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(54) Refractory burner brick

(57) A refractory furnace brick (1) (1/2) has chamfered corner faces (F3/f3) enabling the bricks to be formed into a regular grid with longitudinal rectangular bores formed both within respective bricks and defined by surrounding bricks. Preferably the shorter sidewalls of the bricks are extended slightly in the transverse direction to form ridges R/R' which interlock to strengthen the structure. In order to provide a distributed expansion flexible ceramic pads (P) may be provided between the chamfered corner faces.

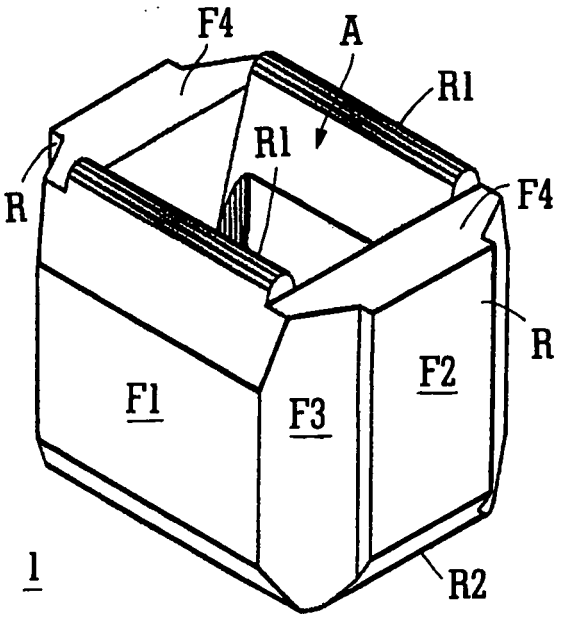

FIG.1

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Description

[0001] The present invention relates to a refractory furnace brick (1) and to burners utilizing a grid of such bricks e.g. in blast furnace s and the like.

[0002] Conventional blast furnace stoves utilize burners made up of successive courses of bricks, each course comprising bricks of different sizes, the courses forming overlapping grids which facilitate combustion of the furnace gases.

[0003] Such burners are subjected to extremely high temperatures and are also impacted by solid debris which can result in failure, particularly of the smaller bricks.

[0004] An object of the present invention is to provide a simpler construction which can overcome or alleviate at least some of the above disadvantages.

[0005] The present invention provides a refractory furnace brick (1) having a longitudinal central bore (A) surrounded by sidewalls, the brick having a transverse cross-section in which corner regions of the junctions of the sidewalls are shaped externally to interface with external corner regions of neighbouring furnace bricks when disposed in a regular two dimensional grid of such bricks.

[0006] An advantage of such a construction is that relatively small bricks which are correspondingly more susceptible to breakage can be eliminated. Furthermore the manufacturing requirements are simplified.

[0007] Preferably said corner regions are chamfered to form mating faces. The chamfering reduces the pressure at the interfacial regions, thereby reducing the risk of fracturing of the bricks, and also stabilizes the arrangement.

[0008] Preferably the interfacial regions comprise ridge portions which can interlock with the ridge portions of neighbouring bricks in said regular two dimensional grid. This feature further stabilizes the construction and obviates the requirement for cement joints.

[0009] Preferably the refractory furnace brick (1) is so shaped and dimensioned that the transverse cross-section of said upright central bore is substantially the same as that of each neighbouring bore defined by the spacing between opposed external brick surfaces in such a regular two dimensional grid. This feature ensures that the grid openings are of a uniform size and facilitates good combustion.

[0010] Preferably the area of said transverse cross-section of said upright central bore is within $\pm$ 20% of that of each said neighbouring bore. More preferably each dimension of said transverse cross-section of said upright central bore is within $\pm$ 10% of the corresponding dimension of said neighbouring bore.

[0011] Further preferred features are defined in the dependent claims.

