

Title:

Disk-shaped tool and method for machining workpieces, cutting device and use of a cutting, grinding and polishing disk to
5 produce a surface structure on a workpiece

Description:

The invention relates to a tool and a method for machining
10 workpieces as specified in the respective preambles of claims 1 and 6, in particular for the simultaneous multiple machining of workpieces and a cutting device according to claim 10 and a use according to claim 12.

15 To machine workpieces, cutting and separating processes are carried out for example by means of rotating tools that are used in stationary or mobile devices. DE 20 2016 102 268 U1 is mentioned here as a possible embodiment of a cutting machine.

20 After cutting and separating processes have been carried out, the resulting cut surfaces have surface characteristics resulting from the cutting or separating process. Separating and cutting tools are mainly designed for a high cutting performance and, due to the correspondingly coarse cutting
25 edges, often produce cut surfaces with a high surface roughness, burrs and material damage caused by the temperatures. In many applications, the surface quality of a cut surface resulting from a cutting or separating process does not meet the requirements of the laboratories in which
30 the cut surface produced as a process result must be examined more closely. In the industrial production as well, clean, burr-free cut surfaces are required, for example, for a further processing of cut workpieces, which should be as free as possible from damage of any kind. It is usually still
35 necessary to further process the relevant cut surface, for

example, in a grinding or polishing process. Individual influences during the specimen preparation are now almost inevitable.

5 In the following description, the possible processing steps for increasing the surface quality in an axial working direction of a disk-shaped rotating tool are collectively referred to as "grinding." The cutting and separating processes in a radial working direction are referred to as
10 "cutting."

According to common methods, for example when insulated cables are cut to length, cutting processes and grinding processes are carried out with different tools in successive operations,
15 because cutting processes and grinding processes each place different demands on the tool structure and the removal rate of the executing tool. Special machine tools are usually used for each process. Workpiece changes or manual grinding processes occur.

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During cutting processes that use rotating tools, the tool plunges into the workpiece to be machined in a radial working direction. It is desirable that the rotating cutting tools have a small thickness so that the material removal necessary
25 for performing the separating cut is low.

In contrast to rotating cutting tools, rotating grinding tools usually have a greater thickness in the axial direction. This way, the axial forces occurring with the side surfaces of the
30 tool during grinding processes are absorbed and the largest possible contact is achieved between tool and workpiece surface during grinding processes in the radial working direction. DE 696 11 764 T2 is mentioned here as an example for the design of disk-shaped grinding tools.

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The degree of wear on the tool is usually checked before starting a cutting or grinding process. This check is often purely visual, and the result is subjectively limited to the impression of the examiner. If a tool now reaches its wear
5 limit during an ongoing machining process, the process must be interrupted and restarted with a new tool. In addition to the extra time required for the tool change, the tool change performed during the machining process can lead to an uneven work result. This is problematic when used for the preparation
10 of a specimen and a subsequent surface analysis on the workpiece.

DE 10 2015 223 428 B4 proposes a disk-shaped cutting tool for making gentle separating cuts, which is particularly suitable
15 for cutting composite materials with poor thermal conductivity. By means of an exclusively radially acting main cutting edge on the outer circumference of the disk-shaped cutting tool, a cutting gap is produced, which is then widened by means of convex secondary cutting edges which are arranged
20 adjacent to the main cutting edge and which act in a partly radial and partly axial manner. The high temperatures that arise when material is removed are distributed over a larger region both in the tool and in the workpiece. Workpiece material in the region of the cut surfaces that has undergone
25 temperature-related, material-damaging structural changes during the production of the cutting gap is at least partially removed during the subsequent widening of the cutting gap. In the application, the invention disclosed in DE 10 2015 223 428 B4 achieves cut surfaces with less pronounced temperature
30 damage.

The material removal required to carry out a separating cut with the tool disclosed in DE 10 2015 223 428 B4 is higher than with a conventional cutting disk due to the special
35 geometry of the peripheral region of the disk. This conflicts

with a use for making efficient separating cuts in metallic materials.

It should also be noted that the tool disclosed in DE 10 2015
5 223 428 B4 should not be used for surface grinding purposes in
an axial working direction.

A saw blade with geometrically defined, alternately set saw
teeth on its outer circumference, which is equipped with guide
10 elements on its side surfaces, is known from US 6632131B1.
According to the invention, the guide elements do not project
axially beyond the separating cut width. The guide elements
can therefore not have a grinding effect in the axial
direction, but are intended to remove splinters that were torn
15 out of the body of the workpiece by the cutting edges but
still adhere to the workpiece and protrude into the separating
cut.

WO 2011/029106A2 describes a wear indicator for rotating
20 material-removing cutting or grinding tools, which provides
information on the radial or axial wear of the tool via
depressions or elevations integrated into the tool.

