(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 010 444**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **79302287.2**

(22) Date of filing: **22.10.79**

(51) Int. Cl.³: **F 27 D 1/00**
C 04 B 43/00

(30) Priority: **20.10.78 GB 4130178**

(43) Date of publication of application:
30.04.80 Bulletin 80/9

(84) Designated Contracting States:
AT DE FR IT NL SE

(71) Applicant: **DUCTILE HOT MILL LIMITED**
Planetary Road
Willenhall West Midlands(GB)

(72) Inventor: **Watkins, Melvyn Alan**
3, Wem Gardens Wednesfield
Wolverhampton West Midlands(GB)

(74) Representative: **Lewis, Samuel Hewitt et al,**
Forrester & Boehmert Widenmayerstrasse 5/IV
D-8000 München 22(DE)

(54) Furnace wall structure.

(57) A preformed roof panel of a furnace comprises an outer layer (37) of openwork form from which there is suspended a thermally insulating inner layer (38). The inner layer consists of a corrugated web of ceramic fibres which is exposed in the openings defined by the outer layer.

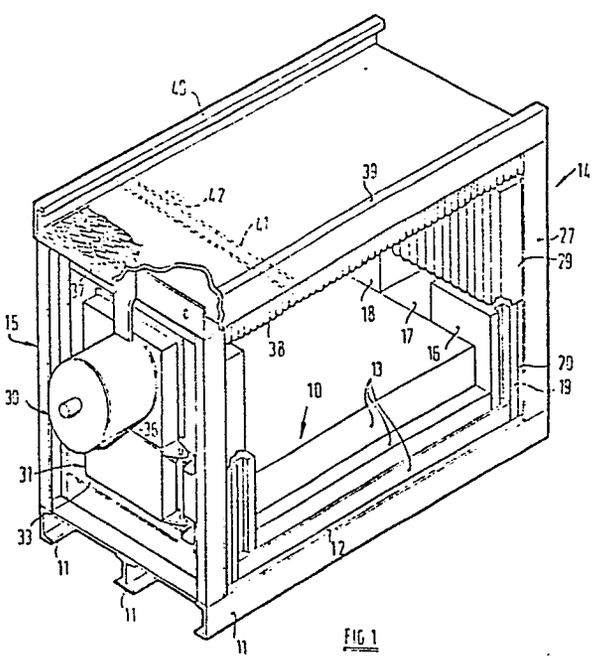

FIG 1

EP 0 010 444 A1

Title: A Furnace

TITLE MODIFIED
see front page

This invention relates to a furnace, in particular to the structure of a furnace wall. By a wall, we mean herein any structure which defines a boundary of a furnace chamber and we use the term generically to include a roof and a door of a furnace.

Furnace walls commonly comprise an outer layer of imperforate sheet metal and a lining constructed of blocks of thermally insulating material .

According to a first aspect of the invention, we provide a furnace having a wall which comprises an inner layer of thermally insulating material and an outer layer which supports the inner layer, wherein the outer layer is of openwork form and the or each inner layer supported thereon is adapted to admit to the interior of the furnace a probe when the probe is thrust into the wall from the outside of the furnace.

By openwork, we mean an array of elements which define apertures between them. Preferably, the elements are initially structurally separate members which are secured together in spaced apart relation to form a panel of openwork form. Alternatively, the elements of a panel may be integral with one another.

We have discovered that an outer layer of openwork form is better able to withstand heating up and cooling down of a furnace without undergoing deformation, than is an outer layer of imperforate sheet metal.

A further advantage of an outer layer of openwork form is that the presence of hot spots on the inner layer

or layers, that is places where the temperature of the outer surface of the inner layer is excessively high, can be observed through the apertures in the openwork outer layer and the exact position of such hot spots can be determined.

According to a second aspect of the invention, we provide a furnace having a wall which comprises an inner layer of thermally insulating material and an outer layer which supports the inner layer, wherein the outer layer is of openwork form, the inner layer comprises a web of fibrous material in which the fibres are not bonded to each other throughout at least a part of the web and the web is exposed in openings defined by the outer layer.

