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(54) **Cooled panels for walls of electric furnaces.**

(57) A panel for walls of electric furnaces comprising a series of elements (2, 3, 4, 5, 6, 15) provided with holes (2*a*, 5*a*, 6*a*) in which suitable tubes (16,3t,4t) for water circulation are inserted or incorporated.

The surface of the panel looking the melted material is preferably shaped with cavities (2*b*, 6*b*) so as to hold refractory material. More refractory bricks (7) may be comprised within adjacent elements.

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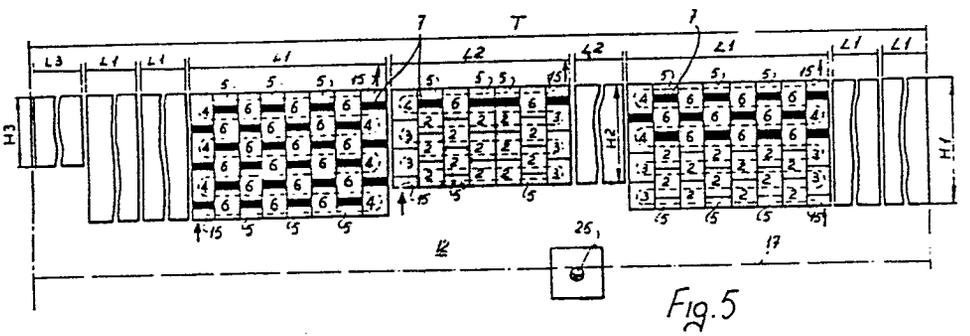

Fig.5

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"COOLED PANELS FOR WALLS OF ELECTRIC FURNACES"

This invention relates to panels cooled by water or other suitable liquid for forming the walls of electric furnaces, wherein, as well known, smelting takes place by electric discharges.

An ideal panel, which may be part of a wall or may form the whole wall of an electric furnace should fulfill the following requirements:

(1) Provide minimal heat losses through the panel.

(2) Provide the greatest possible safety against any accidental exit of water or other fluid.

(3) Be of a big enough size, so that only a reduced number of outside connections has to be carried out for the supply and discharge of water or other fluids.

(4) Be of a suitable size and having thermal characteristics according to each site or zone of each furnace.

(5) Enable a long life of the panel in use.

(6) Allow the partial replacement of zones of the panel according to requirements and as desired.

Different types of panel are commercially available, but the solutions hitherto proposed only partly meet these conditions. Particularly, boxes or sectors are used as panels for electric furnaces having water circulating therein, but this fluid, though it has fixed paths, may, due to the provision of not circular sections, easily build up pockets of steam or dead water causing overheating of some zones of the boxes and accordingly a perforation thereof.

Also steel blocks are used as having a built-in inner coil. The water path is fixed therein, thus assuring a smooth flow, but the disadvantage arises that the panel smelting involves a complicated operation, the reduced size of the panel causing the increase of outside connections. A further disadvantage is that during use the considerable size of the anel causes cracks on the melted inner wall thereof. In this case, it is also required to provide panels for each specific requirement. Thus, different panels should be provided for each type of furnace and in a same furnace panels which are different as to characteristics and size according to the different use zones or sites.

It is the object of the present invention to provide as improved cooled panel for electric furnaces, by which a lower maintenance cost can be obtained having at the same time the possibility of providing in the least possible

time panels having suitable characteristics according to the specific use intended therefor.

It is another object of the present invention to provide a lower consumption of electric energy due to absorption of calories from water or other fluid in the panel.

It is another object of the invention to allow for replacing only part of the panel in case of servicing or maintenance.

It is a further object of the present invention to enable mutual displacements between tubes and body of the panel, such as to take up the differential thermal expansions created by the big changes in temperature.

The main object has been accomplished by providing to form a panel from a series of modular basic elements that can be coupled to one another in any desired chess-board like pattern.

Preferably, these elements comprise an outer body which is inserted over a special tube or by a tube portion which is incorporated in an outer body, said tubes serving for the passage or cooling water or other fluid.

