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(71) Applicant: **EMILCERAMICA S.P.A.**
I-41042 Fiorano Modenese, Modena (IT)

(72) Inventor: **Benedetti, Alfonso**
41100 Modena MO (IT)

(74) Representative: **Gotra, Stefano**
BUGNION S.p.A.
No. 25, Via Emilia Est
41100 Modena (IT)

(54) A device for decorating ceramic tiles

(57) A device (1) for decorating ceramic tiles (3) comprises a conveyor (2) for tiles (3) provided with transversal strip (4) for transporting and correctly positioning the tiles (3). A skin (16) wound tube-like around a rotating frame (5) exhibits a smooth lateral surface externally of which a matrix is formed, constituted by small blind cavities destined to house small quantities of glaze. A feed conduit (7) deposits glaze on the external surface of the skin (16) and a doctor (8) removes excess glaze. Two rollers are arranged internally tangentially to the skin (16), a first (11) of which rollers presses the skin (16) against the doctor (8) and a second (12) of which rollers presses the skin (16) against the tiles (3) as they transit, so as to transfer the glaze on the matrix onto the tiles (3).

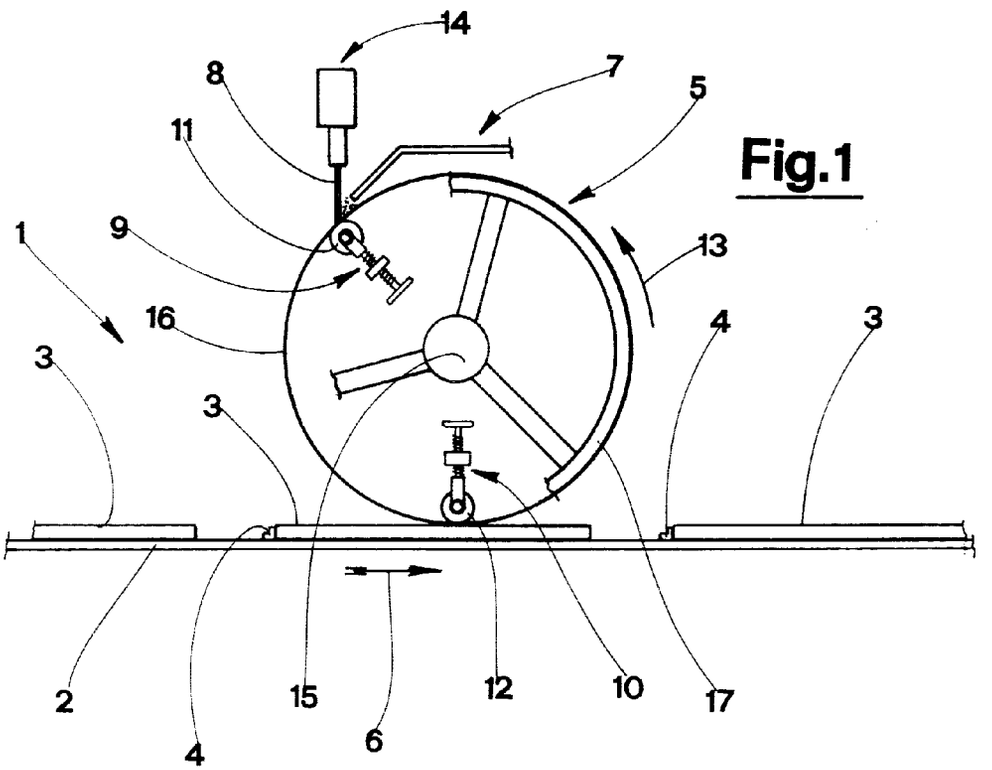

Fig.1

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Description

The invention relates to a device for decorating ceramic tiles.

In the field of industrial glazing for ceramic tiles, a known process comprises essentially the following phases: a) depositing glaze on a non-permeable matrix exhibiting recesses composed of blind cavities for containing small quantities of glaze and afforded over a portion of external cylindrical surface, said portion being elastically deformable and able to rotate; b) removing, by means of a doctor, an excess of glaze deposited on said matrix; c) transferring the glaze contained into the above-mentioned cavities directly by contact and by means of rolling without dragging of the matrix-bearing cylindrical surface on an underlying surface of a tile transiting along a tile feed line.

