AUSTRALIA

Patents Act 1990

NOTICE OF ENTITLEMENT

~~[APPLICANT]~~

I/~~We~~: A. v. Kirschbaum
authorised by Willi ROTH
of Leonhardt-Strasse 86, D-86514 Mering Germany

666968

~~being the Applicant(s) in respect of~~ ☑ ~~the accompanying application~~
☐ ~~Application No.~~

state the following:

1. Willi Roth is / ~~I am/We are~~ the Nominated Person(~~s~~) to whom ~~I/we request~~ the patent is to be granted.

2. [INVENTORS]

(a) ☒ Willi ROTH is / ~~I am/We~~ ~~are~~ the inventor(s) of the invention and ~~I am/we are~~ entitled to the grant of a patent under Section 15(1)(a) of the Patents Act.

(b) ☐ ~~[Name(s) of Inventor(s):]~~

~~of [Address(es) of Inventor(s):]~~

is/are ~~the~~ inventor(s) of the invention and the Nominated Person(s) is/are entitled to the grant of a patent by virtue of the following facts:

☐ The inventor(s) made the invention in the course of employment by the Nominated Person(s) and the Nominated Person(s) would, on the grant of a patent for the invention, be entitled to be assignee(s) of the patent.

☐ The Nominated Person(s) is/are the assignee(s) of the inventor(s) in respect of the invention.

☐ [Other situation entitling Nominated Person(s) to the patent:]

3. [PRIORITY CLAIM]

(a) ☒ [Convention applications] The basic application(~~s~~) identified in the Patent Request was/~~were~~ the first application(~~s~~) made in a Convention country in respect of the invention the subject of this application. Priority is claimed under Part 2 of Chapter 8 of the Patents Act from the basic application(~~s~~) identified in the Patent Request, and I am/~~we are~~ the Applicant(s) is/~~are~~ entitled to claim such priority since:

☒ Willi ROTH is / ~~I am/we are~~/the Applicant(~~s~~) ~~is/are the basic applicant(s)~~ in respect of the basic application(~~s~~).

☐ I am/we are/the Applicant(s) is/are the assignee(s) of rights from applicant(s) in respect of the basic application(s), these rights including the right to file patent application(s) in Australia claiming the priority of the basic application(s).

(b) ☐ [Divisional applications] Priority is claimed under Section 39 of the Patents Act from the original application identified in the Patent Request, and I am/we are/the Applicant(s) is/are entitled to claim such priority since:

☐ I am/we are/the Applicant(s) is/are the applicant(s) in respect of the original application.

☐ I am/we are/the Applicant(s) is/are entitled under an assignment or agreement or by operation of law to request the patent to be granted to me/us/the Applicant(s) and claiming priority from the original application.

(c) ☐ [Complete application after Provisional application] Priority is claimed under Section 38 of the Patents Act from the Provisional application(s) identified in the Patent Request, and I am/we are/the Applicant(s) is/are entitled to claim such priority since:

☐ I am/we are/the Applicant(s) is/are the applicant(s) in respect of the Provisional application(s).

☐ I am/we are/the Applicant(s) is/are entitled under an assignment or agreement or by operation of law to ~~request the patent to be granted to me/us/the Applicant(s) and claiming priority from the Provisional~~ application(s).

Date: April 25, 1996

Signature: V. Kirschbaum

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82118

AU9347056

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MOULD FOR THE PRODUCTION OF MOULDINGS CONTAINING LIQUID

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(56) Prior Art Documents
JP 3290202
EP 121929
FR 2602708

(57) Claim

1. Mould for producing liquid-containing moulded articles, such as roof tiles of clay, a loamy or similar material, characterised in that a layer of the mould coming into contact with the material to be pressed consists of fine-pore, sintered or foamed ceramic material and that the layer therebelow is coarse-pore, sintered or foamed ceramic material or foamed concrete.