A preferred solution also provides that the panel

surface facing inwardly of the furnace is shaped so as to retain therein insulating material comprising slags produced by the furnace itself, or refractory material which is suitably before hand.

Preferably, the modular elements are assembled by welding to some of the elements comprising curves or bendings some tube lengths over which one or more elements provided with corresponding holes are inserted, then further curved elements are welded to the free ends of said tubes, thus providing a circuit or path for the cooling fluid. Such a formed panel can now be bent for adaptation to the diameter of the furnace to which it will be applied.

In case, portions of refractory material can be incorporated between the various modular elements.

The invention will now be more clearly explained with reference to an exemplary embodiment which has been shown in the figures of the accompanying drawings, in which:

Fig. 1 is a front view of a portion of two walls for an electric furnace according to the present invention;

Fig. 2 is a sectional view taken along line II-II of Fig. 1;

Fig. 3 is a sectional view taken along line III-III of Fig. 1;

Fig. 4 is a view taken along line IV-IV of Fig. 1; and

Fig. 5 is a developed view of a wall of a furnace lined up with panels according to the present invention.

Fig. 1 shows a portion of a wall of a furnace, in which a portion of a panel 1 is shown at the right to line IV-IV, while a portion of a panel 18 adjacent to the first mentioned panel is shown at the left to line IV-IV.

In the zone underlying said two panels, there is a refractory base 12. In Figs. 2, 3 and 4 there is also shown the supporting structure comprising two vertical tie rods 13 passing into holes 19 suitably provided in each of the modular elements. Said tie rods 13 are then secured to the furnace housing 14.

Each panel comprises several modular elements, which will now be described one by one.

Element 2 (Figs. 1, 2 and 3) comprises a block containing two parallel holes shown at 2a respectively, in which tubes 16 are inserted during assembling. Elements 3 and 4 (Figs. 1 and 4) comprise blocks containing curved or bent tubes 3t and 4t, respectively. Element 6 is quite similar to element 2, but the distance or spacing between the parallel holes 6a, and

hence between tubes 16 therein contained is larger than that between tubes 16 of said element 2. Element 5 comprises a semielement having a single hole 5a and is for completion of he panel. Finally, element 15 is similar to element 5, but comprises a curved tube 8 or 9, respectively serving for the return and delivery of the cooling fluid.

The assembling of the various elements, so that the latter will form a panel, may be effected by merely taking elements 3 or 4 comprising a curve or bending, preferably projecting out of the element, and welding on these tube ends some lengths of straight tube 16 of a suitable size, then inserting on such straight tubes the preselected tubes, such as those of type 2, 6 or the like, finally welding to the end of these straight tubes other curved elements 3 or 4 and two elements 15 with associated tube 8 and 9, thus forming a continuous circuit panel. Now the panel thus obtained will be curved for adaptation to the furnace diameter. In case, refractory bricks 7 are incorporated in the panel, bricks which are supported by the adjoining elements.

The gaps 10 and 11 in the vertical and horizontal joint zones, respectively, between two adjoining elements, are filled with refractory material or simply with slags produced by the furnace operation, thus rendering the structure sufficiently monolithic.

The side wall of the furnace shown in Fig. 5 comprises nine panels, of which six are for example of a length L1 of 1910 mm and a height H1 of 1200 mm, two are of a length L2 of 1680 mm and a height H2 of 950 mm, and finally one of a length L3 of 920 mm and a height H3 of 530 mm. The assembly of these panels may form the side walls of an electric furnace of about 50t, the circumference T of which is 16,014 mm. In the drawing of Fig. 5, reference numeral 26 denotes the tapping hole and 17 the casting or pouring level. Above this level, the side walls of the furnace first comprise a refractory 12 of a minimal height H4 of 550 mm, this height increasing in proximity of tapping hole 26 and of the gate for the admission of additive materials.

In Fig. 5 three panels have been shown along with the structural modular elements thereof, the water circuit having been shown by arrows and dashed lines indicating the path for the tubes in the elements. Generally, the elements are arranged so as to be offset in height, each row relative to the adjacent row, but this is not the only possible solution, as shown in one of the panels of Fig. 5.

