by means of a cylinder device 10 mounted on the support means 7, the divided members of the forward part of the tubular member 8 are outwardly bent by the bending means 6 of the guide member 5 to spread out in a flower petal manner as shown in Figs. 3 and 4. That is, the bending means 6 functions to spread out the divided forward tip 8a outwardly.

The bending means 6 of the above embodiment is constituted by a head 6c formed at the forward end of the guide member 5 to have a larger diameter than that of the guide member 5, the head 6c being connected to the guide member 5 via a bending body 6a having a predetermined radius of curvature r or a suitable incline. A holder 6b having guide plates $6b_1$ for insertion into the slits of the tubular member 8 is solidly mounted in the opening 4 of the steel shell 1 at a position forward of the bending body 6a. The holder 6b helps ensure that the tubular member 8 is smoothly introduced into the furnace and that the forward part of the tubular member is surely bent radially and outwardly. In this invention, the bending means 6 encompasses an apparatus including the holder 6b, which may be provided according to necessity.

By the forced introduction of the tubular member 8 into the furnace while it is being guided by the guide member 5 as mentioned above, the divided members at the top of the tubular member are spread out in the furnace in a flower petal manner so as to form a support structure for monolithic refractories.

As soon as the insertion of the tubular member 8 into the furnace is completed, the monolithic refractory 12 is injected into the furnace from the gap 11 between the tubular member 8 and the opening 4 as shown in the embodiment of Fig. 5. In the above embodiment, in order to effectively carry out the injection operation, the opening 4 is provided with a mouth piece 13 to which a hose 14 for delivering the monolithic refractory 12 is connected to perform the charging of the refractory 12 into the furnace. The guide member 5 is severed at a flange face 13a of the mouth piece 13 or somewhat nearer to the furnace wall so that the gap between the tubular member 8 and the guide bar member 5 is filled up with the monolithic refractory 12.

The monolithic refractory 12 is gradually introduced under pressure into the furnace from the gap 11, and the monolithic refractory 12 is effectively spread out in the direction of the wall by the petal-like members 8a formed from the divided forward end of the tubular member 8 with the result that the monolithic refractory 12 adheres to the damaged wall inside the steel shell 1 or inside refractory 2.

The monolithic refractory 12 provided between the damaged wall face and the furnace charge 3 is firmly held by the stud-like function exhibited by the divided forward tip 8a of the tubular member 8 so as to effectively prevent the monolithic refractory from peeling off from the wall.

In the present invention, it is preferred that the position, size, and number of the openings 4 in the steel shell 1, the size of the tubular member 8, and the length of the slits 9 and the like be

suitably determined in accordance with the size of the damaged portion of the refractory wall and also with the extent of the damage.

The position where the guide member 5 should be inserted, or in other words the position of the bending means 6 in the furnace may be suitably selected in accordance with the extent of damage to the wall, the gap between the wall face and the charge 3 and the density of the charge 3 in the proximity of the wall. According to the experience of the inventors, a space for charging the monolithic refractory 12 can be formed even when the charge 3 is present at high density up to near the wall, provided that the divided forward end 8a of the tubular member 8 is fully spread out at a position near the wall as shown in Fig. 3, the guide member 5 is then severed at the point corresponding to the rear end of the tubular member 8 as illustrated in Fig. 6, and the tubular member 8 together with the guide member 5 are simultaneously forced into the furnace by the action of the cylinder means 10. Accordingly, both the efficiency of injecting the monolithic refractory 12 and its adherence to the wall are greatly improved by this invention.

It was further found that no trouble results from the guide member 5 which remains in the tubular member 8 after the repair has been made as shown in the embodiment of Fig. 5. Moreover, as in the embodiment illustrated in Fig. 8, which will be described hereinafter, if the guide member 5 is of fairly large size, it can, for instance, be allowed to fall down into the furnace after the monolithic refractory 12 has been injected and a cooling box may be inserted into the space previously occupied thereby. In this manner, the wall can be cooled after the repair is completed so as to improve the effectiveness of the present invention.

Fig. 7 is a sectional view explaining another embodiment of the invention. Here, the cylinder means 10 is of the hollow, single-cylinder type. A piston rod 10a is secured to a piston 10b and abuts on the end face of the tubular member 8. The guide member 5 is secured to the end of the cylinder 10 by a nut 10c. Thus, the piston 10b is freely slidable on the guide member 5, so that the divided forward tip of the tubular member 8 can be made to spread radially in a flower petal manner by applying a pushing force to the tubular member 8. A mouth piece 14a connects to a hose which delivers the monolithic refractory 12 under pressure.

It is understood that the present invention is not limited by the above-mentioned embodiments, and other suitably designed modifications may be adopted without departing from the scope, function and effect of the invention.

For example, if, as frequently happens, a cooling box of the known type provided on the furnace wall should be destroyed or should fall off due to severe damage to the furnace wall, the present invention can be applied by removing the damaged or detached cooling means and by utilizing the old opening in the steel shell in which the cooling means was installed.