Fibres which are not bonded to each other can be moved apart to admit between them a probe which is to be inserted through the wall into the furnace chamber. Thus, temperature measuring instruments can be inserted through the wall at almost any selected position to measure the temperature at a required position within the furnace and subsequently the instruments can be moved to other positions.

If the inner layer of a furnace in accordance with the second aspect of the invention becomes defective in a local region, a temporary repair can be effected by pushing additional thermally insulating material through the apertures of the outer layer. Furthermore, if a hot spot or other defect is observed from the outside of the furnace, the position of the defect can be indicated by inserting an instrument through the wall so that the position of the defect can readily be established at the inside of the furnace when the furnace is cool and a repair can then be effected.

An example of a furnace in accordance with the invention will now be described, with reference to the accompanying drawings wherein:-

FIGURE 1 shows diagrammatically a perspective view of one part of a furnace;

FIGURE 2 shows in isolation a door shown in Figure 1; and

FIGURE 3 shows a fragmentary horizontal cross-section of a side wall of the furnace.

In Figure 1, there is shown a single module of a furnace which comprises a plurality of modules arranged end-to-end to define a furnace chamber of rectangular shape in plan view. The module includes a bottom wall 10 which is supported at a level above the ground on spacers 11. In the particular example shown, the spacers are in the form of rolled steel beams arranged with their lengths transverse to a longitudinal centre-line of the furnace. The bottom wall comprises an outer layer 12 of openwork form which consists of a panel of open steel flooring. On the layer 12 are supported a plurality of layers 13 of thermally insulating material. The layers 13 are composed of bricks or castable refractory material.

Opposite side walls 14 and 15 extend vertically from the bottom wall 10. The side wall 14 includes three panels, 16, 17 and 18 formed of cast refractory material which is substantially incompressible. These panels are arranged edge-to-edge in a row extending along a lateral boundary of the layers 13 of brick. At least the panels 16 and 18 adjacent to opposite ends of the module extend to a level somewhat above the bottom wall 10. The side wall 14 further comprises a pair of secondary panels 19

and 20 formed of a relatively compressible material, for example ceramic fibre board, and a support panel 21 formed of sheet steel. One surface of the panel 21 is exposed at the outside of the wall. The secondary panels lie one outside the other between the support panel and the panels 16, 17 and 18.

Between the panel 16 and a similar panel 22 of an adjacent module, there is formed the joint structure illustrated in Figure 3. The panels 16 and 22 are arranged edge-to-edge with a gap 23 between them and lie at the inner face of the side wall. Each of the panels 16 and 22 is formed along its edge adjacent to the gap 23 with a rebate facing towards the outside of the furnace. In these rebates and the intervening part of the gap 23, there is provided a packing 24 of relatively compressible, thermally insulating material, for example ceramic fibre mat. The panel 19 and a corresponding panel 25 of the adjacent module abut each other edge-to-edge and form a layer which spans the gap 23 and encloses the packing 24 at the surface thereof remote from the interior of the furnace. The panel 20 and a corresponding panel 26 of the adjacent module also abut each other.

Along each of the edges of the panel 21 which are adjacent to ends of the module, there are secured channel section members 27 which project away from the interior of the furnace. The members 27 of adjacent modules are secured together by bolts 28 and overhang the corresponding panels 21 so that adjacent panels are spaced apart by a gap to allow for expansion.

The secondary panels 19 and 20 have upper edges at the same level as the upper edge of the panels 16, 17 and 18. Above these panels, there is supported on the panel 21, at the internal face thereof a layer 29 formed of a currugated web of ceramic fibre. In each bend of the web

which is adjacent to the panel 21, there is disposed a metal rod which is connected with the panel by attachment elements penetrating through the web. These rods support the fibre and are embedded in the layer which is several inches, typically eight inches, thick.