Also known, and published in European Patent Application no. 0 677 364, is a rotogravure glazing-decorating machine with etched matrix, which performs the above-mentioned process. In this machine the image to be reproduced is cut into a matrix-bearing drum which is fed with glaze and which comes into contact with the tiles, transferring thereon the glaze with the image to be reproduced. A doctor removes the excess glaze, leaving only enough glaze on the drum to fill the cavities afforded on the lateral external surface of the drum itself. The synchronised rotation movement of the drum and the advancement of the tiles along the conveyor enable the decoration to be printed through the contact that occurs between a portion of the external cylindrical surface of the drum and the face of the tile to be decorated. In this known machine the drum, which is supported on a rotatable shaft, is constituted by an internal cylindrical core on which an elastically-deformable peripheral part is made solid, which part comprises an internal layer made in silicone foam, of a considerable thickness and spongy consistency, being highly elastically deformable, and an external layer, also elastically deformable, on which the matrix is cut.

The above known machine exhibits a number of drawbacks.

Firstly, the use of a large-diameter matrix-bearing drum (with diameter comparable to that of large glazing machines with silk-screens) is extremely problematic, so that, for example, different images cannot be obtained on tiles of a large size from the same drum, since the circumference thereof is not big enough to contain at least two images.

Secondly, the image reproduced on the tile is less precise and sharp with respect to decorations that can be obtained with other known glazing devices such as, for example, silk-screening machines.

For these reasons the above-mentioned known machine is suitable only for some applications. In particular, it is used on ceramic tiles almost exclusively for less-defined decorations, such as for example those which reproduce the veining of stone, marble and the like.

An aim of the present invention is to eliminate the above-described drawbacks by providing a device for the decoration of ceramic tiles, of a rotogravure type with an etched matrix, which enables definite and perfectly positioned and arranged patterns on tiles to be achieved.

An advantage of the invention is that it can print more than one image even on large tiles.

A further advantage is that it is constructionally simple and economical.

The invention further enables sharp decorations to be realised on unfired and deformed tiles, without causing any breakage, and also at the edges of the tiles, that is in the connection zones between the face to be decorated and the sides of the tiles themselves.

These aims and advantages and more besides are all achieved by the device of the invention, as it is characterised in the claims that follow.

Further characteristics and advantages of the present invention will better emerge from the detailed description that follows of a preferred but non-exclusive embodiment of the invention, illustrated purely by way of nonlimiting example in the accompanying figures of the drawings, in which:

figure 1 is a schematic view in vertical elevation of the device of the invention, partially sectioned according to line I-I of figure 2, and with some parts removed better to evidence others;

figure 2 is a schematic view from above of figure 1.

With reference to the figures, a device for decorating ceramic tiles 3 is shown, comprising a conveyor 2 which is inserted along a usual tile 3 feed line, not shown in the figures. The conveyor 2 bears transversal strips 4 which correctly position the tiles 3 and push them along the conveyor 2 in an advancement direction 6 indicated by an arrow in figure 1, with the tiles 3 specially distanced one from a next. The correct positioning of the tiles 3 with respect to the means for glazing can be obtained using other systems of known type, for example drawing the tiles by means of two lateral chains having a synchronised motion with the means for glazing.

Superiorly to the conveyor 2 is located a rotogravure decorating-glazing device having an etched matrix, comprising a support frame 5 provided with two crowns 17, of a closed annular shape and constrained by means of spokes to a rotating drive shaft 15. The crowns 17, which are distanced one from another and situated at opposite extremities, are provided with respective cylindrical external surfaces which are equal one to the other and coaxial to the drive shaft 15, on which a skin 16 is wound and fixed at lateral edges thereof.

The skin 16, externally delimited by a smooth surface, is made of an elastically deformable material which is non-permeable to glaze; it is preferably made of an elastomer, such as for example silicone rubber.