[0012] A preferred embodiment of the invention is described below by way of example only with reference to Figures 1 to 8 of the accompanying drawings, wherein:

Figure 1 is a perspective view from below of a refractory furnace brick (1) in accordance with the invention and intended for use in the top capping course of a burner;

Figure 2 is a perspective view from below of a further refractory furnace brick (1) in accordance with the invention which is intended for use in the capping course immediately beneath the top capping course of a burner;

Figure 3 is a perspective view from below of the furnace brick of Figure 1 showing one half cut away in order to reveal the longitudinal cross-section of each of the longer sidewalls;

Figure 4 is a perspective view from below showing the top two capping courses of a burner utilizing the furnace bricks of Figures 1 and 3 and Figure 2;

Figure 5 is a diagrammatic horizontal section of either of the capping courses in Figure 4;

Figure 5A is a magnified view of the interfacial region of the two furnace bricks shown in Figure 5;

Figure 6 is a longitudinal diametrical cross-section through a furnace utilizing the capping courses shown in Figure 4;

Figure 6A is a magnified partial view showing the gap between the outer wall of the furnace and the burner grid of Figure 6;

Figure 7 is a transverse cross-section through the upper capping course of Figure 6; and

Figure 8 is a transverse cross-section through the lower capping course of Figure 6.

[0013] Referring to Figure 1, the refractory furnace brick (1) 1 (which is suitably composed of high-alumina firebrick composition) is substantially rectangular in cross-section and has a substantially rectangular upright central bore A as shown. The two longer sidewalls have rounded ridge portions R1 which project beyond flat faces F4 at the bottom of the two shorter sidewalls. The longer sidewalls have external faces F1 which define substantially rectangular bores between the bricks when disposed in a grid as described below with reference to Figure 4. The outer faces F2 of the shorter sidewalls constitute the other internal faces of the neighbouring bores in the grid as will become apparent from Figure 4.

[0014] It will be noted that the shorter sidewalls have longitudinal ridges R whose extremities are defined by faces F2. The upright longitudinal edges of these ridges enable the furnace bridge to interlock when assembled into a grid, and lie adjacent chamfered surfaces F3 at the four corners of the block which interface with the chamfered corners of neighbouring bricks as will become apparent from the discussion of Figure 5 below.

[0015] As best seen in Figure 3, all four sidewalls are tapered in transverse cross-section at their upper extremities to form ridges R2 which are also shown in Figure 4.

[0016] The refractory furnace brick (1) 2 showing in Figure 2 is intended to be assembled into a grid supporting an upper capping course composed of bricks 1 and

it will be noted that the longer sidewalls and upper ridges r1 which are similar to ridges R1 of brick 1 and that the shorter sidewalls have upper end faces f4 which are similar to flat faces F4 of furnace brick 1. As will become apparent from Figure 4, when the furnace bricks 1 are inverted they can be placed on the furnace bricks 2 with the ridges R1 sitting on end faces f4 and the ridges r1 contacting the faces F4. This arrangement enables the upper capping course to be displaced horizontally relative to the lower capping course as necessary since there is no interlocking between the flat faces f4/F4 and the ridges R1/r1. The lower end portions of the sidewalls have flat faces (not shown) unlike the ridged portions of the bricks 1 since they rest on flat surfaces of a lower grid. The bricks 2 are otherwise similar to the bricks 1, in particular by including external sidewall faces f1 and f2 which define neighoburing bores in the lower grid of Figure 4, by incorporating a ridge R' similar to the ridge R of brick 1 which ensures interlocking between neighbouring bricks and by incorporating chamfered mating surfaces f3 at the respective corners.

[0017] Turning now to Figure 4, it will be seen that an upper layer of furnace bricks 1 can be assembled to form a regular grid with each brick contacting neighbouring bricks as its chamfered faces F3 and at the edge portions of its ridges R, and that the bricks 2 of the lower grid similarly define a lower grid.

[0018] It will be seen that the two grids are mutually offset by half a brick width along the direction of the shorter sidewalls, enabling airstreams a and gas streams b to be bifurcated and mixed to ensure efficient combustion.

[0019] In order to provide a distributed expansion allowance, the chamfered faces F3/f3 of the bricks 1/2 are spaced apart by ceramic fiber pads P having a thickness e.g. 1.5 mm to 2 mm corresponding to the brick spacing as best seen in Figure 5A. These pads are relatively thin compared to the height of the ridges R, again as best seen in Figure 5A and hence do not prevent interlocking between the sides of the ridges and the faces F1/f1.