Fig. 8 shows an embodiment of the apparatus for making repairs in accordance with the present invention wherein an old opening 40 in the steel shell from which a cooling means has been removed is utilized. In this case, the effectiveness of the present invention can also be exhibited by forming both the guide member 50 and the tubular member 80 into a shape approximately the same as the sectional shape of the cooling means (for instance, into the shape of an ellipse and also by providing a plurality of slits at the forward part 80a of the tubular member 80 so as to radially spread out the divided part 80a in a flower petal manner and build up monolithic refractories with a support structure for monolithic refractories.

Next, Fig. 9 shows another embodiment of the present invention based on the fundamental principle thereof wherein two tubular members 81 and 82 of different diameters but of the same construction are double fitted on the outside of a guide bar member 5 secured in the furnace wall as described in the foregoing embodiments, and are forced into the furnace.

As clearly shown in Fig. 10, the double tubular members 81 and 82 fitted on the guide member 5 are inserted into the furnace while the forward parts of two tubular members 81 and 82 each divided into a plurality of members as in the embodiments described hereinbefore are radially spread out in the furnace in a flower petal manner.

As soon as the forced introduction of two tubular members 81 and 82 into the furnace is completed, a two-stage support structure 101 is formed either by retracting the outer tubular member 82 by a predetermined length L or by advancing the inner member 81 together with the guide member 5 by such predetermined length, as illustrated in Fig. 11.

The above embodiment of the invention including the use of double tubular members is particularly effective for repairs in which there is no charge 3 at all inside the refractory wall as might happen when, for instance, operation is carried out with a lower charging line and it is required to repair a damaged part of the refractory wall above the charge line. In this case, the forward tip of the guide member 5 is held at a predetermined position in the furnace and then double tubular members 81 and 82 are forced thereinto. As a result, the support structure 101 for monolithic refractories is formed either by retracting the outer tubular member 82 or by inwardly advancing the inner tubular member 81 together with the guide member 5.

In addition, it is understood that it is feasible to force more than two tubular members 8 combined together into the furnace in a manner similar to that in the foregoing embodiment. Hence, a support structure 101 for monolithic refractories having a desired number of stages can be easily formed.

Fig. 12 indicates another embodiment of the invention in which a support structure 101 of multistage construction is formed. Two bending means 61 and 62 are provided at the forward part of the

guide member 5 and one bending means 61 is spaced from the other one 62 by an optional distance l. Of the two bending means 61 and 62, the latter 62 is provided with an aperture 62a through which the tubular member 81 only can penetrate as shown in Fig. 13. The structure of the bending means 62 is like that of the holder 6b mentioned in conjunction with Fig. 1.

In the above embodiment of the invention, when the double-layer tubular members 81 and 82 are forced into the furnace, the inner tubular member 81 passes through the aperture 62a of the rear bending means 62 and the divided members of the forward part of the tubular member 81 are outwardly bent by the foremost bending means 61. On the other hand, the divided members of the forward part of the outer tubular member 82 are outwardly bent by the rear bending means 62. As a result, a two-stage support structure 101 having its stages spaced by the distance l is formed within the furnace wall.

When the introduction of the tubular member 8 into the furnace is completed monolithic refractory 12 is delivered via the gap 11 between the tubular member 8 and the opening 4 as in the embodiments shown in Fig. 1 and Fig. 3.

On the other hand, when the repair operation is to be carried out at a place in the furnace where there is no charge 3, as shown in Fig. 14, mixed powder and particle refractory material is sprayed through an opening 15 at the furnace top onto the spot to be repaired. The repair work is carried out as follows: a nozzle 16 is introduced into the furnace from the opening at the top, and monolithic refractory 12 is sprayed via the nozzle 16 onto the damaged part of the refractory wall, whereupon the support structure 101 of the invention exhibits its stud function and firmly holds the thus spray-formed refractory structure.

Particularly, in this embodiment of the invention, in repairing a severly damaged part of the furnace the thickness of the sprayed refractory layer can be much thickened by a support member of two or more stages so that a repaired refractory wall of high dependability as well as durability can be attained. Thus, the repair work according to this invention is exceedingly effective.

As fully described in the foregoing, in accordance with the principle of the present invention an opening 4 is provided by piercing or drilling at a part of the steel shell 1 where the refractory wall has been damaged, a guide member 5 is inserted via the opening 4 to be held thereat, a tubular member 8 having its forward end provided with a plurality of slits is fitted on the outside of the guide member 5, the guide member 5 together with the tubular member 8 are forced into the furnace, and the divided members of the forward end of the tubular member 8 are made to spread in the furnace in a flower petal manner to form a support structure 101 consisting of radially spread members. Subsequently, after the support structure 101 has been formed the monolithic refractory 12 is injected via the gap between the opening 4 and the tubular member 8, or the monolithic refractory 12 is sprayed via a nozzle introduced from an opening provided at the furnace top onto the spot to be repaired, so that a repaired refractory wall of high reliability can be obtained.