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(81) Bestimmungsstaaten: AU, BG, BR, CA, FI, HU, JP, KR, NO, NZ, PL, RO, RU, US, europäisches Patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

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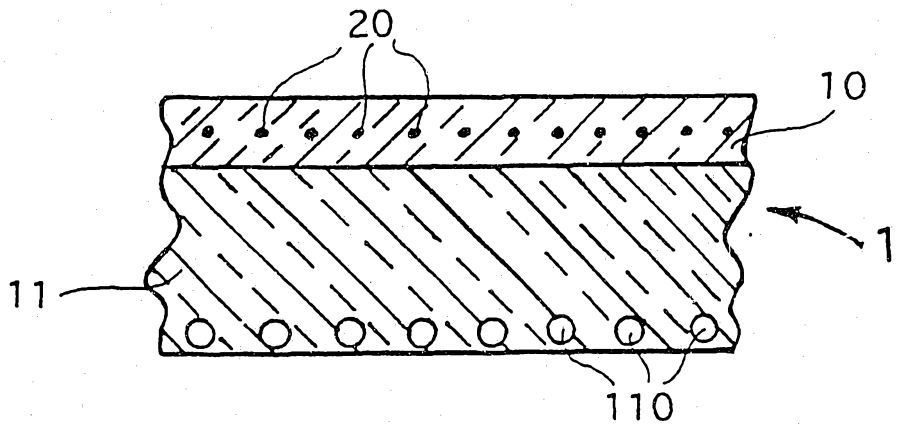
666968

(54) Title: MOULD FOR THE PRODUCTION OF MOULDINGS CONTAINING LIQUID

(54) Bezeichnung: FORM ZUM HERSTELLEN VON FLÜSSIGKEITSHALTIGEN PRESSTEILEN




(57) Abstract

The invention concerns a mould for the production of mouldings containing liquid, such as roof tiles made from clay or a similar material. The mould is made up of two layers, one of which (the layer which comes in contact with the material being moulded) consists of a fine-grained sintered or foamed ceramic material, while the layer located below it is made of coarse-grained sintered or foamed ceramic material or foamed concrete. The use of foamed ceramic material with pores of various sizes gives a mould which is particularly resistant to wear and whose lifetime is several times longer than that of the gypsum moulds used at present in the production of compression-moulded roof tiles.

(57) Zusammenfassung

Eine Form (1) zum Herstellen von flüssigkeitshaltigen Pressteilen, wie Dachziegeln aus Lehm oder ähnlichem Material weist zwei Schichten (10, 11) auf, wobei die eine mit dem zu verpressenden Material in Kontakt kommende Schicht (10) aus feinporigem, gesintertem oder geschäumtem Keramikmaterial besteht, während die darunter angeordnete Schicht (11) grobporiges, gesintertes oder geschäumtes Keramikmaterial oder geschäumter Beton ist. Durch die Verwendung von geschäumtem Keramikmaterial mit unterschiedlich grossen Poren ist eine ausgesprochen abriebfeste und verschleissarme Form geschaffen, deren Lebensdauer um ein Vielfaches höher ist als die bisher bei der Herstellung von Press-Dachziegeln benutzten Gipsformen.

Description

# Mould for producing liquid-containing moulded articles

## Field of the Invention

The invention relates to a mould for producing liquid-containing moulded articles, such as roof tiles of clay, loamy or similar material.

## Prior Art

Roof tiles in the form of pressed roof tiles are usually made from clay, loamy or similar material with a quite specific water content; the clay or loamy material is applied in well proportioned amount to a negative mould of gypsum or plaster accommodated in a steel frame and serving as lower mould and by means of a negative mould of plaster likewise accommodated in a steel frame and serving as upper mould finally pressed to form a raw tile of the desired shape in a press. The upper side of the plaster mould serving as lower mould is shaped like the surface of the lower side of the tiles to be produced whilst the downwardly pointing upper side of the plaster negative mould serving as upper mould corresponds to the visible outer surface of a tile.

Due to the high application pressure, the liquid contained in the material to be pressed is taken up by the plaster in the lower mould and released on the lower side thereof.

On each pressing the negative plaster moulds used as upper and lower mould undergo considerable abrasion so that after an approximately known, not very high, number of pressings the wear by abrasion at the plaster negative mould serving as upper mould is so great that it is no longer possible to keep to the predetermined tolerances, in particular as regards the permissible minimum thickness of the finished tiles. Consequently, in particular the plaster mould serving as upper mould must be replaced after about 600 to 800, in the most

favourable case 1000, tile pressings by a new upper mould kept ready.