Once applied on the crowns 17, the skin 16 exhibits

a tubular shape which is coaxial with the support frame 5. The central part of the skin 16 is not directly fixed to the lateral crowns 17 of the frame 5 and is therefore, on its internal side, not occupied by the frame itself. This central and free part of the skin 16 exhibits on an external side thereof small blind cavities constituting a matrix, conformed and arranged so as to create an image to be reproduced, and able to contain small quantities of glaze. The etching method for obtaining the above-mentioned pattern (i.e. the matrix) on the smooth external surface of the skin 16 is known.

It is stressed that the skin 16 is supported only at lateral edges thereof on the frame 5: it is rigidly anchored - for example, by gluing - to the crowns 17 at the edges, while it is free and elastically deformable at its centre, that is in the part where the matrix is etched and which is destined to come into contact with the tiles 3. Thanks to the lateral support offered by the cylindrical crowns 17, the skin 16 assumes, if not deformed, a substantially cylindrical shape in the free central part.

The frame 5 has its axis perpendicular to the advancement direction 6 of the conveyor 2 and is provided with rotary motion in a rotation direction 13 indicated by an arrow. The rotation motion of the frame 5 is discontinuous and synchronised with the conveyor 2 motion by means for synchronising of known type and not illustrated. Thanks to the means for synchronising the discontinuous rotation of the frame 5 means that when a tile 3 nears the frame 5 the latter is set in rotation by the shaft 15, bringing the tile 3 and the external side of the etched skin 16 into contact at a generatrix, so that the glaze is transferred from the matrix on to the tile 3. The frame 5 is located on the conveyor 2 in such a way that the peripheral speed of the skin 16 is equal to the advancement speed of the tiles 3, so that the contact between the skin 16 and the tile 3 is achieved by pure rolling, with no dragging. Usually a sensor is also provided, of known type and not illustrated, which verifies the presence or absence of a tile 3 and sets the shaft 15 in rotation only if a tile 3 presence is verified; if this does not happen, the shaft 15 does not rotate and awaits the next tile 3. This synchronisation mechanism between the conveyor 2 and the shaft 15 is of known type and is normally used in tile silk-screening.

The external surface of theskin 16 exhibits two (or more) zones bearing the images to the reproduced and destined to contact the transiting tiles 3, which are two (or more) in circumferential direction with two non-etched zones. This enables two different decorations to be printed on a same line. The non-etched zones are angularly arranged in such a way, when the shaft 15 is still, as to correspond to the free space between two consecutive tiles 3 on the conveyor 2.

Known type means are provided for depositing the glaze on the matrix etched on the external surface of the skin 16. The means for depositing the glaze comprise, for example, a feed conduit 7.

A doctor 8, supported on a frame 14, is predisposed to operate in contact with a generatrix of the external lateral surface of the skin 16, and has the task of scraping the external lateral surface thus removing the excess of glaze as well as any other impurities deposited on the surface. An annular seat 18 is afforded on the periphery of each crown 17, which seat 18 houses a rubber washer - not illustrated and constituted for example by an O-ring - so as to form an annular relief for discharge of excess glaze removed by the doctor 8 into a collection tray.

The device 1 comprises first and second means for pressing the central part (free of the frame 5 and elastically deformable) of the skin 16 from inside towards the outside, respectively against the doctor 8 and the transiting tiles 3. The first means for pressing comprise a first roller 11, mounted idle on a special support and internally tangential to the skin 16 surface at the position of the doctor 8. The second means for pressing comprise a second roller 12, also mounted idle and internally tangential to the skin 16 surface at the lower generatrix of the skin 16, that is in the zone where contact with the tile 3 takes place. The two rollers 11 and 12 are situated in the space comprised between the two lateral crowns 17 and act from the inside of the skin 16. The two rollers 11 and 12 are preferably made of a soft, giving material, such as for example foamy silicone.

Both rollers 11 and 12 are positionable radially with respect to the skin 16, by means of a screw device, respectively 9 and 10, thanks to which it is possible to predetermine and regulate the pressure with each roller presses the elastic surface of the tile 16 against the doctor 8 or the transiting tiles 3. The diameter of each roller 11 and 12 is considerably less - almost half - of the degree of curvature of the skin 16 wound on the crowns 17.

