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(54) Title: METHOD FOR MANUFACTURING A TOOL VIA RAPID PROTOTYPING

(57) Abstract: A method for making a tool comprising the steps of providing a polymeric thermoplastic or thermosetting material or equivalent and abrasive material in powder to be mixed together with said polymeric material, in order to obtain a filament containing a matrix / polymer resin with abrasive characteristics, and feeding said filament to a three-dimensional 3D printing device to obtain in output from said printing device a tool with certain shapes and sizes.



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**METHOD FOR MAKING A TOOL.**

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The present invention relates to a method for making tools.

In particular, the invention is advantageously used to produce tools suitable for performing various types of processing, such as roughing, smoothing, lapping, polishing or equivalent treatment, on materials such as natural stone, cement, glass, metal or laminated surfaces, agglomerates and composite materials in general, such as Bretonstone® or Terastone®, the description that follows will make explicit reference to without losing its generality.

The object of the present invention is to provide a method for making tools of various shapes and sizes, chosen according to specific requirements of the field of use and/or of the end user.

Another object of the present invention is to provide a method for making tools defined by various types of materials combined with each other, and with optimal surface finishes and increased machining efficiency.

The structural and functional features of the present invention and its advantages over the known art will become clearer and more evident from the following claims and, in particular, from an examination of the following description.

The innovative methodology in question involves performance of the following operating phases:

- preparing a thermoplastic, thermosetting or equivalent polymeric material and a loose material (powder) with abrasive properties, such as diamond, carbides, alumina, mineral fillers,

metal materials in general to be mixed together with said polymeric material in order to obtain a filament containing a resin/polymer matrix with abrasive properties to allow use with a smoothing and/or polishing function that, in particular, emphasizes the features of the processed materials creating abraded surfaces of more or less intense colour tones, and eventually obtaining "anti-finger" (elimination of fingerprints created with the contact between the fingertips of the operator's fingers and the material itself) or "gloss/matt" (polished and opaque points) effects, more or less balanced between them but always without the typical defects of repetitive mechanical processing (e.g. sense of rotation); and

- feeding said filament to a three-dimensional or 3D printing device so that said printing device outputs a tool with defined shapes and sizes.

These shapes and sizes are customizable for each single customer based on specific needs.

Preferably but with no limitation thereto, the methodology also provides for a subsequent baking step (post-curing) of said tool thus produced in order to consolidate/harden the thermoplastic polymeric material of which the tool itself is made, or free sintering step, in order to compact the molecules of the same tool, also removing any polymeric additives previously added to favour the aforementioned 3D printing step (in the case of metals).

It must be emphasised that, in this way, it is possible to weave materials of different nature and appropriately designed geometries by the simultaneous use of more heads, and therefore the tools obtained with this method can be made

with more materials, at least the same number as the printing heads of which the printing device is provided.

By way of example only, it is possible to make tools that have a base called "support", made of neutral material, that is without the addition of an abrasive part, an abrasive part made of a thermoplastic rubber matrix, and an abrasive part made of a matrix of a different type, such as, for instance, nylon or similar materials.

The method of the present invention therefore allows to obtain the following advantages:

- compared to known methodologies using injection moulding, for instance the one described in EP 1.524.078 B1, it is possible to make tools without particular size and shape constraints determined by the employed mould, eliminating typical technical problems of injection moulding (e.g. undercuts, cavities inside the moulds, etc.),
- considerable time reduction and high reduction of production costs: in fact, by avoiding the use and set-up of traditionally used injection moulding machines, thanks to the possibility of shifting from one tool to the other during production without emptying phases of the injection cylinders and their consequent necessary cleaning, and moreover, following the total elimination of injection moulds, without their consequent necessary maintenance normally caused by strong wear and tear due to the polymer-abrasive fillers mixture.

### CLAIMS

1. Method for making a tool, characterized by comprising the steps of providing a polymeric thermoplastic or thermosetting material or equivalent and abrasive material in powder to be mixed together with said polymeric material, in order to obtain a filament containing a matrix / polymer resin with abrasive characteristics, and feeding said filament to a three-dimensional 3D printing device to obtain in output from said printing device a tool with certain shapes and sizes.
2. Method according to claim 1, characterized in that it further comprises a subsequent firing step of said tool.
3. Method according to claim 1, characterized in that it further comprises a subsequent free sintering step of said tool.
4. Tool in particular for performing machining operations such as grinding, polishing, lapping, polishing or equivalent treatments, on materials such as natural stone, concrete, glass, metal or laminates surfaces, agglomerate and composite materials in general, obtained with the method according to one or more of Claims 1 to 3.

## INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2018/051729

## A. CLASSIFICATION OF SUBJECT MATTER

INV. B24D18/00 B24D11/00  
ADD.

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)

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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 practicable, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents :

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"E" earlier application or patent but published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

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| C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT |                                                                                                                                                                                                 |                       |
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