[0020] Figure 6 shows the complete burner in cross-section, which is typically part of a blast furnace or other high temperature combustion unit. As shown in Figure 6A, a further expansion gap G is provided at the periphery of the burner grid. The tapered upper extremities of the sidewalls prevent debris from catching on the grid walls which might otherwise lock the grid openings. The tapered lower extremities of the furnace bricks 1 facilitate a smooth gas flow through the burner assembly.

[0021] As best seen in Figure 7, the bores A within the interior of the respective bricks 1 are of essentially the same transverse cross-section as the bores B defined by the faces F1 and F2 of surrounding bricks. The corners of the bores A are however rounded slightly to avoid weak points at these regions.

[0022] The outer bricks are cut in half where necessary in order to provide a roughly circular shape which can be confined within the outer walls W of the burner.

[0023] Figure 8 shows a similar arrangement of the furnace bricks 2 of the lower grid and again it will be seen that the bores A' are of a similar transverse cross-section to the bores B' defined by the faces f1 and f2 of surrounding bricks 2.

Claims

1. A refractory furnace brick (1) having a longitudinal central bore (A) surrounded by sidewalls, the brick being **characterized by** a transverse cross-section in which corner regions at the junctions of the sidewalls are shaped externally to interlock transversely with external corner regions of neighbouring furnace bricks (2) when disposed in a regular two-dimensional transversely extending grid of such bricks.

2. A refractory furnace brick (1) according to claim 1 wherein said corner regions are chamfered to form mating faces (F3).

3. A refractory furnace brick (1) according to claim 1 or claim 2 wherein the interfacial regions comprise longitudinally-extending ridge portions (R) which can interlock transversely with the ridge portions of neighbouring bricks in said regular two-dimensional grid.

4. A refractory furnace brick (1) according to any preceding wherein the longitudinal ends of said sidewalls lie in a common plane whereby one such grid can be displaced transversely relative to a longitudinally adjacent such grid.

5. A refractory furnace brick (1) according to any preceding claim which is so shaped and dimensioned that the transverse cross-section of said upright central bore (A) is substantially the same as that of each neighbouring bore (A') defined by the spacing between opposed external brick surfaces (F1,f1;F2,f2) in such a regular two-dimensional grid.

6. A refractory furnace brick (1) according to claim 5 wherein the area of said transverse cross-section of said upright central bore (A) is within $\pm$ 20% of that of each said neighbouring bore (A').

7. A refractory furnace brick (1) according to claim 5 or claim 6 wherein each dimension of said transverse cross-section of said upright central bore (A) is within $\pm$ 10% of the corresponding dimension of each said neighbouring bore (A').

8. A refractory furnace brick (1) according to any preceding claim wherein the ends of one pair of opposite sidewalls are tapered in longitudinal cross-section.

9. A refractory furnace brick (1) according to claim 8 wherein a further pair of opposite sidewalls have flat

end surfaces (F4) which are disposed below the extremities of said tapered sidewalls.

10. A refractory furnace brick (1) according to claim 8 or claim 9 wherein a a pair of opposite sidewalls are tapered in longitudinal cross-section at both ends thereof.

11. A refractory furnace brick (1) according to any preceding claim which is substantially rectangular in a transverse cross-section.

12. A grid comprising a layer of refractory furnace bricks (1,2) as claimed in any preceding claim .

13. A grid according to claim 12 in which resilient refractory pads (P) are disposed at interfaces between external corner regions of neighbouring refractory furnace bricks (1,2).

14. A grid according to claim 11 comprising two vertically adjacent layers of such refractory furnace bricks (1,2) in which one layer is displaced relative to the adjacent layer so as in use to bifurcate a gas stream (b) flowing through the bores (A') of one layer in to the bores (A) of the adjacent layer.