For this purpose, the press must be stopped depending upon the material to be pressed used after half an hour to at the most one hour whilst the new unused plaster mould is replaced, this operation taking an average of 5 to a maximum of 10 minutes. The changing of the plaster mould serving as upper mould alone takes up 1 to 1.5 h during a ten-hour shift duration and consequently the tile press is stationary for 10 to 15% of the time during a shift.

Furthermore, in each shift as a rule three workers are occupied with the preparation and production of new plaster moulds and replacing the old used moulds by said new plaster moulds.

Thus, not only is the preparation and making available of new perfect plaster moulds and substituting them for used moulds altogether very time-consuming and costly, but furthermore the accruing shutdown times for replacing used moulds and for inserting new moulds and the amounts of plaster required represent a considerable cost factor, as does the water consumed when spraying out the plaster moulds. Further costs arise due to the supplying and disposal of considerable amounts of gypsum or plaster.

~~Summary of the Invention~~

~~The problem underlying the invention is therefore to~~ provide a mould for producing liquid-containing moulded articles, such as roof tiles of clay, a loamy or similar material, which has a very high resistance to wear and very high durability. According to the invention, this is achieved with a mould for producing liquid-containing pressed articles, such as roof tiles of clay, a loamy or similar material by the features in the characterizing ~~clause of claim 1 or 17. Advantageous further~~

Summary of the Invention

The problem underlying the invention is therefore to provide a mould for producing liquid-containing moulded articles, such as roof tiles of clay, a loamy or similar material, which has a very high resistance to wear and very high durability. According to the invention, this is achieved with a mould for producing liquid-containing moulded articles, such as roof tiles of clay, a loamy or similar material, characterised in that a layer of the mould coming into contact with the material to be pressed consists of fine-pore, sintered or foamed ceramic material and that the layer therebelow is coarse-pore, sintered or foamed ceramic material or foamed concrete.

In the mould according to the invention, a layer coming into contact with the material to be pressed consists of fine-pore, sintered or foamed ceramic material whilst the layer therebelow is coarse-pore, sintered or foamed ceramic material or foamed concrete.

The fine-pore, sintered or foamed ceramic material has pores having a diameter of the order of magnitude of 10 Å ($10.10^{-10}$m) to 30µm. The porosity proportion or voidage lies between 5 to 60% depending on the material to be pressed.

According to a further advantageous development of the invention, additives such as corundum, mullite, silicon carbide, silicon nitride, zirconium dioxide and the like, may be admixed with the fine-pore, sintered or foamed ceramic material. Furthermore; the fine-pore, sintered or foamed ceramic material consists of corundum, mullite, silicon carbide, silicon nitride or zirconium dioxide. Since zirconium dioxide is electrically conductive, on adding zirconium to the fine-pore, sintered or foamed ceramic material the removal from the mould can be facilitated and by applying direct current the adhesion between the mould and the pressed material can be considerably reduced. The same effect can also be achieved by the surface of the layer of fine-pore, sintered or foamed material having a metallized or oxidation layer. Furthermore, according to another advantageous development of the invention to increase the conductivity metal particles may be intercalated into the fine-pore, sintered or foamed ceramic material.

Furthermore, the layer of sintered or foamed ceramic material preferably has a thickness of the order of magnitude of 0.1 to 2mm. To strengthen the thin layer of

fine-pore sintered or foamed ceramic material a fabric of stainless steel is incorporated into said material. In particular, such a fabric of stainless steel is accommodated in a region corresponding to the sealing labyrinth of the finished tile in the form of strip-like or web-like projections which extend in the longitudinal direction of a tile and which project outwardly from the layer or fine-pore ceramic material; this largely prevents breaking away of the web-like or strip-like projections in the layer of fine-pore, sintered or foamed material.