Claims

1. Method for making repairs in the refractory wall of a blast furnace, characterized by the steps of providing an opening at a part of the steel shell of said blast furnace where the refractory body is diamaged, inserting a guide bar member having a head provided with an outwardly bending means to be held at said opening, fitting a tubular member having a forward part provided with a plurality of slits in its axial direction on the outside of said guide bar member, forcing said guide bar member together with said tubular member under pressure into said furnace, and pushing said forward part of said tubular member against said head of said guide bar member to spread the narrow pieces of said forward part divided by said slits radially in a flower petal manner to form a support structure for monolithic refractory body.

2. Method as claimed in Claim 1 wherein a refractory material is introduced through a gap between said opening of the steel shell of said blast furnace and said guide bar member on which said tubular member is provided, and whereby a refractory body is formed about said support structure in said refractory wall.

3. Method as claimed in Claim 1 or 2 wherein monolithic refractories are sprayed under pressure via a nozzle through an opening provided in the top of said blast furnace, and whereby a refractory structure is formed about said support structure in said refractory wall.

4. Method as claimed in any of Claims 1 to 3 wherein plural tubular members of different diameters are fitted in a multi-layer manner on the outside of said guide bar member, and said monolithic refractory body with a plurality of stages of said support structure consisting of radially spread pieces of said tubular members in a flower petal manner is formed in said refractory wall.

5. Apparatus for making repairs in the refractory wall of a blast furnace by means of the method as claimed in any of Claims 1 to 4, characterized by

a guide bar member (5;50) having a head provided with an outwardly bending means (6) to be held at an opening (4) at a part of the steel shell (1) of said blast furnace where the refractory body is damaged,

a tubular member (8; 80) having a forward part provided with a plurality of slits (9) in its axial direction and fitted on the outside of said guide bar member (5;50) and

means (10) for forcing said guide bar member (5;50) together with said tubular member (8;80) under pressure into said furnace, and for pushing said forward part of said tubular member (8;80)

against said head of said guide bar member (5;50) to spread the narrow pieces of said forward part divided by said slits (9) radially in a flower petal manner to form a support structure for monolithic refractory body.

6. Apparatus as claimed in claim 5, characterized by a nozzle (16) for spraying monolithic refractories (12) under pressure through an opening (15) provided in the top of said blast furnace, whereby a refractory structure is formed about said support structure (101) in said refractory wall.

7. Apparatus as claimed in claim 5 or 6, characterized by plural tubular members (81, 82) of different diameters being fitted in a multi-layer manner on the outside of said guide bar member (5), whereby said monolithic refractory body with a plurality of stages of said support structure (101) consisting of radially spread pieces of said tubular members (81, 82) in a flower petal manner is formed in said refractory wall.

Patentansprüche

1. Verfahren zum Durchführen von Reparaturen in der feuerfesten Wand eines Hochofens, gekennzeichnet durch die folgenden Verfahrensschritte: Vorsehen einer Öffnung in einem Teil des Stahlmantels des Hochofens, wo der feuerfeste Körper beschädigt ist, Einführen einer Führungsstange mit einem mit einer Außenbiegeeinrichtung versehenen Kopf zum Halten an der Öffnung, Aufbringen eines Rohres, dessen Vorderteil in Axialrichtung mehrere Schlitze aufweist, auf die Außenseite der Führungsstange, Drücken der Führungsstange zusammen mit dem Rohr unter Druck in den Hochofen, und Stoßen des Vorderteils des Rohres gegen den Kopf der Führungsstange, so daß die durch die Schlitze getrennten schmalen Stücke des Vorderteils radial in Form von Blütenblättern gespreizt werden, und eine Stützstruktur für den monolithischen feuerfesten Körper ausbilden.

2. Verfahren nach Asnpruch 1, dadurch gekennzeichnet, daß ein feuerfestes Material durch die Lücke zwischen der Öffnung im Stahlmantel des Hochofens und der Führungsstange, auf der das Rohr vorgesehen ist, eingeführt wird, und daß ein feuerfester Körper um die Stützstruktur in der feuerfesten Wand ausgebildet wird.

3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß monolithische feuerfeste Stoffe unter Druck über eine Düse durch eine im Oberteil des Hochofens vorgesehene Öffnung gesprüht werden, und daß eine feuerfeste Struktur um die Stützstruktur in der feuerfesten Wand ausgebildet wird.

4. Verfahren nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß mehrere Rohre mit verschiedenen Durchmessern mehrschichtig auf die Außenseite der Führungsstange aufgebracht werden, und daß der monolithische feuerfeste Körper mittels mehrere Stufen der Stütstruktur, die aus in Form von Blütenblättern radial gespreizten Stücken der Rohre besteht, in der feuerfesten Wand ausgebildet wird.