Based on the prior art shown, the present invention
25 furthermore has the object of providing a tool or a machining
method that can be used on commercially available portable or
stationary cutting and grinding machines and with which it is
possible to efficiently cut a workpiece with a defined surface
characteristic by means of a cutting process. The machining
30 quality should be assured. It should be possible to reproduce
the produced surfaces in the same way over and over again.

Another object of the invention is to provide a tool which, if
possible, comprises a wear indicator that allows the tool user
35 to draw a conclusion as to whether the operation in question

can be fully carried out within the remaining utilization capacity of the tool before the start of an operation.

The object of the invention is achieved by the subject matter
5 of the independent claims, including their respective features.

Advantageous further developments of the invention are defined in the respective subclaims.

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The disk-shaped cutting tool according to the invention is provided for the rotating cutting of a stationary clamped workpiece elongated at least roughly along an axis of rotation, with a radial advance with respect to this axis of
15 rotation at least roughly in the direction of the orthogonally clamped workpiece. However, the cutting tool does not exclusively have cutting edges in a radially outer circumferential region of the cutting tool. At least one of two opposing disk flanks is provided with at least one
20 grinding and/or polishing agent in a radially inner region with respect to the circumferential region.

A disk-shaped tool according to the invention is advantageously provided for use in commercially available
25 mobile or stationary cutting and grinding machines. A use in a test laboratory for electrical cables has saved considerable effort and improved the informative value of studies.

Following the idea of the invention further, a cutting device
30 according to the invention is suitable for a method for the machining of test workpieces, namely by means of a disk-shaped cutting tool. During an exclusively at least roughly radial movement of the tool, the tool is separated, ground and/or polished in succession, either simultaneously or directly
35 consecutively, particularly preferably during a single infeed

instruction from a machine control. According to a further advantageous embodiment, a wear indicator shows a remaining utilization capacity, in particular a remaining cutting volume and/or a remaining utilization time. The display particularly
5 preferably reacts independently to mechanical wear of the tool that exceeds a certain level, in particular in that a different color appears or becomes recognizable.

In its design, the tool already takes into account loads that
10 impair the quality of the workpiece such as the temperature and the tool fatigue.

The wear indicator now even provides information on the process parameters to be selected such as the tool speed and
15 the feed speed.

The invention avoids a separate performance of the "cutting," "grinding" and, if necessary, "polishing" processes. Setup work and thus machine and personnel costs are saved. Setup
20 work on machines that work with material-removing processes is time-consuming and labor-intensive, since, for example, during each changeover, all mounting surfaces for workpieces and tools have to be cleaned of machining residue such as material chips and cooling lubricants very thoroughly. Setup work on
25 machine tools usually results in the positions of the workpiece to be machined and possibly also in the tool being shifted from the machine's coordinate system and having to be found again. Setup, spanning and programming work on machine tools involve, especially concerning the uses according to the
30 invention in view, a certain potential for errors due to the complex work processes.

If a workpiece needs to be reworked after a cutting process, it must have a certain minimum size so that it can be fastened
35 with a clamping device for further processing. Especially with

very expensive materials or materials that are only available to a limited extent, the need to maintain a minimum workpiece size is associated with increased effort, such as a fastening of the workpiece on a support.

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In a particularly preferred embodiment, the tool according to the invention, in particular a cutting-grinding-polishing disk, comprises a disk-shaped base body, which preferably consists of a composite material, that uses, for example, a synthetic resin matrix similar to a cutting disk.

The tool according to the invention particularly preferably comprises, in particular, a cutting-grinding-polishing disk, at least one region with cutting edges acting in the radial working direction and at least one grinding and polishing region acting in the axial working direction. The cutting edges that are used are preferably designed to be geometrically indeterminate, for example, as a grained abrasive. Furthermore, the tool according to the invention, in particular a cutting-grinding-polishing disk, preferably has a central bore in the axial direction for fastening in the usual standardized tool holders of mobile and stationary cutting and grinding machines.

The feed movement of the tool according to the invention, in particular a cutting-grinding-polishing disk, in the radial working direction for the performance of the separating cut can, depending on the design of the machine technology used, take place mechanically or manually.

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The tool according to the invention, in particular a cutting-grinding-polishing disk, is provided with grinding and polishing agents on at least one disk flank. The grinding and polishing agents are more finely grained or toothed or designed for less material removal than the cutting agents in

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order to be able to achieve the intended improvement of the surface quality of the cut surfaces in the axial direction while at the same time being able to achieve an efficient separating machining in the radial direction.

