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**Machine tool for working stone and agglomerates of inert materials**

Werkzeugmaschine zum Bearbeiten von Gestein und Agglomeraten von inerten Materialen

Machine-outil pour l’usinage de pierre et d’agglomérés de matériaux inertes

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Description

[0001] The invention relates to a tool for machines for working stone and agglomerates of inert materials, particularly for polishing, facing, cutting, millling, sizing, shaping, rab buttering, squaring or beveling natural stone, such as porphyrites, granites, marbles or synthetic stone such as for example ceramics as per the preambule of claim 1, and to a method as per the preambule of claim 6. Such machines and methods are known by, for example, EP 395 162 A.

[0002] During stone working, the machines cause the tools to perform repeated movements which are typical and specific for the type of work to be performed, such as back-and-forth straight-line motions, intermittent or stepwise straight-line movements, oscillations, continuous rotations in one direction, alternating rotations in two directions, etcetera, or even a movement which is a combination of two or more movements.

[0003] Said movement is generated by the machine and transmitted to the tool. For this purpose, the tool is connected to the machine through a connecting part, which is provided with appropriate connecting means, such as for example an insertion seat for an arm or for a chuck of the machine. The tool further has a support for the abrasive or, respectively, cutting material with which the stone is worked. Said support accommodates the abrasive or, respectively, cutting material with which the stone is worked. The material is diamond-impregnated, i.e., it contains a certain amount of diamond, which being harder than the stone, allows to work said stone.

[0004] In conventional tools, the support and the connecting part are currently fastened to each other in a fixed but detachable manner by way of removable locking means, such as for example screws, grub screws and the like. This allows to disassemble the support together with the abrasive or, respectively, cutting material in order to replace it when the abrasive or the cutting material has lost its effectiveness due to wear.

[0005] Experience has shown that the abrasive or cutting material loses its effectiveness rather quickly, particularly due to the fact that the stone-like material removed during working, gums the abrasive or the cutting material gradually, reducing its removal power. However, in view of the high cost of diamond, it is a primary requirement to fully utilize the abrasive or the cutting material. In this situation, at present, when gumming of the abrasive or cutting material of the tools of a machine occurs, the position of the tools in a same machine is swopped, taking advantage from the fact that gumming does not occur uniformly, so that a tool that has become gummed by working on a certain part of the stone is generally still effective if it is used on a different part of the stone, on which another tool has been working up to that time. This method allows to extend the average life of the abrasive or of the cutting material of the tool, but the result is still unsatisfactory.

[0006] EP-A 0 395 162 discloses a tool for the working heads of polishing machines in which the elastic means interposed between the base and the means for fixing the tool to the working head comprise for example a layer of rubber such as para rubber.


[0008] The aim of the present invention is to develop a tool of the above-mentioned type, with a reduced tendency of having gummed its abrasive or cutting material, to thus maintain its operating capabilities for a considerably longer time than currently occurs.

[0009] This aim is achieved by means of the features set forth in claim 1, and claim 6.

[0010] In particular, between the support and the connecting part a layer is interposed, made of a material which is adapted to damp the mechanical vibrations of the machine, attenuating their transmission from the connecting part to the support, and adapted to damp the vibrations that occur in the support during work, attenuating their transmission from the support to the connecting part.

[0011] The invention is based on the finding that the mechanical vibrations of the machine and the vibrations that occur in the support of the material during machining, mutually interfere, in a way which creates occasional and irregular maximums and minimums of the vibrations, which lead to uneven action of the abrasive or cutting materials on the stone. During the maximums, the stone is not worked, but rather bitten into, by the abrasive or cutting material, so that it becomes more difficult to dress or restore the abrasive or cutting material, which consequently gums up and loses its effectiveness.

[0012] The solution according to the invention prevents, or in any case considerably reduces, the possibility of mutual contact between the two separate series of vibrations. This considerably lowers the damaging effect of the mechanical vibrations of the machine, since they no longer reach the abrasive or, respectively, cutting material.