5. Vorrichtung zum Durchführen von Reparaturen in der feuerfesten Wand eines Hochofens mittels des Verfahrens nach einem der Ansprüche 1 bis 4, gekennzeichnet durch eine Führungsstange (5;50) mit einem mit einer Außenbiegeeinrichtung (6) versehenen Kopf zum Halten in einer Öffnung (4) eines Teils des Stahlmantels (1) des Hochofens, wo der feuerfeste Körper beschädigt, einem Rohr (8;80), dessen Vorderteil in Axialrichtung mehrere Schlitze (9) aufweist und das auf die Außenseite der Führungsstange (5;50) aufgebracht ist, und einer Einrichtung (10) zum Drücken der Führungsstange (5;50) zusammen mit dem Rohr (8;80) unter Druck in den Hochofen und zum Stoßen des Vorderteils des Rohres (8;80) gegen den Kopf der Führungsstange (5;50), wodurch die durch die Schlitze (9) getrennten schmalen Stücke des Vorderteils radial in Form von Blütenblättern gespreizt werden und eine Stützstruktur für den monolithischen feuerfesten Körper ausbilden.

6. Vorrichtung nach Anspruch 5, gekennzeichnet durch eine Düse (16) zum Sprühen monolithischer feuerfester Stoffe (12) unter Druck durch eine im Oberteil des Hochofens vorgesehene Öffnung (15), wobei eine feuerfeste Struktur um die Stützstruktur (101) in der feuerfesten Wand ausgebildet wird.

7. Vorrichtung nach Anspruch 5 oder 6, gekennzeichnet durch mehrere Rohre (81,82) mit verschiedenen Durchmessern, die mehrschichtig auf die Außenseite der Führungsstange (5) aufgebracht sind, wobei der monolithische feuerfeste Körper mittels mehrere Stufen der Stützstruktur (101), die aus in Form von Blütenblättern radial gespreizten Stücken der Rohre (81,82) besteht, in der feuerfesten Wand ausgebildet wird.

Revendications

1. Procédé pour effectuer des réparations dans la paroi réfractaire d'un haut fourneau, caractérisé par les étapes consistant à ménager une ouverture dans une partie de l'enveloppe en acier dudit haut fourneau où le corps réfractaire est endommagé, à insérer un élément formant barre de guidage comportant une tête pourvue d'un moyen de pliage vers l'extérieur, cet élément étant maintenu dans ladite ouverture, à monter un élément tubulaire comportant une partie avant pourvue d'une pluralité de fentes orientées axialement sur l'extérieur dudit élément formant barre de guidage, à forcer ledit élément formant barre de guidage en même temps que ledit élément tubulaire sous pression à l'intérieur du fourneau, et à pousser ladite partie avant dudit élément tubulaire contre ladite tête dudit élément formant barre de guidage pour étaler les parties étroites de ladite extrémité avant subdivisées par lesdites fentes radialement à la manière de pétales d'une fleur afin de former une structure support pour ledit corps réfractaire monolithique.

2. Procédé tel que revendiqué dans la revendication 1, selon lequel un matérial réfractaire est introduit par un intervalle existant entre ladite

ouverture de l'enveloppe en acier dudit haut fourneau et ledit élément formant barre de guidage sur lequel ledit élément tubulaire est prévu, ce par quoi un corps réfractaire est formé autour de ladite structure support dans ladite paroi réfractaire.

3. Procédé tel que revendiqué dans la revendication 1 ou 2, selon lequel des réfractaires monolithiques sont projetés sous pression par une buse au travers d'une ouverture ménagée à la partie supérieure dudit haut fourneau, ce par quoi une structure réfractaire est formée autour de ladite structure support dans ladite paroi réfractaire.

4. Procédé tel que revendiqué dans une quelconque des revendications 1 à 3, dans lequel plusieurs éléments tubulaires de diamètres différents sont montés d'une manière multi-couche à l'extérieur dudit élément formant barre de guidage, et ledit corps réfractaire monolithique est formé dans ladite paroi réfractaire avec une pluralité d'étages de ladite structure support se composant des parties desdits éléments tubulaires qui ont été radialement étalées à la manière de pétales d'une fleur.

5. Appareillage pour réaliser des réparations dans la paroi réfractaire d'un haut fourneau au moyen du procédé tel que revendiqué dans une quelconque des revendications 1 à 4, caractérisé par un élément formant barre de guidage (5;50) comportant une tête pourvue d'un moyen de pliage vers l'extérieur (6), cet élément étant maintenu dans une ouverture (4) prévue dans une partie de l'enveloppe en acier (1) dudit haut fourneau où le corps réfractaire est endommagé, un élément tubulaire (8; 80) comportant une partie avant pourvue d'une pluralité de fentes (9) selon sa direction axiale et monté à l'extérieur dudit élément formant barre de guidage (5; 50), et un moyen (10) pour forcer ledit élément formant barre de guidage (5; 50) en même temps que ledit élément tubulaire (8; 80) sous pression ver l'intérieur dudit fourneau, et pour pousser ladite partie avant dudit élément tubulaire (8; 80) contre ladite tête dudit élément formant barre de guidage (5; 50) afin d'étaler les parties étroites de ladite extrémité avant divisée par lesdites fentes (9) radialement à la façon de pétales d'une fleur pour former une structure support pour les corps réfractaire monolithique.