In use, each time the sensor signals the arrival of a tile 3, the shaft 15 rotates by an angle equal to a revolution divided by the number of images etched on the skin 16. The tile 3 transits below the tubular skin 16 which is fed with glaze through the outlet mouth of the conduit 7. The glaze is deposited on the skin 16 in a zone situated upstream of the doctor 8, with reference to the rotation direction 13 of the rotating apparatus.

During rotation, a generatrix of the skin 16 passes between the doctor 8 and the first roller 11 and is compressed by said first roller 11 against the doctor 8; the doctor 8 scrapes the generatrix of the skin 16 and removes the excess glaze, leaving only the glaze which fills the blind cavities of the matrix.

If a pressing element were not present, operating internally of the cylindrical skin 16, the doctor 8 could not perform its action because the skin 16, which must be scraped, being thin, deformable and not directly supported internally, is not stiff enough to offer resistance to the action of the doctor 8 to obtain a good scrape.

The same can be said for the lower generatrix of the skin 16, that is for the zone where contact is made with the tiles 3 and the transfer of the glaze on to the tiles 3 is performed. The skin 16 is pressed by the sec-

ond roller 12 against the upper surface of the tile 3, and thanks to this pressure the glaze contained in the cavities etched on the skin 16 is extracted and deposited on the surface of the tile, reproducing the image designed in the cavities.

It has resulted that the decoration produced on the tile is much better defined and sharper in relation to presently obtainable decorations using rotogravure machines with etched matrix. We suppose that this advantageous effect is due to the fact that the pressure action on the transiting tile, by effect of which the glaze filling the etched cavities is deposited on the tile, is performed by a pressing element, i.e. the second roller 12, having a degree of curvature which is relatively small and in any case considerably smaller than those of the pressing elements currently used in known-type rotogravure machines with etched matrix.

Thanks to the invention pressure on the doctor and the tiles can be regulated, independently and with great simplicity.

As has been shown, the method in which both the pressure between the doctor and the matrix surface (for the scraping operation) and the reciprocal pressure between the matrix and the tiles (for the transfer of the glaze) are achieved is substantially different to that of prior-art rotogravure machines. In the latter both the above-mentioned pressures are due to the interaction between the rigid pressing elements, at least one of which is represented by the surface of the rotating drum on which the matrix is etched (while the other rigid pressing element is represented either by the doctor or the tile). In other words, in known machines the etched surface of the matrix, while provided with a certain elastic deformability, must in any case be sufficiently rigid to contrast bother the doctor and the tile. Proof of this, for example, is the fact that to adjust the pressure of transfer of the glaze on to the tile the position of the matrix-bearing drum relative to the tile has to be modified.

In the device of the present invention the situation is different. The matrix is predisposed on a skin which, both at the doctor position and the tile position, is too elastic correctly to scrape off the excess glaze correctly or to transfer the glaze on to the tile properly. In the present device the contrasting element is not constituted by the surface bearing the matrix but rather by fixed contrasting means which are independent from each other and do not have the function of bearing the matrix, but only that of pressing it against the doctor or tile. Consequently the contrast means, characteristic of the invention, may exhibit, in the zone at which they act against the skin, a degree of curvature which is relatively very small. It follows that, among other things, the contact zone between the matrix and the tiles is constituted by an extremely thin line, in which the pressing action is concentrated, which, as has been mentioned, considerably improves the precision in the glaze transfer and the sharpness of the image printed on the tiles. Furthermore, in the device of the invention, the regulation of the pressures (both for scraping and glaze-laying) is done by adjusting the position of the contrasting means against the rotating tubular skin.

Claims

1. A device (1) for decorating ceramic tiles, characterised in that it comprises:

   a conveyor (2) for tiles (3), on which said tiles (3) advance according to a predetermined advancement direction (6);
   a rotating support frame (5) arranged with an axis thereof transversal to said advancement direction (6) of the conveyor (2);
   a skin (16) constrained to said support frame (5) and exhibiting a tubular shape which is coaxial to the frame (5), at least a part of said skin (16) being, on an internal side thereof, not occupied by said frame (5) and on an external side thereof provided with small blind cavities constituting a matrix and able to house small quantities of glaze, a rotary motion of said support frame (5) being synchronised with a motion of said conveyor (2) in order to bring said small blind cavities into a position corresponding to a passage of said tiles (3) as said tiles (3) transit below the device;
   means for depositing the glaze on the external tubular surface of said at least part of said skin (16);
   a doctor (8) for removing excess glaze deposited on the external tubular surface of said at least part of said skin (16);
   first means for pressing and second means for pressing, situated internally of said skin (16) and predisposed for pressing said part of the skin (16) from inside outwards, the first means for pressing against the doctor (8) and the second means for pressing against the tiles (3) as they transit.