The construction of the side wall 15 is generally similar to that of the side wall 14 but a burner 30 is mounted in an upper part of the side wall 15 and there is therefore an aperture in the side wall in alignment with the burner. A further difference between the side walls is that the side wall 16 includes a movable wall portion or door 31.

The construction of the door 31 is illustrated in Figure 2. The door comprises a hollow casing 32 which is fabricated from sheet steel or other substantially incompressible material. The casing is hingedly connected with a metal panel 33 of the wall corresponding to the panel 21 of the wall 14.

At least one side of the casing is open and, preferably, at least two sides of the casing are at least partly open. In the particular example illustrated, the upper side of the casing and the side which is presented towards the interior of the furnace when the door is closed are both entirely open. The casing is filled with a body 34 of relatively compressible material which is exposed at the open sides of the casing. In the particular example illustrated, the body 34 comprises ceramic fibres and protrudes from the casing towards the interior of the furnace.

The door 31 further comprises a retaining element mounted on the casing 32 for retaining the body 34 of ceramic fibres in the casing. The retaining element is in the form of a rod 35 which extends completely through

the body 34 and opposite ends of which are engaged in apertures in the casing.

When the door 31 is closed, the body 34 of compressible material engages with the cast refractory panels corresponding to the panels 16, 17 and 18 of the side wall 14 and also engages with a housing 36 of the burner. Such engagement forms a seal between the door and the adjacent stationary part of the side wall 15. It will be noted that the only part of the door which is exposed to the atmosphere within the furnace is the body 34 of ceramic fibre. Because of its compressibility and resilient nature, this material is inherently adapted to form a seal with substantially incompressible parts of the wall.

The roof of the module comprises an outer layer 37 of openwork form and an inner layer 38 of thermally insulating material which is supported from the outer layer.

The outer layer 37 comprises a first set of elongate elements which are parallel to each other and a second set of elongate elements which connect the elements of the first set together and have a depth, as measured in a direction from an outer face to an inner face of the wall, less than the depth of the elements of the first set. The elements of the second set extend in a direction from the side wall 14 to the side wall 15. The outer layer 37 conveniently comprises a panel of open steel flooring, opposite end portions of which rest on the side walls 14 and 15. Beams 39 and 40 are secured to opposite edges of the panel and each extend from one side wall to the other.

The inner layer 38 is composed of a readily compressible and resiliently deformable mass of discreet

fibres. The fibres are not bonded to each other but are present in the form of a corrugated web which is attached to the outer layer 37 by attachment elements which terminate within the inner layer and do not penetrate to the internal face of the wall. The attachment elements include a plurality of metal rods 41, one of which lies at the inside of each bend of the web adjacent to the layer 37. The rods are attached by steel hooks 42 to the outer layer, the hooks penetrating through the web in the bends thereof adjacent to the outer layer. The rods 41 and hooks 42 are embedded in the inner layer 38 and are spaced from the lower surface thereof by a distance which is typically six inches. The corrugations of the web are pressed together to avoid the presence of any gaps or substantial recesses in the lower surface of the layer 38. The inner layer 38 of the roof overlaps with the inner layer 29 of the side wall 14 and with the corresponding layer of the side wall 15.

The roof layers 37 and 38 may be assembled together to form a unit prior to assembly of that unit with the side walls 14 and 15. Adjacent roof panels may be drawn together and releasably secured together by bolts passing through aligned apertures in adjacent pairs of beams 39 and 40.

Both the layer 12 of the bottom wall and the layer 37 of the roof are exposed to the atmosphere outside the furnace. These layers are therefore air-cooled and such cooling is facilitated by the openwork form of the layers. It will be understood that the layers present a larger exposed surface area than would be the case if these layers were formed of imperforate, flat sheets of metal.

In a case where the roof comprises a plurality of inner layers, each of these consists of a fibrous web a

is otherwise adapted to admit to the interior of the furnace a probe when the probe is thrust into the roof from the outside of the furnace.