6. Appareillage tel que revendiqué dans la revendication 5, caractérisé par une base (16) pour projeter du réfractaire monolithique (12) sous pression par l'intermédiaire d'une ouverture (15) ménagée en haut dudit haut fourneau, de façon à former une structure réfractaire autour de ladite structure support (101) dans ladite paroi réfractaire.

7. Appareillage tel que revendiqué dans la revendication 5 ou 6, caractérisé par plusieurs éléments tubulaires (81, 82) de diamètres différents qui sont montés d'une manière multicouche sur l'extérieur dudit élément formant barre de guidage (5), ce par quoi ledit corps réfractaire monolithique est formé dans ladite paroi réfractaire avec une pluralité d'étages de ladite structure support (101) se composant des parties desdits éléments tubulaires (81, 82) qui sont radialement étalées à la manière de pétales d'une fleur.

FIG. 1

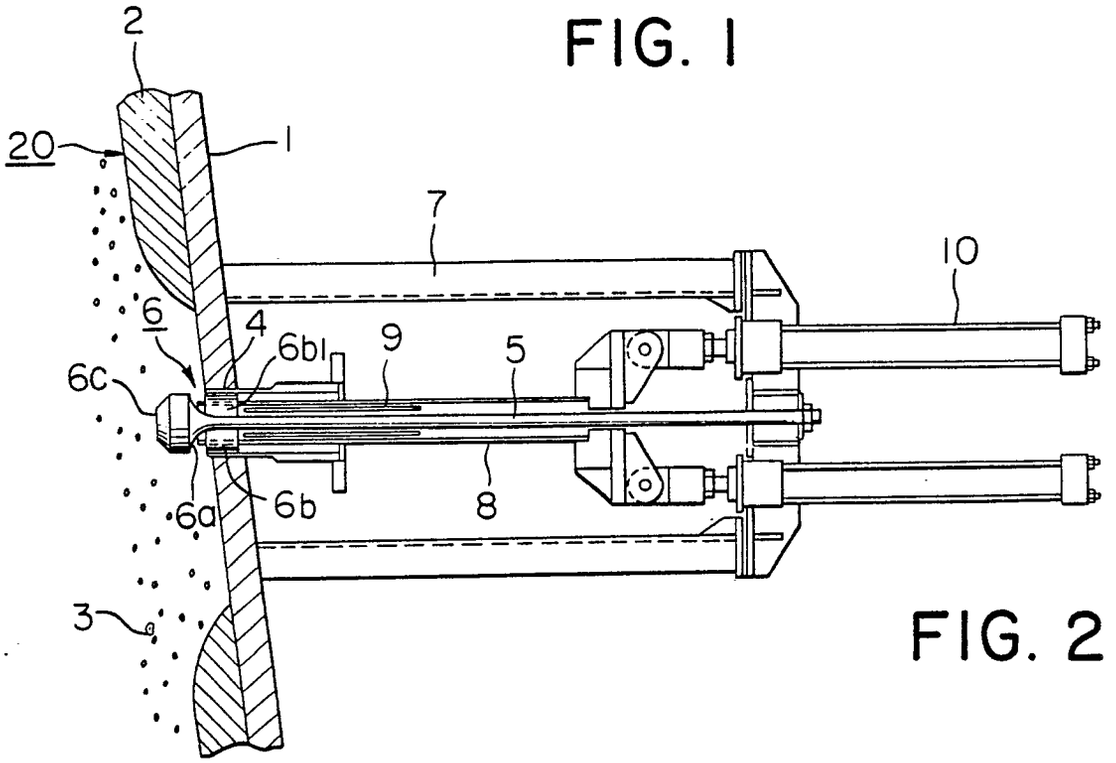


FIG. 2

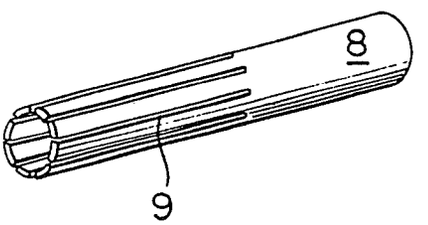


FIG. 3

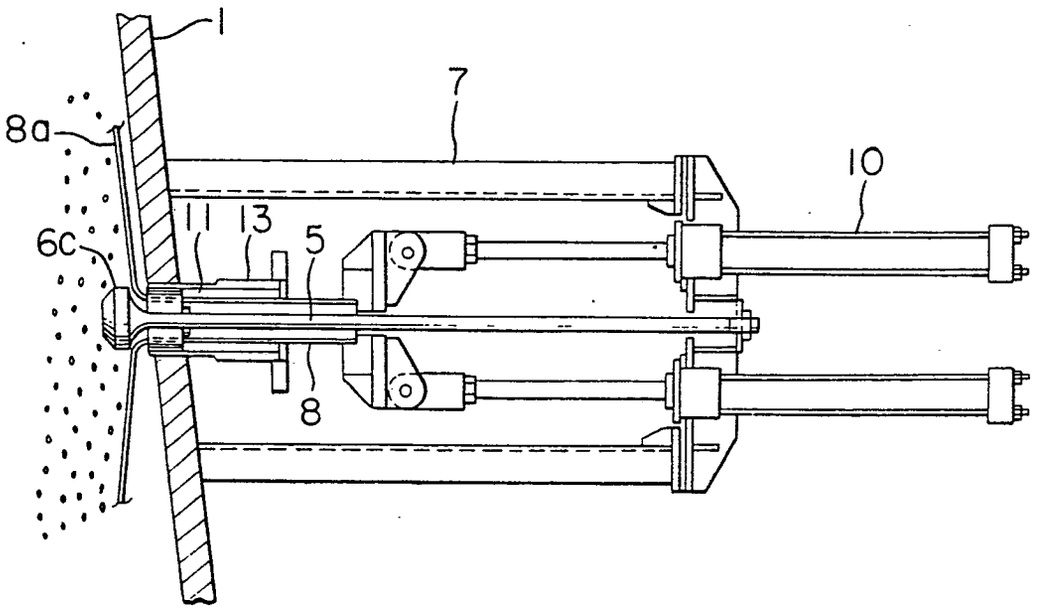
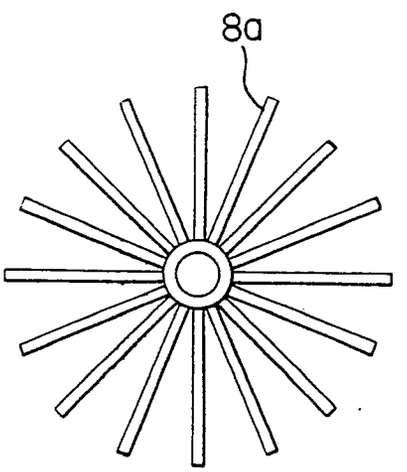