[0013] The layer is constituted by a carbon-fiber fabric. The empty spaces of the carbon-fiber fabric are filled with silicone and the fabric is covered with a film of silicone. Experience has shown that such a layer has, in addition to the necessary vibration-damping characteristics described above, suitable mechanical strength characteristics which are necessary in order to contrast the forces, particularly the torsional forces, that are transmitted between the support and the connecting part.

[0014] The rigidity of the layer has a decisive effect on the characteristics of the work performed on the stone and is directly linked to the aggressive or, respectively, delicate nature of the work. The higher the rigidity of the layer, the greater the strength with which the stone is bitten into during working. By preferably adding fibers of other materials to the carbon fibers, it is possible to vary
the rigidity of the layer, adapting it to the type of stone to be worked and to the type of work to be performed.

[0015] In claims 2 to 4 preferred examples of said mixed fabrics, are claimed.

[0016] If one wishes to increase the mechanical strength of the layer, conveniently, the layer can be obtained by vacuum formation, as in claim 6.

[0017] Another parameter which affects the rigidity of the layer is its thickness. Suitably, as claimed in claim 5, said layer should be less than one millimeter thick, and its thickness should be, in particular, between 3 and 8 tenths of a millimeter. Layers with a thickness of approximately or exactly 3 tenths of a millimeter make possible to work the stone more aggressively than allowed by thicknesses of approximately or exactly 8 tenths of a millimeter, which are adapted for more delicate work.

[0018] Further characteristics and advantages of the invention will become apparent from the following description of an example of a preferred embodiment of the invention, illustrated merely by way of non-limitative example on the basis of the accompanying drawings, wherein:

Figure 1 is a partially sectional view of a tool according to the present invention for working a stone; and Figure 2 is a bottom partial view of the tool of Figure 1.

[0019] In the figures, the reference numeral 1 designates a tool for machines for working stones. The term "working" designates all possible operations to which a stone can be subjected, such as for example polishing, facing, cutting, milling, sizing, shaping, rabbeting, squaring or beveling. The stones can be natural stones, such as for example porphyres, granites, marbles or even synthetic stones such as for example ceramics.

[0020] The invention relates to all of the tools that are used in machines for working stone during said working, regardless of their shape and dimensions, so long as they comprise a support 2 for the abrasive or, respectively, cutting material 3 and a connecting part 4 for connecting the tool to the machine.

[0021] The abrasive or cutting material 3 is in contact with the stone during working, whereas the movement that the tool 1 has to perform during working is transmitted to the connecting part 4 from the machine.

[0022] The invention will be explained on the basis of a grinding wheel 1, as shown in Figures 1 and 2, but it is stressed once more that this explanation is merely a representative example, and as such the invention is applicable to any tool that has characteristics as illustrated.

[0023] As shown in Figure 1, the support 2 and the connecting part 4 are mutually fastened in a fixed but detachable manner by way of removable locking means 5, particularly screws. A plurality of diamond-impregnated sectors 7 are arranged on the support 2 to provide work surfaces for the stone, particularly for polishing and facing it, during the rotation of the tool 1 about the rotation axis A. The rotation is produced by a chuck, not shown, of a machine which also is not shown. The chuck is coupled to the tool 1 in the seat 8 of the connecting part 4. The chuck can furthermore be moved by the machine with a translatory motion, so as to move the rotating tool 1 along the stone being worked.

[0024] According to the invention, between the support 2 and the connecting part 4 a layer 6 is interposed, made of a material that is adapted to damp the mechanical vibrations of the machine and the vibrations generated in the support 2 during working. This allows to attenuate the transmission of vibrations of the machine from the connecting part 4 to the support 2, and to attenuate the transmission from the support 2 to the connecting part 4 of vibrations that originate in the abrasive or cutting material during working.

[0025] In this manner, the two different vibrational states do not interact, or only do so to a limited extent, and therefore no mutual interference occurs, which is the source of the maximums and minimums in vibrations having negative effects in terms of gumming of the abrasive or of the cutting material.