Due to the high resistance to abrasion of fine-pore sintered or foamed ceramic material, the wear thereof in one pressing is very small compared with the wear with the usually employed plaster moulds and consequently a mould according to the invention can have a life of 6 months to a year and more, depending upon the material used to produce roof tiles. Thus, when using the mould according to the invention in particular the daily stoppage times of the press are eliminated, which were of the order of magnitude of 1 h to 1.5 h and hitherto necessary for spraying out used plaster moulds and inserting new prepared moulds. As a result, the personnel dealing with the production, preparation and spraying our of new plaster moulds is no longer required and in addition the entire costs for plaster are eliminated.

~~According to a further advantageous development of the~~ mould according to the invention the layer of coarse-pore, sintered or ceramic material consists preferably of silicon carbide or corundum and to permit a backflushing with solvents or water has a porosity which is a factor of 3 to 20 times greater than the porosity of the layer of fine-pore sintered or foamed ceramic material. Furthermore, preferably in an advantageous further ~~development in the region of the layer therebelow of~~

RB

According to a further advantageous development of the mould according to the invention the layer of coarse-pore, sintered or ceramic material consists preferably of silicon carbide or corundum and to permit a backflushing with solvents or water. Coarse pores have a pore diameter which is a factor of 3 to 20 times greater than the pore diameter of the layer of fine-pore, sintered or foamed ceramic material. Furthermore, preferably in an advantageous further development in the region of the layer therebelow of

coarse-pore, sintered or foamed ceramic material or foamed concrete remote from the layer of fine-pore, sintered or foamed ceramic material a plurality of tubular passages are formed for carrying away the liquid in the form of water.

According to an advantageous embodiment of the mould according to the invention, in the layer of coarse-pore ceramic material or foamed concrete cavities are formed with supporting intermediate webs left therebetween. Preferably, the cavities in the layer of coarse-pore, foamed or sintered ceramic material have a cross-sectional area of the order of magnitude of 100 $mm^2$ whilst the supporting intermediate webs have a thickness of 4 to 5 mm.

By the formation of the cavities in the layer of coarse-pore material a considerable saving of material is achieved, simultaneously considerably shortening the distance and thus the time which the liquid expelled from the material to be processed in the form of water requires to penetrate the relatively thin layer thickness via the numerous cavities in the layer of coarse-pore sintered or foamed ceramic material. Liquid reaching the cavities can be extracted through tubular passages running transversely thereof or, as hitherto usual, by vacuum.

Furthermore, to increase the bonding a porous bonding layer may be provided between the layer of fine-pore sintered or foamed ceramic material and the layer of coarse-pore sintered or foamed ceramic material.

In advantageous manner, the mould according to the invention can also be used in slip casting or metal casting with or without vacuum.

~~According to a modification of the invention, in the~~ mould the layer coming into contact with the material to be pressed is a metal plate perforated by a large number of very fine holes and under said plate a layer of coarse-pore sintered or foamed ceramic material or foamed concrete is again provided. The holes in the plate are conically widened towards the layer of coarse-pore, sintered or foamed ceramic material or foamed concrete therebelow so that the water expelled from the clay can move more quickly into the layer therebelow of foamed concrete or coarse-pore, sintered or foamed ceramic material.

The holes widening conically towards the layer of fine-pore, sintered or foamed ceramic material or foamed concrete extend substantially perpendicularly to the surface of the metal plate. If necessary, according to a further advantageous embodiment of the invention in various regions the holes are arranged in a different distribution density and/or different diameters. The conically widening holes are for example made by laser or ~~electron beam methods.~~

Hereinafter the invention will be explained in detail with reference to preferred embodiments with the aid of the attached drawings, wherein:

Fig. 1 shows schematically in a greatly enlarged illustration, not true to scale, part of a section through a mould according to the invention;

Fig. 2 is a likewise schematic illustration, not true to scale, of a section of another region of the embodiment according to Fig. 1, and

Fig. 3 again shows schematically, not true to scale, an illustration of part of a section of a modified ~~embodiment of the~~ mould, ~~according to the invention.~~

In Fig 1, schematically and not true to scale, a first example of embodiment of a mould 1 according to the invention is illustrated. An upper layer 10 in Fig.1 consists of fine-pore, sintered or foamed ceramic material whilst therebelow a further layer 11 is provided comprising coarse-pore, sintered or foamed ceramic material or foamed concrete. In the lower region of the layer 11 in Fig. 1 tubularly formed passages 110 are provided via which in the production of pressed roof tiles the liquid is drained from the clay, loamy or similar material, substantially in the form of water.