FIG. 4



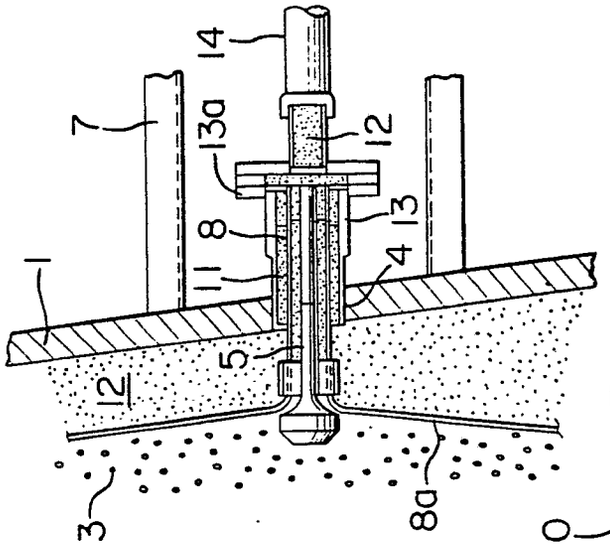


FIG. 5

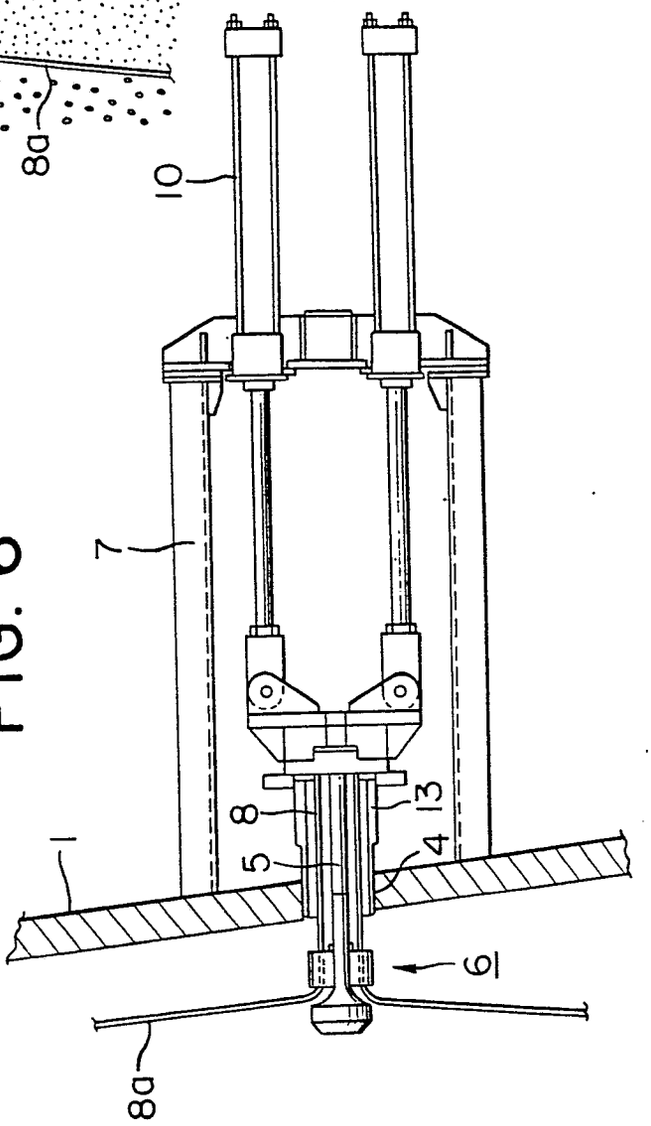


FIG. 6

FIG. 7

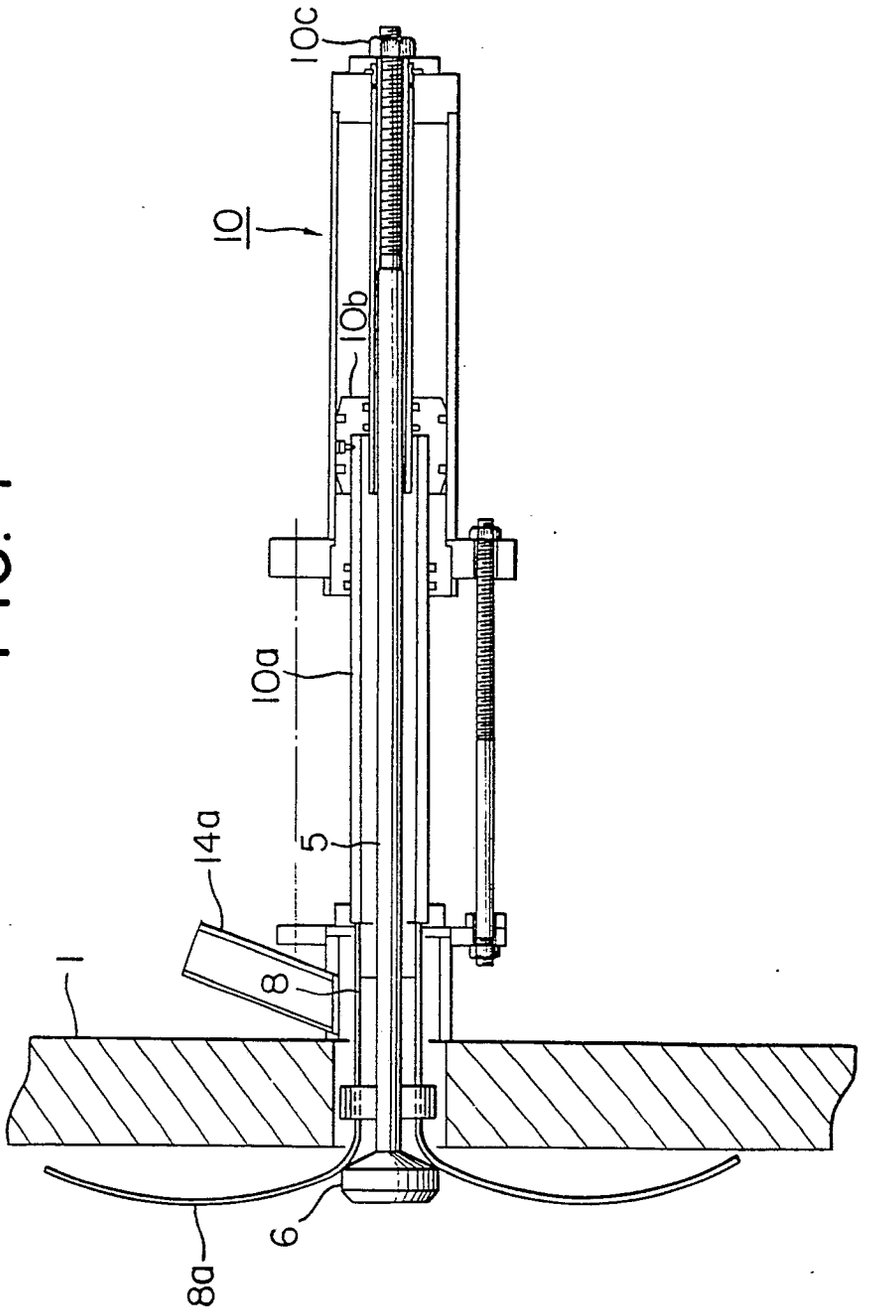