If the insulating ability of the roof layer 38 is reduced locally, with consequent formation of a hot spot, such hot spot can readily be observed through the openings defined by the roof panel 37 if the roof of the furnace is inspected. Whilst operation of the furnace continues, additional wads of ceramic fibre can be pushed through the layer 37 at the hot spot to increase the insulating ability of the layer 38 and effect at least a temporary repair.

The temperature at any selected position along the length of the furnace can readily be ascertained by inserting a temperature measuring instrument through the roof of the furnace at a required position. Such instrument can be passed through one of the openings defined by the layer 37 of a roof panel and forced through the fibrous layer 38. Owing to the compressible and resilient character of the ceramic fibre web, if the instrument is subsequently withdrawn, the hole which has been made in the layer 38 will tend to close. A similar procedure may be used to mark a hot spot or other position where repair of the roof is required from within the furnace. If a marking instrument is pushed through the roof whilst the furnace is in operation, the instrument can readily be found at the inside of the furnace when the furnace is out of operation. If a repair cannot conveniently be carried out in situ, the roof panel comprising layers 37 and 38 can readily be lifted off the furnace and replaced by a new panel without disturbance of other parts of the furnace.

The furnace illustrated in the accopanying drawing is intended for heating slabs and billets which are

pushed along the bottom wall 10 from one end of the furnace to the other. Side wall panels 16, 17 and 18 extend sufficiently far above the bottom wall 10 to ensure that the layer 29 of the side wall cannot be damaged by the slabs or billets.

Claims:-

1. A furnace having a wall which comprises an inner layer (38) of thermally insulating material and an outer layer (37) which supports the inner layer, characterised in that the outer layer (37) is of openwork form and the or each inner layer (38) supported thereon is adapted to admit to the interior of the furnace a probe when the probe is thrust into the wall from the outside of the furnace.

2. A furnace having a wall which comprises an inner layer (38) of thermally insulating material and an outer layer (37) which supports the inner layer, characterised in that the outer layer (37) is of openwork form, the inner layer (38) comprises a web of fibrous material in which the fibres are not bonded to each other throughout at least a part of the web and the web is exposed in openings defined by the outer layer.

3. A furnace according to claim 1 or claim 2 further characterised in that the outer layer (37) of the wall is exposed to the atmosphere outside the furnace and the inner layer (38) of the wall is exposed to the atmosphere inside the furnace.

4. A furnace according to any preceding claim further characterised in that there extends from the outer layer (37) into the inner layer 38) a plurality of attachment elements (42) by which the inner layer is attached to the outer layer.

5. A furnace according to claim 4 further characterised in that the attachment elements (42) terminate within the inner layer (38) and do not penetrate to an internal face of the wall.

6. A furnace according to claim 5 further characterised in that the inner layer (38) comprises a web of thermally insulating material and the attachment elements (42) penetrate through the web.

7. A furnace according to any preceding claim further characterised in that said wall comprises a plurality of pre-formed panels, each panel including an inner layer (38) and an outer layer (37) which are assembled together as a unit prior to assembly of a plurality of panels with one another to form the wall.

8. A furnace according to any preceding claim comprising a further wall characterised in that the further wall includes a plurality of panels (16, 22) of substantially incompressible material arranged in spaced apart edge-to-edge relation with a packing (24) of compressible thermally insulating material between adjacent incompressible panels and, associated with said incompressible panels, respective secondary panels (19, 25) disposed adjacent to corresponding faces of the incompressible panels and in that the secondary panels abut each other to form a layer which spans the gap (23) between the incompressible panels and encloses the packing (24) at one surface thereof.

9. A furnace according to claim 8 further characterised in that said panels (16, 22) of substantially incompressible material present one face of said further wall of the furnace.

10. A furnace according to any preceding claim further characterised by a door which includes a hollow casing (32) of substantially incompressible material and a filling (34) of relatively compressible material,

the casing being adapted by the provision of at least one opening to permit engagement of the filling with a further portion of the furnace.

11. A furnace according to claim 10 further characterised in that one side of the casing (32) is completely open.

12. A furnace according to claim 10 or claim 11 further characterised in that the door includes a retaining element (35) mounted on the casing and extending into the filling to retain the filling in the casing.