[0026] Accordingly, a more regular and controlled manner for the transmission of the power from the machine to the abrasive or cutting material is possible with the result of obtaining a doubling of the working life of the tools before gumming occurs, without compromising the quality of the work and indeed with a lower installed power capacity of the machine.

[0027] Excellent results have been achieved by using a layer 6 constituted by a carbon-fiber fabric and by filling the empty spaces of the carbon-fiber fabric with silicone and by covering the fabric with a film of silicone.

[0028] It is also conceivable to provide a fabric made of mixed fibers by mixing fibers made of other materials to the carbon fibers, in order to vary the rigidity of the layer, adapting it to the requirements of the various types of work.

[0029] Examples of embodiments of said layers of mixed fabric can be obtained, by adding fibers of cardboard or natural fibers, such as for example wool, cotton, linen, silk and the like or glass fibers to the carbon fibers.

[0030] If one wishes to increase the mechanical strength of the layer 6, this can be achieved with a vacuum process, in which the carbon-fiber fabric or one of the above cited mixed-fiber fabrics is impregnated with synthetic resin and then subjected to a vacuum treatment in which it is deaerated. This gives greater compactness to the layer 6.

[0031] The layer 6 has a thickness of less than one millimeter. In particular, it has a thickness of 3 to 8 tenths of a millimeter, which is the range that provides optimum results.

[0032] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of exam-
ple by such reference signs.

Claims

1. A machine tool (1) for working stones and agglomerates of inert materials, particularly for polishing, facing, cutting, milling, sizing, shaping, rabbeting, squaring or beveling natural stones, such as for example porphyries, granites, marbles, or synthetic stones such as ceramics, comprising a support (2) for the abrasive or, respectively, cutting material (3) to contact the stone during working, and a connecting part (4) for connecting the tool (1) to the machine which generates and transmits to the tool (1) the movement that said tool performs during working, said support (2) and said connecting part (4) being fastened to each other, in a detachable manner, by way of removable locking means (5), and, between the support (2) and the connecting part (4) a layer (6) is interposed, made of a material which is adapted to damp the mechanical vibrations of the machine, attenuating transmission thereof from the connecting part (4) to the support (2), and adapted to damp the vibrations that occur in the support (2) during working, and further attenuating transmission thereof from the support (2) to the connecting part (4), characterized in that said layer (6) is constituted by a carbon-fiber fabric obtained through vacuum formation, so as to increase its mechanical strength.

2. The tool according to claim 1, characterized in that the fabric also has cardboard fibers mixed with the carbon fibers.

3. The tool according to claim 1, characterized in that the fabric also has natural fibers mixed with the carbon fibers.

4. The tool according to claim 1, characterized in that the fabric also has glass fibers mixed with the carbon fibers.

5. The tool according to one of the preceding claims 1 to 4, characterized in that the layer (6) has a thickness of less than one millimeter, particularly a thickness between 3 and 8 tenths of a millimeter.

6. A method for reducing the gumming of the abrasive or the cutting material (3) of a machine tool (1) for working stones and agglomerates of inert materials, particularly for polishing, facing, cutting, milling, sizing, shaping, rabbeting, squaring or beveling natural stones, such as for example porphyries, granites, marbles, or synthetic stones such as ceramics, comprising a support (2) for said abrasive or, respectively, cutting material (3) to contact the stone during working, said method comprising the steps of:

(a) connecting the tool (1), with a connecting part (4), to the machine which generates and transmits to the tool (1) the movement that said tool performs during working;
(b) fastening the support (2) to the connecting part (4), in a detachable manner, by way of removable locking means (5);
(c) interposing a layer (6) of material which is adapted to damp the mechanical vibrations of the machine, attenuating transmission thereof from said connecting part (4) to the support (2) during working, and further attenuating transmission thereof from the support (2) to the connecting part.