FIG. 8

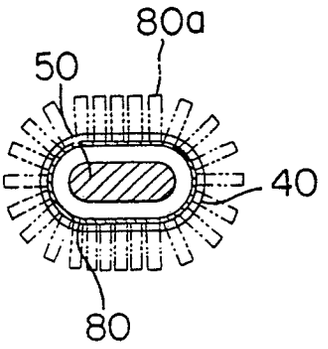


FIG. 10

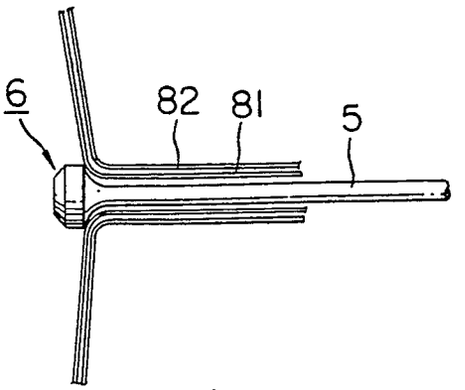


FIG. 9

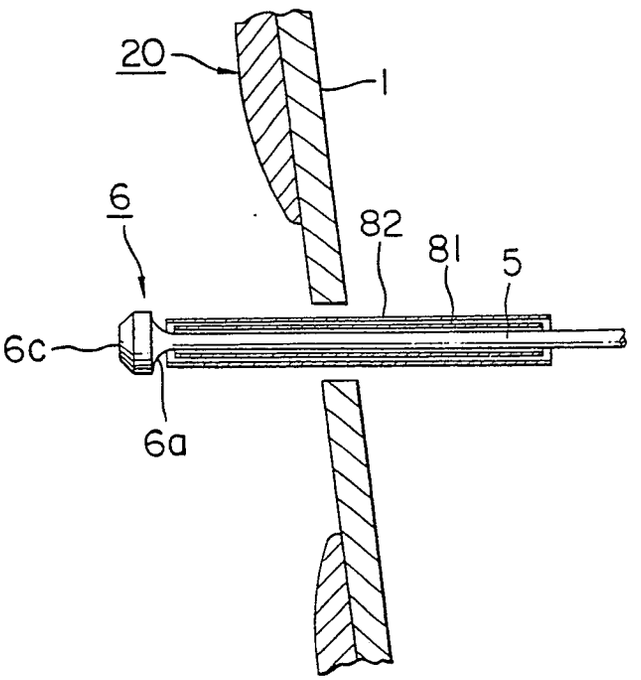