2. The device of claim 1, characterised in that said first means for pressing comprise a first roller (11) internally tangential to the tubular surface of the skin (16).

3. The device of claim 2 characterised in that a diameter of said first roller (11) is considerably smaller than a degree of curvature of the tubular surface ofthe skin (16).

4. The device of claim 2 or 3, characterised in that the first roller (11) is positionable with respect to the skin (16) in a radial direction.

5. The device of any one of the preceding claims, char-

acterised in that said second means for pressing comprise a second roller (12) internally tangential to the tubular surface of the skin (16).

6. The device of claim 5, characterised in that the diameter of the second roller (12) is considerably smaller than a degree of curvature of the tubular surface ofthe skin (16).

7. The device of claim 5 or 6, characterised in that the second roller (12) is positionable in radial direction with respect to the skin (16).

8. The device of any one of the preceding claims, characterised in that the skin (16) is made of a material which is non-permeable to glaze and elastically deformable and which has a smooth external surface.

9. The device of any one of the preceding claims, characterised in that the support frame (5) comprises two lateral crowns (17), situated at opposite ends and solidly constrained to a central support shaft (15), which crowns (17) are provided with respective cylindrical external surfaces which are equal and coaxial to the support shaft (15) and on which the skin (16) is wound and fixed at lateral edges thereof.

10. The device of any one of the preceding claims, characterised in that the external tubular surface of the skin (16) exhibits a plurality of zones, affording said blind cavities constituting the matrix and destined to contact the transiting tiles (3), alternating in a circumferential direction with zones which are not destined to contact the tiles (3).

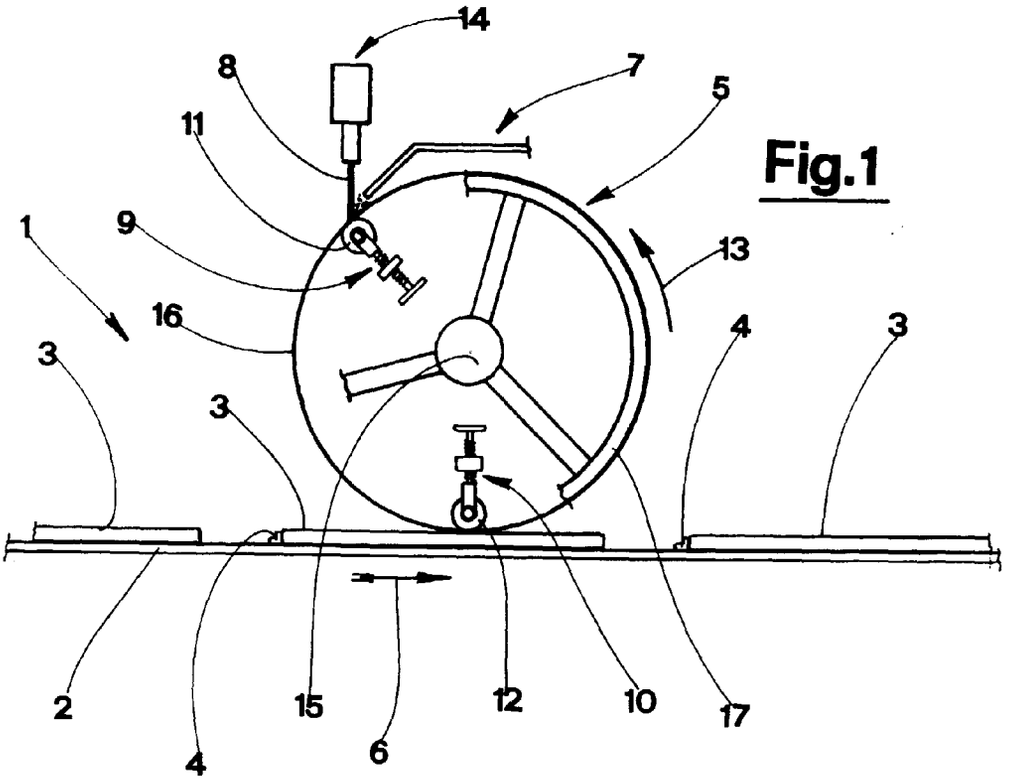
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Fig.1