The layer 10 preferably has a thickness of 1.5 mm. Furthermore, preferably both the layers 10 and 11 are coloured throughout so that the appearance of the colour of the layer 11 therebelow is in itself an indication that the layer 10 of fine-pore, sintered or foamed ceramic material is used up.

In contrast to Fig. 1, in Fig. 2 at the upper side of the layer 10 of fine-pore, sintered or foamed ceramic material projections 100 are shown which in the section project outwardly (in Fig. 2 upwardly) and which are formed as strip-like or web-like projections extending parallel to each other in a direction perpendicular to the plane of the drawing, said projections corresponding in the negative mould to the seal labyrinth provided in the lateral region of each roof tile.

In order to increase the resistance to breakage of these projections 100 consisting of fine-pore, foamed or sintered ceramic material, or to substantially exclude

any breaking away, in the region of such projections 100 a steel fabric 20 of preferably stainless steel is accommodated which in the sectional view of Figs. 1 and 2 is apparent only as dots. As is apparent from Fig. 1, the steel fabric 20 is also expediently provided in the entire layer of fine-pore, sintered or foamed ceramic material.

As apparent from Fig. 2, in the layer 11 of coarse-pore sintered or foamed ceramic material or foamed concrete cavities 111 are formed, between which supporting webs 112 have been left. The cavities 111 have a cross-sectional area of the order of magnitude of 100 mm whilst the supporting intermediate webs 112 have a thickness of the order of magnitude of preferably 4 to 5mm. The provision of cavities 111 in the layer 11 represents a considerable saving of material and at the same time the liquid emerging from the layer 10, generally in the form of water, need penetrate only a considerably thinner layer via the individual cavities. The liquid discharged into the cavities may for example be drained from the latter through passages corresponding to the tubular passages 110 in Fig. 1, or also extracted by vacuum, as hitherto usual in tile and brick production.

In Fig. 3 a modification of a mould 1' ~~according to the invention~~ is illustrated. In this mould ~~embodiment~~, above the layer 10 of coarse-pore sintered or foamed ceramic material or foamed concrete a steel plate 30 is arranged which is perforated by a large number of holes 300. In Fig. 3 the holes 300 shown in section are conically widened towards the layer 11 of foamed concrete or coarse-pore sintered or foamed ceramic material provided there. The respective centre axes are indicated by dot-dash lines in the individual holes 300. The conical holes 300 have a diameter of 10 µm to 400 µm.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. Mould for producing liquid-containing moulded articles, such as roof tiles of clay, a loamy or similar material, characterised in that a layer of the mould coming into contact with the material to be pressed consists of fine-pore, sintered or foamed ceramic material and that the layer therebelow is coarse-pore, sintered or foamed ceramic material or foamed concrete.

2. Mould according to claim 1, characterized in that the diameter of the pores of the fine-pore, sintered or foamed ceramic material is of the order of magnitude of 10 Å (1nm) to 30µm.

3. Mould according to claim 1 and 2, characterized in that the porosity proportion lies between 5 to 60% depending on the material to be pressed.

4. Mould according to any one of claims 1 to 3, characterized in that the fine-pore, sintered or foamed ceramic material of the layer consists of corundum, mullite, silicon carbide, silicon nitride or zirconium dioxide.

5. Mould according to any one of claims 1 to 4, characterized in that additives such as corundum, mullite, silicon carbide, silicon nitride, zirconium dioxide, are added to the fine-pore, sintered or foamed ceramic material of the layer.

6. Mould according to any one of claims 1 to 5, characterized in that the surface of the layer of fine-pore, sintered or foamed ceramic material has a metallized layer.

7. Mould according to any one of claims 1 to 5, characterized in that the surface of the layer of fine-pore, sintered or foam material has an oxidation layer.

8. Mould according to any one of claims 1 to 5, characterized in that to increase the conductivity metal particles are intercalated into the fine-pore, sintered or foamed ceramic material.