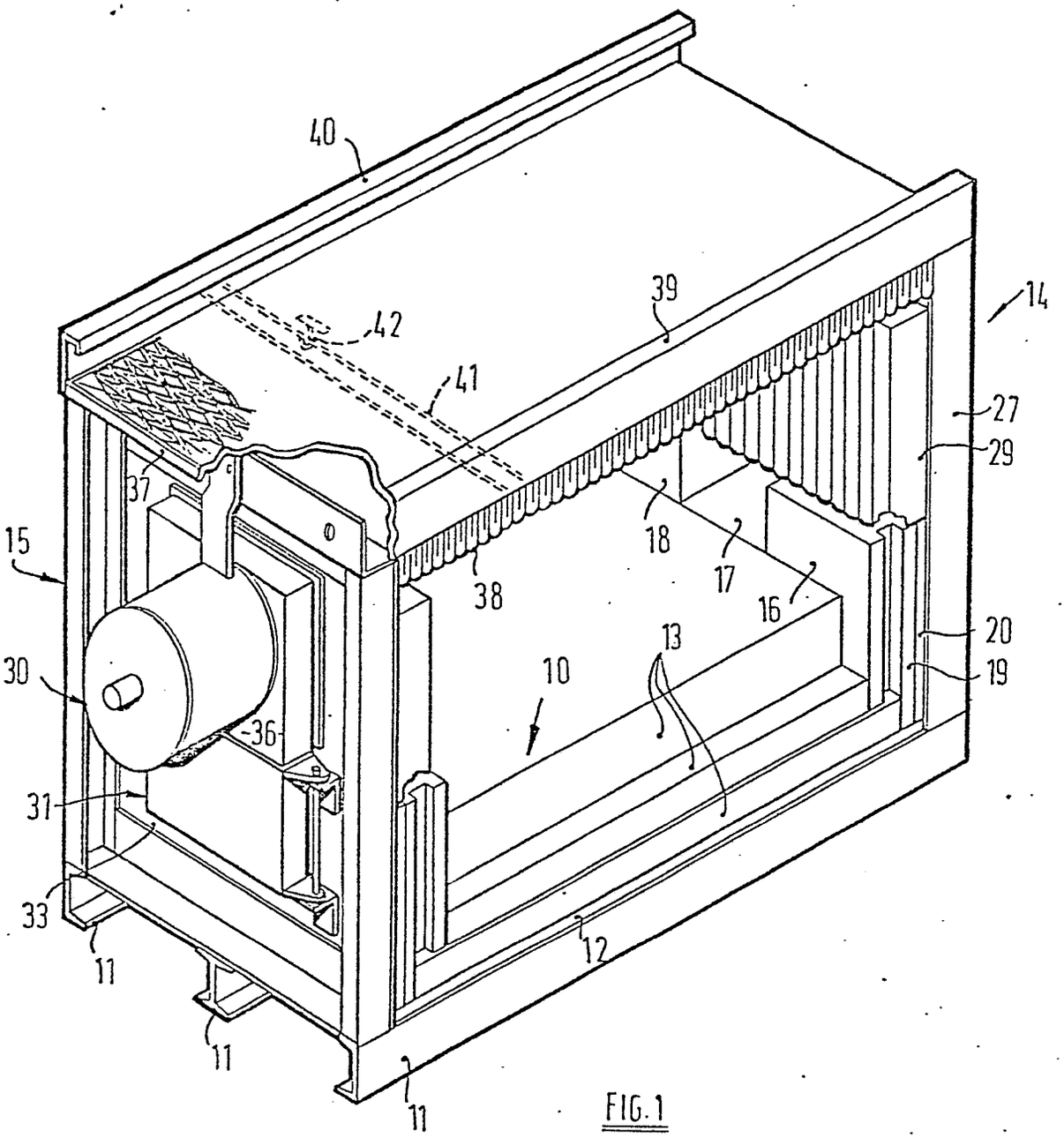
40
42
41
39
14
27
29
37
15
18
17
16
38
20
13
10
19
30
36
31
33
11
12
11
11