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The tool according to the invention ensures its usability due to its combined geometric and kinematic properties and therefore does not have any of the problems and limitations described above. When the tool according to the invention touches the workpiece with its outer circumference in a radial infeed movement during the cutting process, several specific and deliberately exploited factors lead to a defined deflection of the disk in both axial directions without the cutting tool itself moving axially in its center. This leads to a widening of the cutting gap, which is for example 10% in this explanation. The cutting gap is therefore 10% wider than the radial outer geometry of the cutting tool would traditionally dictate. In this 10% wider cutting gap, the grinding/polishing layers applied to the disk sides take effect and are therefore not relevant for the cutting process. In any case, no effect is relevant in the radial direction, and the separation process itself is not influenced at all. The material thickness of the grinding/polishing layers is precisely matched to the resulting widening of the cutting gap. There is, therefore, no need for a wider cutting edge, in the shadow of which the grinding/polishing elements can act during the radial cutting process. Their relevance for the functioning of the invention now lies in the axial action, namely grinding/polishing.

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This axial deflection of the disk, and thus the widening of the cutting gap, is made possible by certain properties of the disk. The combination of material properties and geometric properties, such as the width of the disk, give the cutting disk a certain flexibility. This flexibility makes it possible

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for the process forces that occur during the cutting process to lead to an axial deflection of the disk of up to approximately 5% of the disk width in both directions. In addition, the operating speed of the cutting disk has a value
5 that corresponds to a multiple of one of the natural frequencies of the cutting disk. When in operation, the cutting disk performs axial vibrations, the amplitude of which is approximately up to 5% of the thickness of the disk. In addition, the cutting disk is not flat, but has an impact of
10 up to approximately 10% of the width of the disk. This impact additionally supports the widening of the cutting gap. The impact of these effects can be increased with a grinding/polishing layer that widens towards the center of the disk. This utilization of geometric and kinematic properties
15 that lead to an axial deflection of the tool according to the invention make it possible to dispense with a wide cutting edge. A radial consumption of the tool according to the invention is basically possible up to the tool holder of the operating machine. This leads to a more efficient use of the
20 tool and allows for the use of wear-prone binding materials for the abrasive grains responsible for the cutting process. This allows for a precise and yet efficient cut. The described axial deflection of the tool according to the invention also leads to an infeed of the grinding/polishing layers applied to
25 the cutting disk sides in the axial direction to the cut surfaces of the workpiece. This infeed ensures a clean grinding/polishing of the cut surfaces, regardless of the degree of wear on the grinding/polishing surfaces. No machine control is required for the grinding/polishing process of the
30 cut surfaces, which allows for the axial infeed of the grinding/polishing elements to the cut surfaces. The machine only has to provide a radial feed.

A preferably provided thickening of the flanks of the disk-
35 shaped tool according to the invention towards the center has

a supporting effect with regard to the axial movement of the grinding and polishing means towards the cut surfaces to be processed. The thickening is preferably carried out in a single or multiple gradation in order to hold the grinding and polishing surfaces parallel to the cut surfaces of the separating cut. The thickening can be realized in one or more layers.

As a result of the feed movement in a radial working direction when performing the separating cut, the tool according to the invention plunges into the workpiece and, when the tool according to the invention is plunged, it leads to a flat contact of the grinding and polishing surfaces with at least one cutting surface of the workpiece.

In a particularly preferred embodiment, the tool according to the invention, in particular a cutting-grinding-polishing disk, is provided with at least one channel along at least one side flank for an improved removal of chips, broken-off grinding material and/or cooling lubricant.

In a further preferred embodiment, the at least one grinding and polishing region present on at least one disk flank is designed without cooling channels.

In a preferred embodiment of the tool according to the invention, in particular a cutting-grinding-polishing disk, it is provided to have the grinding and polishing material become finer towards the center of the disk in order to have increasingly finer grinding and polishing agents come into contact as the depth of the tool in the workpiece increases and thus to achieve the highest possible surface quality in one operation.

In a particularly preferred embodiment, the tool according to the invention, in particular a cutting-grinding-polishing disk, is equipped with an optical wear indicator for the at least one grinding and polishing region. The at least one grinding and polishing region is preferably made up of multiple layers, as shown in Fig. 2 to 5, with the number of layers increasing towards the center of the disk. The individual layers are marked with individual color codes, which indicate the wear in both the radial and the axial direction. On the basis of the visible color codes, the current degree of wear and thus also the remaining capacity of the tool according to the invention, in particular a cutting-grinding-polishing disk, can be reliably determined.

Another preferred embodiment provides for the wear indicator to be designed in a single layer so that the wear of the grinding layer on the side of the pane reveals the differently colored support layer underneath, which is responsible for the cutting, and thus visually indicates the wear. This single-layer grinding layer on the side of the disk can also be segmented towards the center of the disk on the basis of a different grain size or simply in a different color. If the radial wear then reaches such a specific segment, conclusions can be drawn about the state of wear as well. Wear can thus be visualized in the radial and the axial direction.