Patentansprüche

1. Ein Maschinenwerkzeug (1) zur Bearbeitung von Gesteinen und Agglomeraten aus inerten Materialien, im Besonderen zum Polieren, Planbearbeiten, Schneiden, Fräsen, Klassieren, Formen, Nuten, Rechtwinklgschneiden oder Abschrägen natürlicher Gesteine, wie zum Beispiel Porphyr, Granite, Marmore, oder synthetische Gesteine, wie zum Beispiel Keramiken, umfassend einen Träger (2) für das Schleifmittel beziehungsweise Schneidmaterial (3), der mit dem Gestein während der Bearbeitung in Verbindung tritt, und ein Verbindungsteil (4) zur Verbindung des Werkzeugs (1) mit der Maschine, die die Bewegung erzeugt und zu dem Werkzeug (1) überträgt, die das Werkzeug während der Bearbeitung ausübt, wobei der Träger (2) und das Verbindungsteil (4) miteinander in lösbarer Weise, mittels entfernbaren Verriegelungsmittel (5), befestigt werden, und zwischen dem Träger (2) und dem Verbindungsteil (4) eine Schicht (6) eingefügt ist, die aus einem Material hergestellt ist, das angepasst ist, die mechanischen Vibrationen der Maschine zu dämpfen, eine Übertragung davon von dem Verbindungsteil (4) zum Träger (2) zu vermindern, und angepasst ist die Vibrationen, die in dem Träger (2) während der Bearbeitung auftreten, zu dämpfen und weiter eine Übertragung davon von dem Träger (2) zum Verbindungsteil (4) zu vermindern, dadurch gekennzeichnet, dass die Schicht (6) aus einem Kohlenstoffasergewebe gebildet ist, das freie Stellen aufweist, die mit Silikon gefüllt sind, und mit einem Silikonfilm überdeckt sind.

2. Das Werkzeug gemäß Anspruch 1, dadurch gekennzeichnet, dass das Gewebe außerdem mit den Kohlenstofffasern vermischte Kartonfasern aufweist.
3. Das Werkzeug gemäß Anspruch 1, dadurch gekennzeichnet, dass das Gewebe außerdem mit den Kohlenstofffasern vermischte natürliche Fasern aufweist.

4. Das Werkzeug gemäß Anspruch 1, dadurch gekennzeichnet, dass das Gewebe außerdem mit den Kohlenstofffasern vermischte Glasfasern aufweist.

5. Das Werkzeug gemäß einem der vorhergehenden Ansprüche 1 bis 4, dadurch gekennzeichnet, dass die Schicht (6) eine Dicke von weniger als einem Millimeter, im Besonderen eine Dicke zwischen 3 und 8 Zehntel Millimetern, aufweist.

6. Ein Verfahren zur Reduzierung der Verklebung des Schleifmittels oder des Schneidmaterials (3) eines Maschinenwerkzeugs (1) zur Bearbeitung von Gesteinen und Agglomeraten aus inerten Materialien, im Besonderen zum Polieren, Planbearbeiten, Schneiden, Fräsen, Klassieren, Formen, Nuten, Rechtwinkel Schneiden oder Abschrägen natürlicher Gesteine, zum Beispiel Porphyre, Granite, Marmore, oder synthetischen Gesteine, zum Beispiel Keramiken, umfassend einen Träger (2) für das Schleifmittel beziehungsweise Schneidmaterial (3), der mit dem Gestein während der Bearbeitung in Verbindung tritt, wobei das Verfahren die folgenden Schritte umfasst:

   a) Verbinden des Werkzeugs (1) mit einem Verbindungsteil (4) mit der Maschine, die die Bewegung erzeugt, die das Werkzeug im Betrieb ausübt und zu dem Werkzeug (1) überträgt;
   b) Befestigen des Trägers (2) mit dem Verbindungsteil (4), in lösbare Weise, mittels entfernbaren Verriegelungsmittel (5);
   c) Einfügen einer Schicht (6) eines Materials, das angepasst ist, die mechanischen Vibrationen der Maschine zu dämpfen, eine Übertragung davon von dem Verbindungsteil (4) zu dem Träger (2) während des Betriebs zu vermindern, und weiter eine Übertragung davon von dem Träger (2) zu dem Verbindungsteil zu vermindern,

   dadurch gekennzeichnet, dass die Schicht (6) aus einem Kohlenstofffasergewebe gebildet ist, das durch Vakuumbildun