The darkened zones in each of the panels are those in which refractory material 7 has been inserted.

From the foregoing description, it will be appreciated that panels can be provided of different characteristics along

the height thereof, having for example lower zones with a larger cooling factor than that of the upper zones, as predicated. This can be done only because of the availability of small modular casting elements.

By this principle, the furnace cooling can be differentiately balanced: at the hot locations, a higher cooling is provided, while at those less liable to heat, cooling is smaller.

From Figs. 2 and 3, it will be also appreciated that the surface of each element is formed with cavities 2b and 6b, in which refractory material is inserted, and in any case against which the furnace slags will deposit, thus increasing the wall insulation and hence decreasing the heat exchange and increasing the panel life. These cavities may be of any shape and pattern as far as capable of retaining the insulating material.

The provision of refractory bricks along with cavities 2b and 6b carrying refractory material or slags allows a lower removal of calories from the cooling water and accordingly a lower energy consumption for steel smelting.

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CLAIMS

1. A cooled panel for walls of electric furnaces, characterized by comprising a series of element (2, 3, 4, 5, 6 and 15) made of cast iron, steel, or other metals or alloys.

2. A panel according to Claim 1, characterized in that each of the elements (2, 3, 4, 5, 6 and 15) made of a casting of steel, cast iron or other materials has holes in which suitable tubes for water circulation are inserted or incorporated.

3. A panel according to Claim 1 or 2, characterized in that the outer surface of the panels is shaped, that is has cavities (2b and 6b) even of different shapes, such as to allow for the insertion therein of refractory material or insulating slags.

4. A panel according to any of the preceding claims, characterized in that some elements 2,6; 3,4) are of different size and shapes, allowing differentiated thermal or heat exchanges depending on the local requirements of the various furnace zones.

5. Panels according to any of the preceding claims, characterized in that even refractory material (7) can be inserted therein.

6. A panel according to any of the preceding claims, characterized in that some free gap (10, 11) is left between some of the adjoining elements by inserting in said gaps refractory material or simple slags from the processing.

7. A panel according to any of the preceding claims, characterized by being replaceable at will as to a portion of the panel only by removing the most worn out elements and replacing the latter with new elements.