9. Mould according to any one of the preceding claims, characterized in that the layer of fine-pore, sintered or foamed ceramic material has a thickness of the order of magnitude of 0.1 to 2.0mm.

10. Mould according to any one of the preceding claims, characterized in that for reinforcement a fabric of stainless steel is inserted into the thin layer of fine-pore, sintered or foamed ceramic material.

11. Mould according to claim 10, characterized in that in particular strip-like or web-like projections extending parallel to each other and projecting

outwardly from the layer of fine-pore, sintered or foamed ceramic material are reinforced by the steel fabric of the stainless steel.

12. Mould according to any one of claims 1 to 11, characterized in that the layer of coarse-pore, sintered or foamed ceramic material consists of silicon carbide or corundum and for backflushing with solvents or water has pores of a diameter which is a factor of 3 to 20 times greater than the pore diameter of the layer of fine-pore, sintered or foamed ceramic material.

13. Mould according to any one of the preceding claims, characterized in that a plurality of tubular passages for draining the liquid are formed in the region of the layer or coarse-pore, sintered or foamed ceramic material or foamed concrete, remote from the layer of fine-pore, sintered or foamed ceramic material.

14. Mould according to any one of the preceding claims, characterized in that in the layer of coarse-pore, sintered or foamed ceramic material or foamed concrete, cavities having supporting intermediate webs are formed.

15. Mould according to claim 14, characterized in that the cavities in the layer have a cross-sectional area of the order of magnitude of $100mm^2$ and the supporting intermediate webs a thickness of the order of magnitude of 4 to 5mm.

16. Mould according to claim 1, characterized in that to increase the bonding a porous bonding layer is provided between the layer of fine-pore, sintered or foamed ceramic material and the layer of coarse-pore, sintered or foamed ceramic material.

17. Use of the mould according to claims 1 to 6 in slip casting or metal casting with or without vacuum.

18. A mould substantially as hereinbefore described with reference to and as shown in Figures 1 and 2 of the drawings.

DATED this 20th day of December 1995

WILLI ROTH
Patent Attorneys for the Applicant:

F.B. RICE & CO.

## Abstract

A mould for producing liquid-containing press moulded articles, such as roof tiles of clay or similar material, comprises two layers, the layer coming into contact with the material to be pressed consisting of fine-pore sintered or foamed ceramic material whilst the layer arranged therebelow is coarse-pore, sintered or foamed ceramic material or foamed concrete. By using sintered or foamed ceramic material with different size pores an extremely abrasion-resistant and low-wear mould is obtained which has a life many times longer than the plaster moulds hitherto used in the manufacture of press moulded roof tiles.