Revendications

1. Outil (1) de machine pour l’usinage de pierres et d’agglomérés de matériaux inertes, en particulier pour le polissage, le surfacage, le découpage, le fraisage, le rainurage, le façonnage, le calibrage, le façonnage, l’équarrissage, ou le chanfreinage de pierres naturelles, telles que par exemples les porphyres, les granites, les marbres ou de pierres synthétiques telles que les céramiques, comprenant un support (2) pour le matériau abrasif ou respectivement de découpage (3) en contact avec la pierre lors de l’usinage et une partie de connexion (4) pour connecter l’outil (1) à la machine qui génère et transmet à l’outil (1) le mouvement que l’outil exécute lors de l’usinage, ledit support (2) et ladite partie de connexion (4) étant attachés l’un à l’autre, de façon détachable, à l’aide de moyens de verrouillage amovibles (5), et, entre le support (2) et la partie de connexion (4) une couche (6) est interposée, réalisée en un matériau qui est adapté pour amortir les vibrations mécaniques de la machine, atténuant leur transmission de la partie de connexion (4) au support (2), et qui est adapté pour amortir les vibrations qui se produisent dans le support (2) lors de l’usinage, et atténuant en outre leur transmission du support (2) à la partie de connexion (4), caractérisé en ce que ladite couche (6) est constituée d’un tissu en fibre de carbone présentant des espaces vides remplis avec du silicone et recouvert d’un film en silicone.

2. Outil selon la revendication 1, caractérisé en ce que le tissu présente également des fibres de verre mélangées aux fibres de carbone.

3. Outil selon la revendication 1, caractérisé en ce que le tissu présente également des fibres naturelles mélangées aux fibres de carbone.

4. Outil selon la revendication 1, caractérisé en ce que le tissu présente également des fibres de verre mélangées aux fibres de carbone.

5. Outil selon l’une ou plusieurs des revendications 1 à 4, caractérisé en ce que la couche (6) présente une épaisseur de moins de un millimètre, en particulier une épaisseur comprise entre 3 et 8 dixièmes de millimètre.

6. Méthode pour réduire l’affûtage du matériau abrasif ou de découpage (3) d’un outil (1) de machine pour l’usinage de pierres et d’agglomérés de matériaux inertes, en particulier pour le polissage, le surfacage, le découpage, le fraisage, le calibrage, le façonnage, le rainurage, l’équarrissage, ou le chanfreinage de pierres naturelles, telles que par exemples les porphyres, les granites, les marbres ou de pierres synthétiques telles que les céramiques, comprenant un support (2) pour le support (2) d’un outil (1) de machine pour l’usinage de pierres et d’agglomérés de matériaux inertes, en particulier pour le polissage, le surfacage, le découpage, le fraisage, le calibrage, le façonnage, le rainurage, l’équarrissage, ou le chanfreinage de pierres naturelles, telles que par exemples les porphyres, les granites, les marbres ou de pierres synthétiques telles que les céramiques, comprenant un support (2) pour le matériau abrasif ou respectivement de découpage (3) en contact avec la pierre lors de l’usinage, ladite méthode comprenant les étapes consistent à:
(a) connecter l’outil (1), avec une partie de connexion (4), à la machine qui génère et transmet à l’outil (1) le mouvement que ledit outil exécute lors de l’usinage;
(b) attacher le support (2) à la partie de connexion (4), de façon détachable, à l’aide de moyens de verrouillage amovibles (5);
(c) interposer une couche (6) de matériau qui est adapté pour amortir les vibrations mécaniques de la machine, atténuant leur transmission de la partie de connexion (4) au support (2) lors de l’usinage, et atténuant en outre leur transmission du support (2) à la partie de connexion,

**caractérisée en ce que** la couche (6) est constituée d’un tissu en fibre de carbone obtenu avec un procédé de production sous-vide, afin d’augmenter sa résistance mécanique.