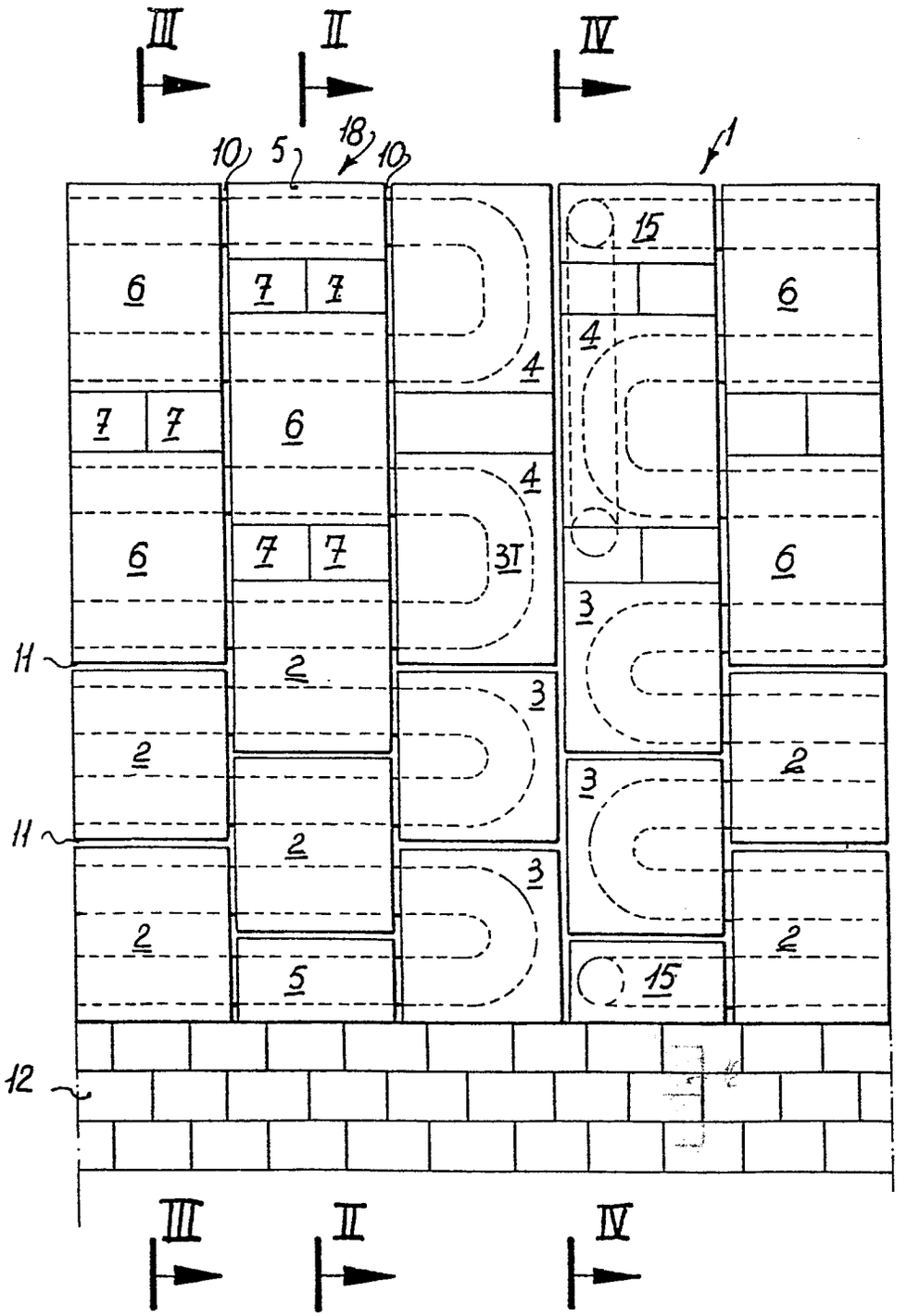
III
II
IV
10
5
18
10
1
15
6
7
7
4
6
7
7
4
6
7
7
3T
6
3
11
2
3
2
2
11
2
3
2
2
3
2
5
15
12
III
II
IV

Fig. 1

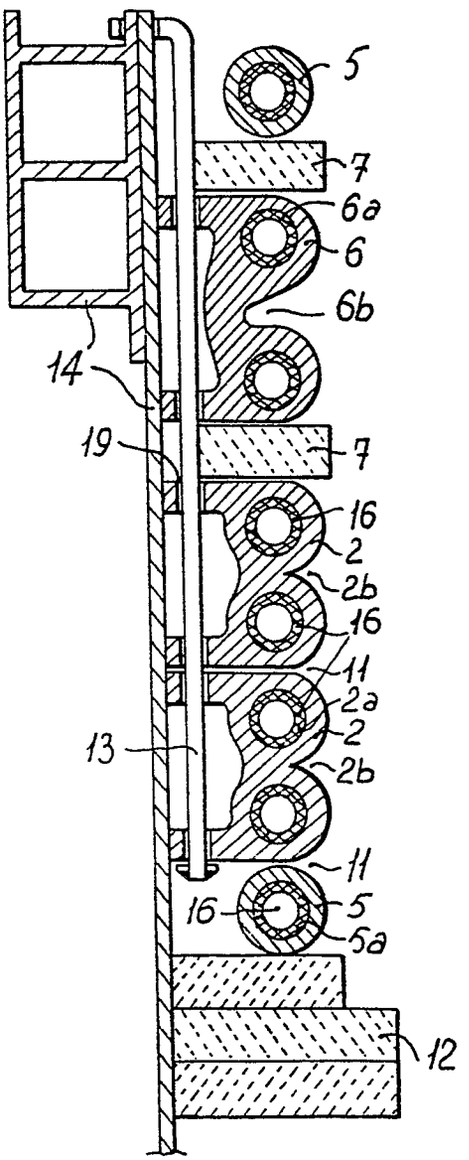
5
7
6a
6
6b
14
19
7
16
2
2b
16
11
2a
2
13
2b
11
16
5
5a
12