Fig.1

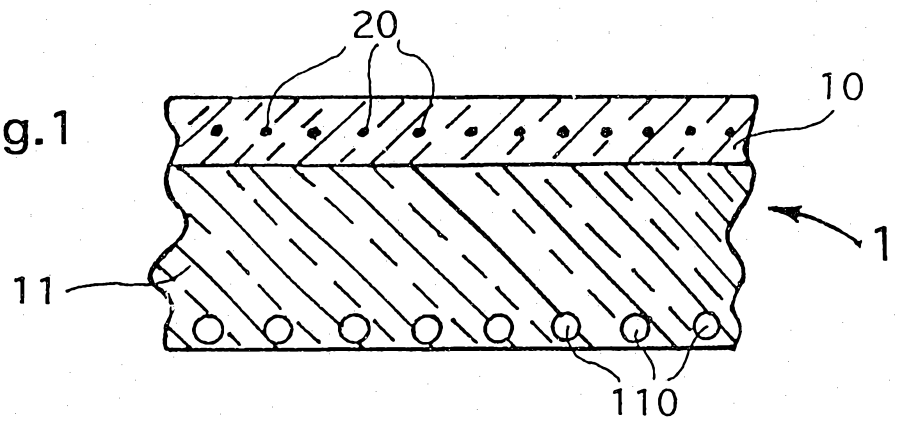



Fig.2

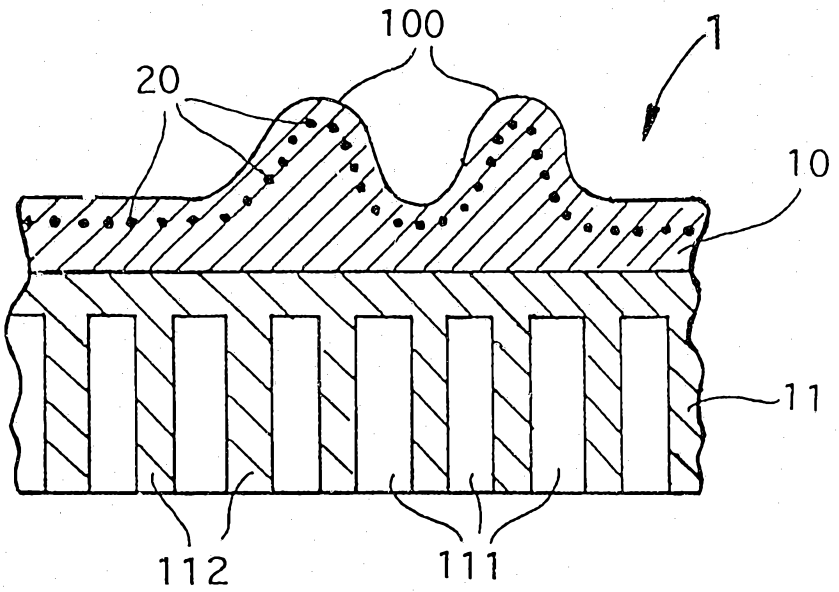
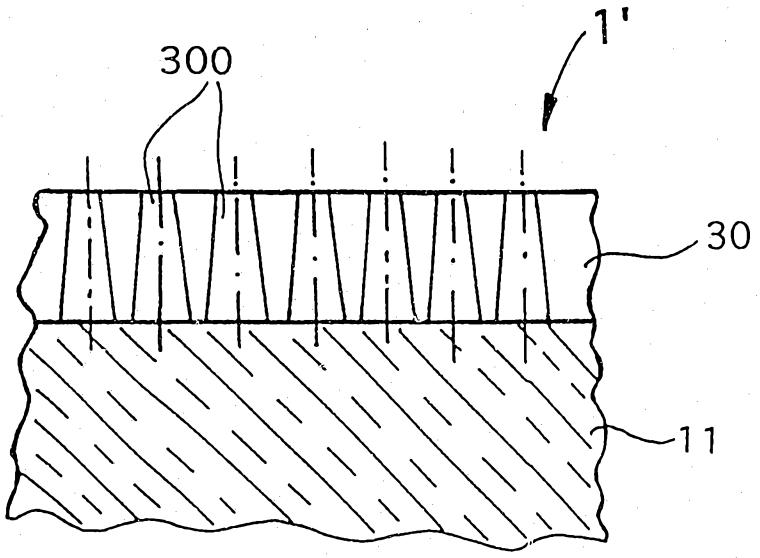



Fig.3



# INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 93/02048

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 B28B7/34 B28B7/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 5 B28B B30B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | PATENT ABSTRACTS OF JAPAN vol. 016, no. 127 (M-1227)31 March 1992 & JP,A,03 290 202 (KAWASAKI STEEL CORP) 19 December 1991 | 1,4 |
| A | see abstract | 12,17 |
| | --- | |
| X | EP,A,0 121 929 (SINTO KOGIO LTD) 17 October 1984 see the whole document | 1-6,9, 12,17 |
| A | | 14 |
| | --- | |
| X | FR,A,2 602 708 (ELMETHERM) 19 February 1988 see the whole document | 1 |
| A | | 2-5,9, 12,17 |
| | --- | |
| | -/-- | |

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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1

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 28 October 1993 | 17 -12- 1993 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax (+31-70) 340-3016 | GOURIER, P |

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | WO,A,88 00933 (CERAMIQUES TECHNIQUES DESMARQUEST) 11 February 1988<br>see the whole document | 1-5,8,17 |
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A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 5 B28B7/34 B28B7/00

Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
IPK 5 B28B B30B

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