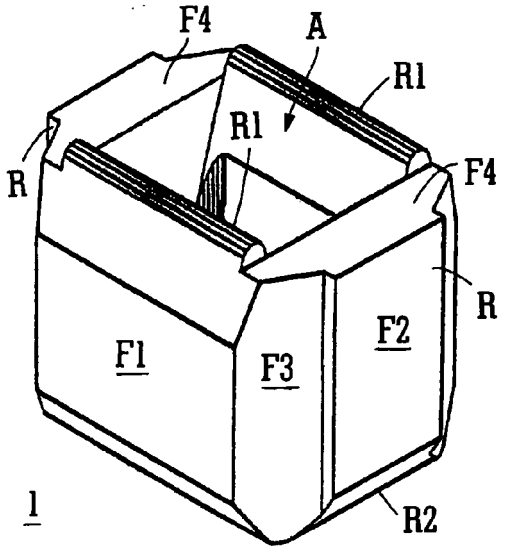

FIG.1

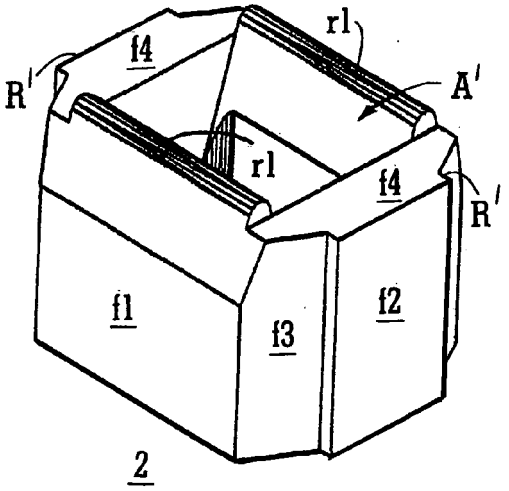

FIG. 2

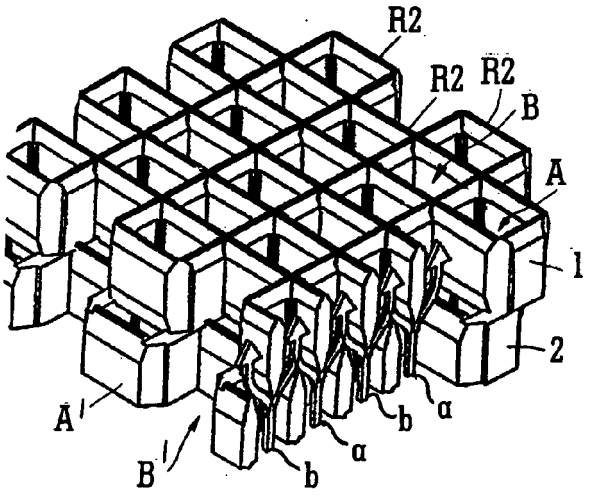

FIG. 4

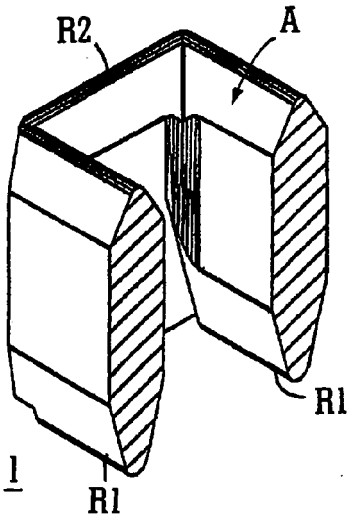

FIG. 3

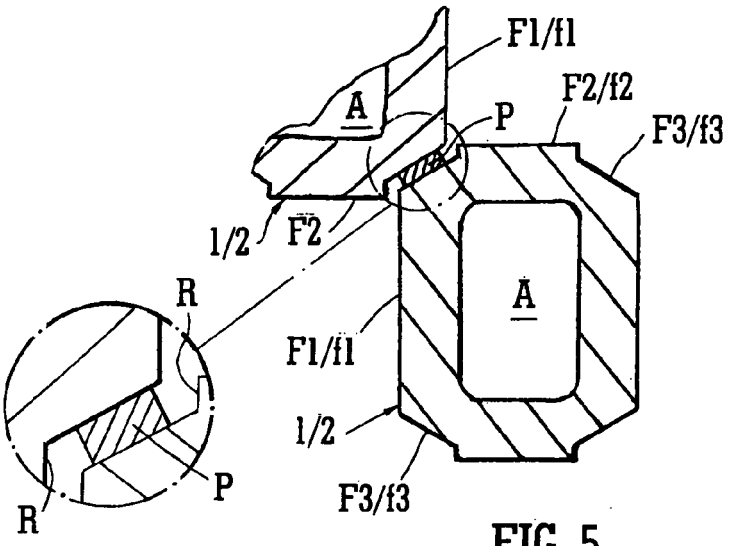

FIG. 5A

FIG. 5

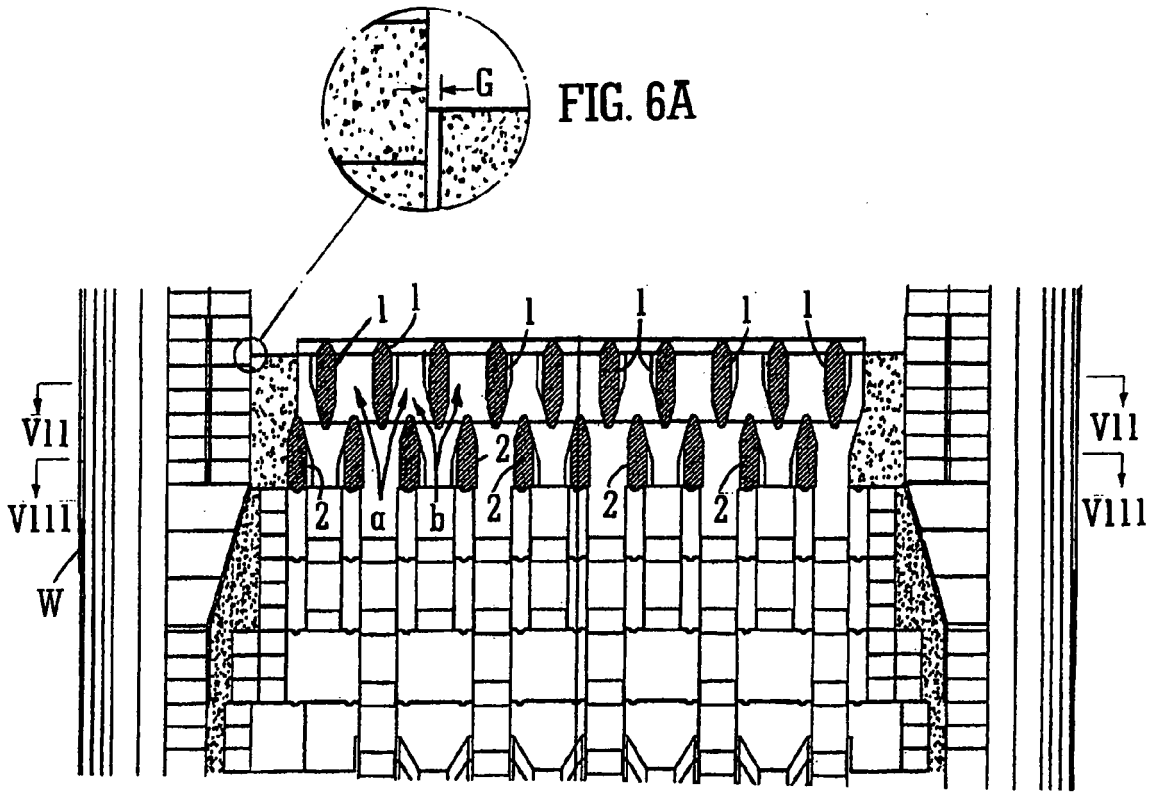

FIG. 6A