Fig. 2

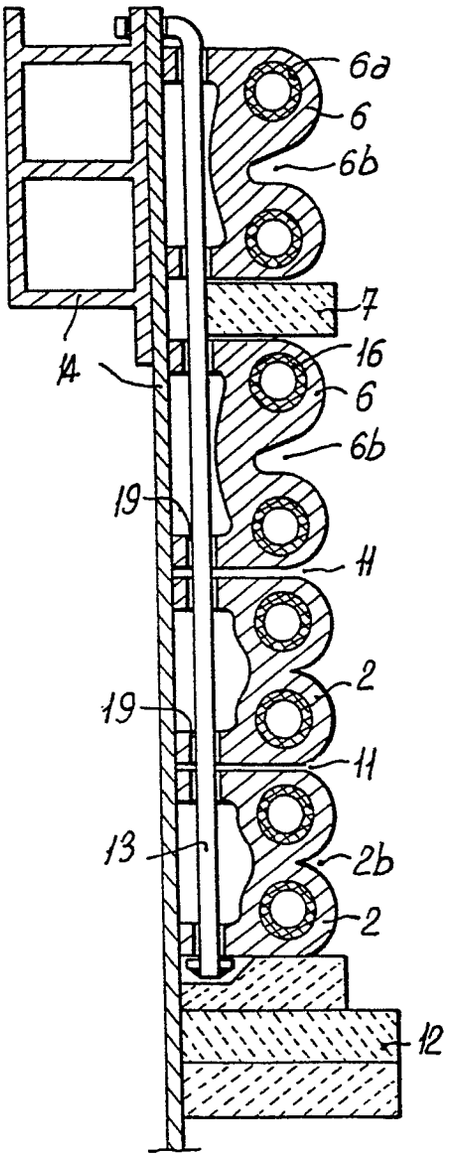
6a
6
6b
7
16
14
6
6b
19
11
2
19
11
13
2b
2
12

Fig. 3

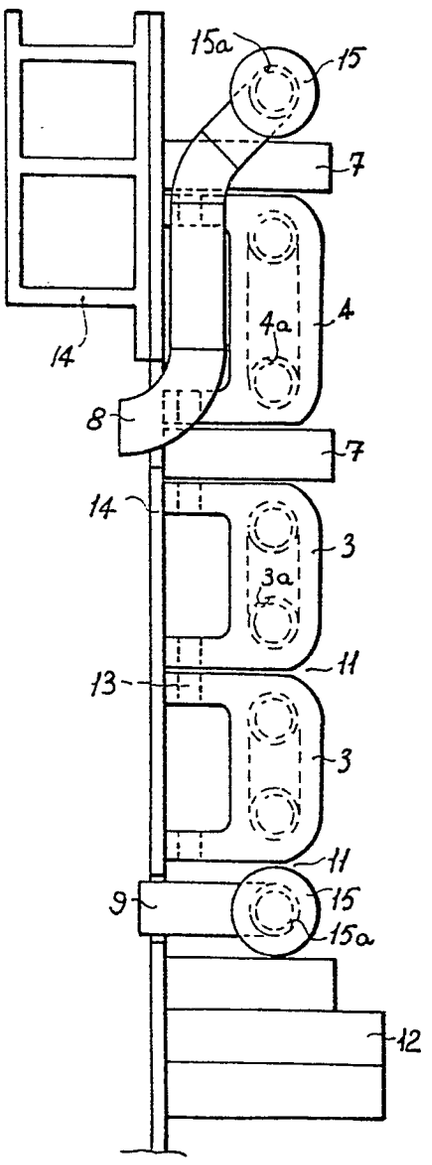
15a
15
7
4
4a
14
8
7
14
3
3a
11
13
3
11
9
15
15a
12