FIG. 11

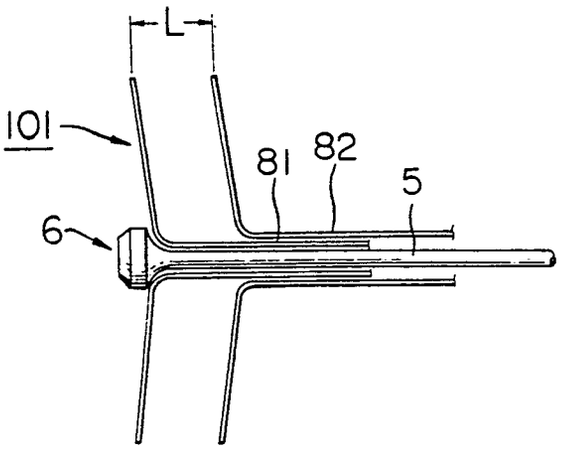


FIG. 13

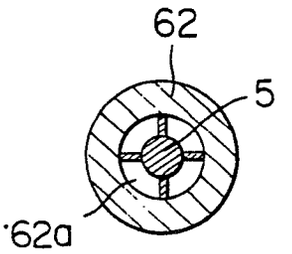


FIG. 12

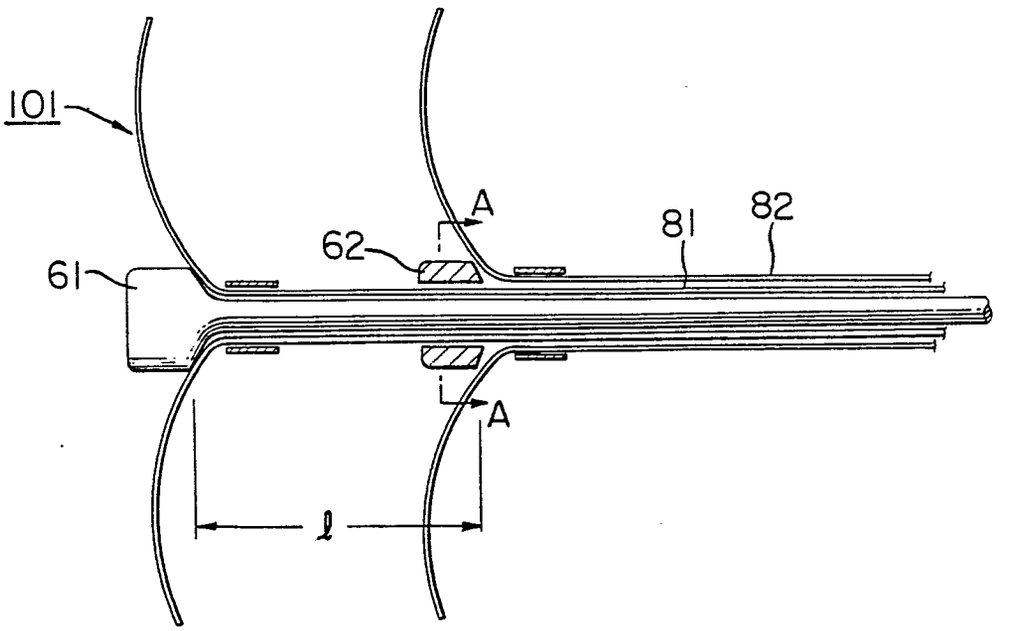


FIG. 14