FIG.1

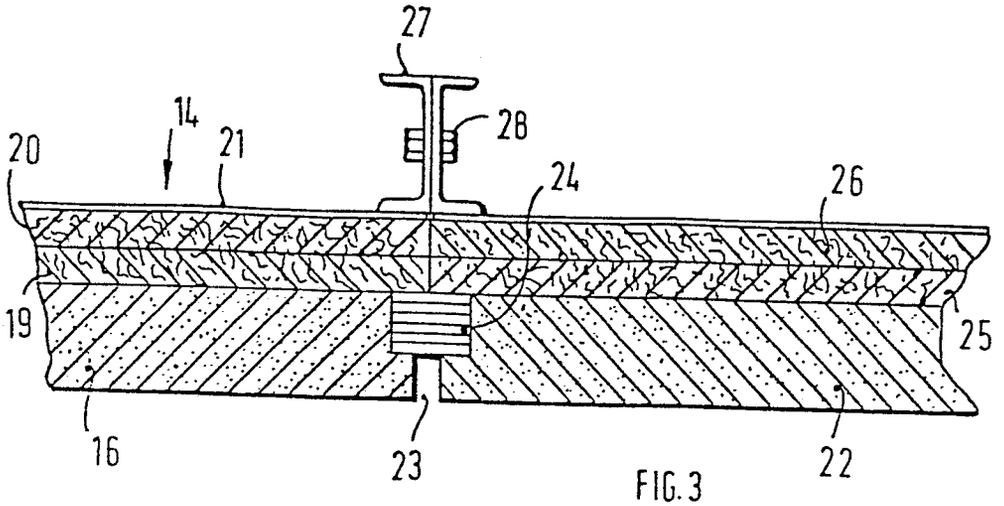

FIG. 3

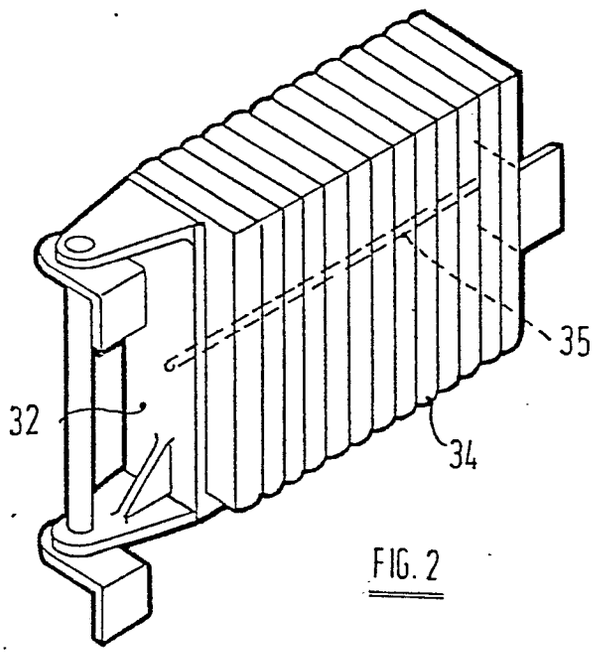

FIG. 2

European Patent Office

EUROPEAN SEARCH REPORT

0010444
Application number

EP 79 30 2287

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	US - A - 3 990 203 (J.R. GREAVES) * Figures 1-6; columns 4,5,6 * --	1-7
	US - A - 4 088 825 (V.H. CARR) * Column 2; figures 1,3; claim 1 * --	3-7
	US - A - 3 832 815 (J.K. BALAZ) * Claims 1,9; figures 1,3; column 5 * --	3
A	DE - B - 1 268 167 (HOESCH A.G.) ----	

CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)

F 27 D 1/00
C 04 B 43/00

TECHNICAL FIELDS SEARCHED (Int Cl. ³)

F 27 D
F 23 M

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	25-01-1980	COULOMB

EPO Form 1503.1 06.78