FIG. 6

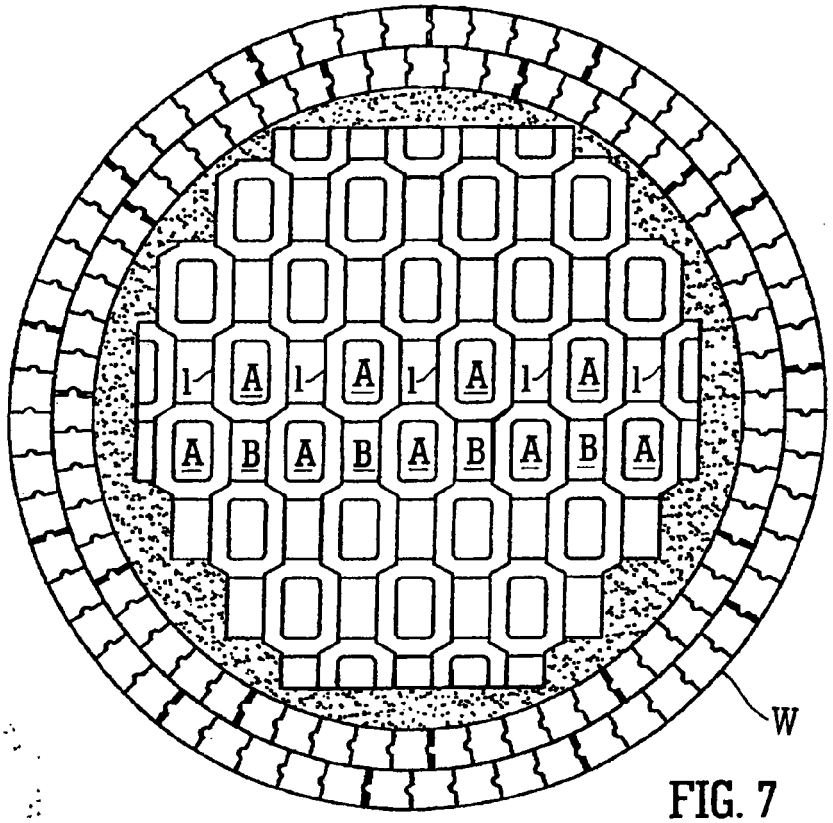

FIG. 7

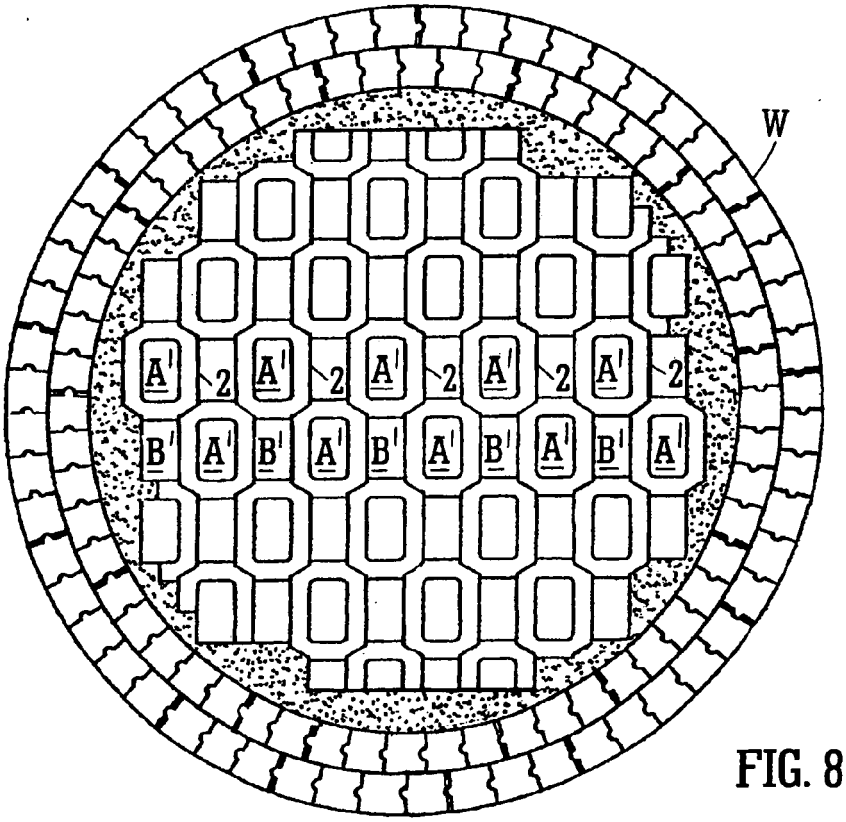

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 06 25 5415

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2 221 416 A (TAU BRUCE E) 12 November 1940 (1940-11-12) * column 2, line 28 - column 3, line 41; figures 1-8 *	1-4,11, 12,14	INV. C21B9/00
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TECHNICAL FIELDS SEARCHED (IPC)

C21B
F27B
F23M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 February 2007	Theis, Gilbert

CATEGORY OF CITED DOCUMENTS

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