Fig. 4

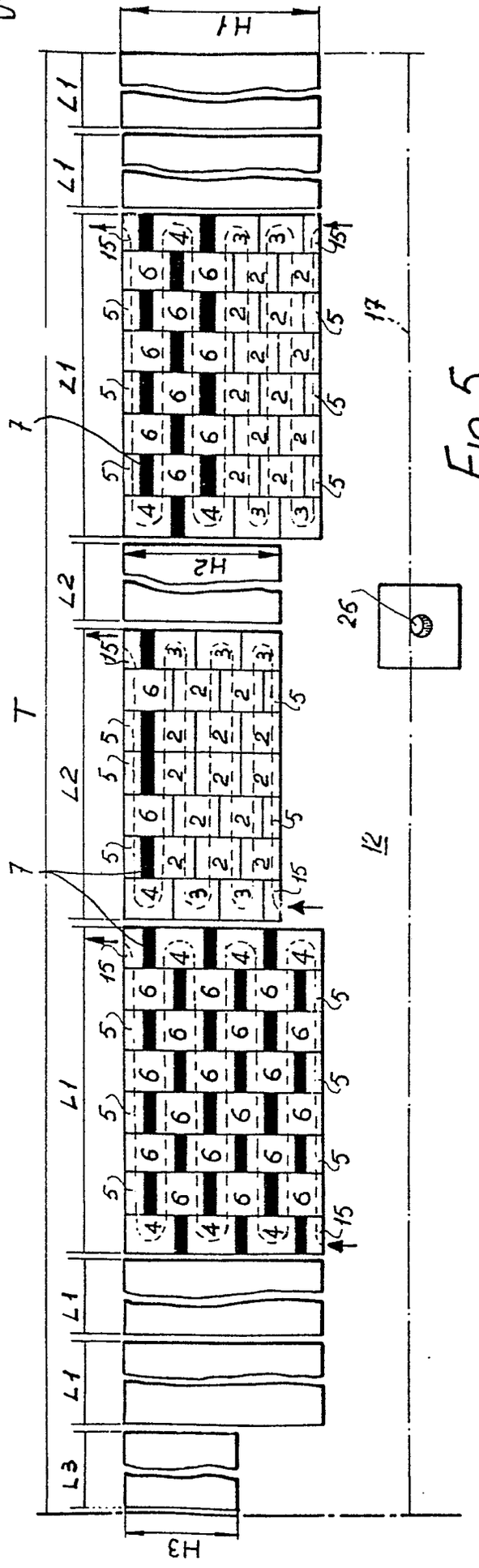
H1
L1
L1
17
7
L1
5
6
2
4
3
15
H2
L2
26
T
L2
12
7
L1
L1
L1
L3
H3

Fig. 5

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EUROPEAN SEARCH REPORT

Application number EP 79 10 3972

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
A	DE - C - 655 249 (E. GRIMM) * Claim; figures 1,2 *	1,5
A	DE - C - 957 758 (E. THOMAS) * Claims 1-4; page 2, right-hand column, lines 76-96; figures 1-5 *	1,7
A	FR - A - 2 021 222 (MITSUBISHI JUKOGYO) * Figures; claims 1-3 *	1
A	US - A - 3 829 595 (TOSHIO NANJYO) * Claims 1-5; figures 1-7 *	2,3
A	DE - A - 2 354 570 (ISHIKAWAJIMA-HARIMA JUKOGYO) * Figures 1-10; claims 1-7 *	2,3
A	DE - B - 2 719 165 (THYSSEN) * Figure 1; claims 1-5 *	2,3
P	GB - A - 2 006 410 (DEMAG) * Figures 1-4; claims 1,13,19-22 *	1-3
P	GB - A - 2 009 898 (SANYO SPECIAL STEEL) * Figure 11; page 3, lines 119-129; claims 1,14 *	1-3

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

F 27 B 3/24
F 27 D 1/12
F 28 F 1/00

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

C 21 B 7/10
F 27 B 3/24
1/24
F 27 D 1/12
9/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague.	21-12-1979	ELSEN