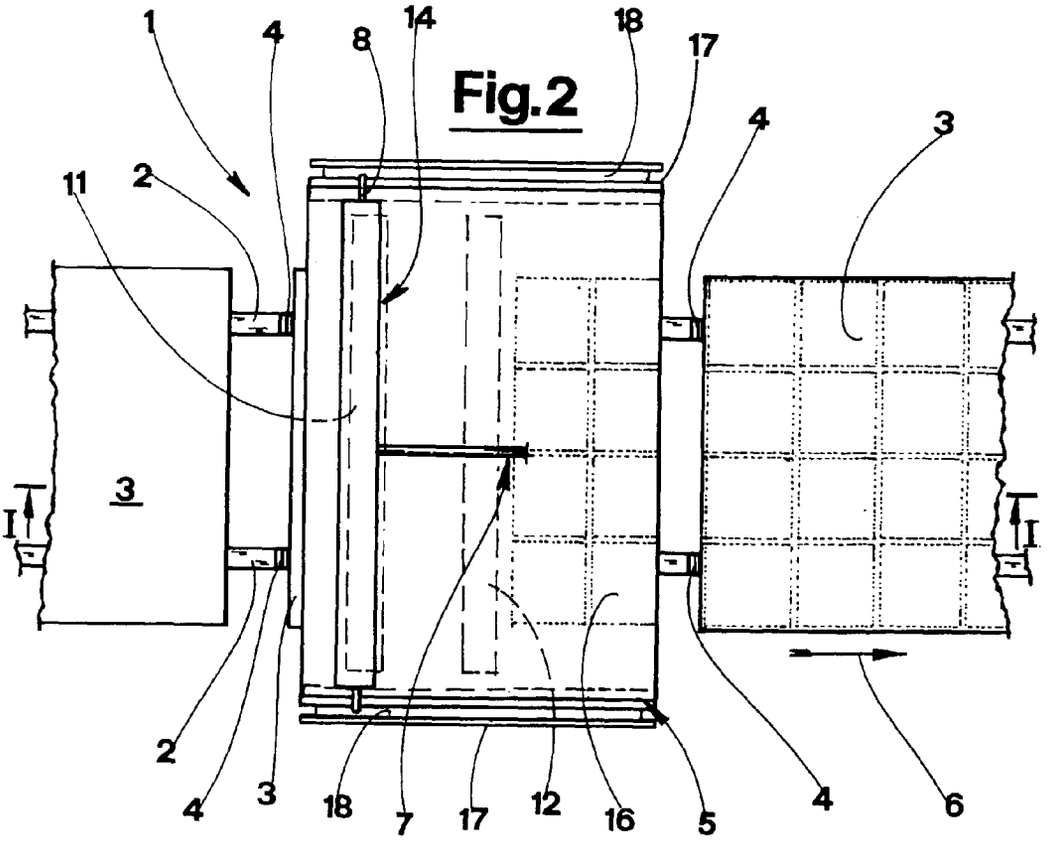
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Fig.2

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EUROPEAN SEARCH REPORT

Application Number
EP 97 83 0330

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	DE 28 27 901 A (SAUERESSIG GMBH) * the whole document * * page 8, line 12 - page 9, line 24 * * figures 2-4 *	1,5-9	B28B11/00 B28B11/04 B05C1/08
A	PATENT ABSTRACTS OF JAPAN vol. 007, no. 046 (C-153), 23 February 1983 & JP 57 197067 A (NIPPON PAINT KK), 3 December 1982, * abstract *	1,8	
A	EP 0 645 223 A (T S C S R L) * the whole document *	1	
A,D	EP 0 677 364 A (SYFAL SRL) * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
B28B B05C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 December 1997	Gourier, P

CATEGORY OF CITED DOCUMENTS

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