In further preferred embodiments, other configurations of the wear indicator, for example using acoustic or electronic signals, are conceivable as well.

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The drawings show the following:

Fig. 1 - a side view of a disk flank with a view of the base body, the cutting edge and the grinding and polishing elements

of a tool according to the invention, in particular a cutting-grinding-polishing disk,

Fig. 2 - a side view of a disk flank showing the grinding
5 stages of a tool according to the invention, in particular a cutting-grinding-polishing disk

Fig. 3 - a side view of a disk flank showing the layer
structure of a tool according to the invention, in particular
10 a cutting-grinding-polishing disk,

Fig. 4 - a front view of the outer circumferential region with
a representation of the cutting edge and the step-like
structure of the grinding and polishing components of a tool
15 according to the invention, in particular a cutting-grinding-polishing disk,

and

20 Fig. 5 - an exploded drawing of a tool according to the invention, in particular a cutting-grinding-polishing disk, in a side view with a representation of the color code for displaying the wear of the cutting, grinding and polishing components

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The invention is explained in detail below with reference to the drawings listed above. Fig. 1 shows, in a side view, a particularly preferred embodiment of a disk-shaped tool 1 according to the invention, in particular a cutting-grinding-polishing disk. A base body 2, preferably formed from a composite material, which, similar to a commercially available cutting disk, already contains cutting agents of a defined grain size and thus has geometrically undefined cutting edges 5 on an outer circumferential area 3, is clearly shown. A fastening bore 7 is provided centrally in the axial direction
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in the base body 2 for fastening the disk-shaped tool 1 according to the invention, in particular a cutting-grinding-polishing disk, in the standardized tool holders of stationary or mobile cutting and grinding machines.

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In a particularly preferred embodiment, grinding and polishing surfaces 6 are applied on one side of a disk flank 4 of the base body 2. These grinding and polishing surfaces 6 make it possible for the cutting surface of a workpiece to be reworked simultaneously for the execution of the separating cut. The separating cut is carried out in a radial working direction VR shown in Fig. 2 and 4 by means of cutting edges 5 on the outer circumferential region 3 of the disk-shaped tool 1, in particular a cutting-grinding-polishing disk. The advance in a radial working direction VR can take place manually or mechanically, depending on the design of the cutting or grinding machine used.

In a first particularly preferred embodiment, channels 8 for removing chips or coolant from the cutting, grinding and polishing region are clearly shown. In a particularly preferred embodiment of the disk-shaped tool 1 according to the invention, in particular a cutting-grinding-polishing disk, the channels 8 run along the disk flank 4 in the radial direction towards the outer circumferential region 3. The channels 8 are preferably inclined against the direction of rotation D in order to avoid or at least reduce a clogging of the channels 8 during a movement in the radial advance direction VR.

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In a particularly preferred second embodiment, although not shown here, the disk-shaped tool 1 according to the invention, in particular a cutting-grinding-polishing disk, is designed without channels 8.

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In further particularly preferred embodiments, although not shown here, the disk-shaped tool 1 according to the invention, in particular a cutting-grinding-polishing disk, is designed with single-layer grinding/polishing elements, with and
5 without channels.

Fig. 2 shows, in a side view of a disk flank 4, the representation of the grinding stages of a disk-shaped tool 1 according to the invention, in particular a cutting-grinding-polishing disk. The disk-shaped tool 1 according to the
10 invention, in particular a cutting-grinding-polishing disk, is provided with grinding and polishing agents on at least one disk flank 4. The grinding and polishing agents are finer grained or toothed or designed for less material removal than
15 the cutting edges 5 in order to be able to achieve the intended improvement in the surface quality of the cut surfaces.

In order to bring the grinding and polishing surfaces 6 of the disk-shaped tool 1 according to the invention, in particular a
20 cutting-grinding-polishing disk, as shown in Fig. 1, into engagement in an axial working direction VA shown in Fig. 4, a thickening of the at least one flank 4 of the disk-shaped tool provided for engagement, which preferably achieved by means of
25 process-related vibrations of the tool 1, has a supporting effect in the embodiment shown. The thickening is preferably realized in a single or multiple gradation 40 in order to hold the grinding and polishing surfaces 6 parallel to the cut surfaces of the separating cut. The movement in an axial
30 working direction is amplified by vibrations of the disk-shaped tool 1, in particular a cutting-grinding-polishing disk, which are typical for the process, in an axial direction.

Graduations 40 which delimit the surface of a first grinding and polishing stage 10 and the surface of a second grinding and polishing stage 11 can be seen. In a particularly preferred embodiment of the disk-shaped tool 1 according to the invention, in particular a cutting-grinding-polishing disk, the grain size or tothing of the cutting edges 5 is coarser than the grain size or the tothing of the surfaces of the grinding and polishing stages 10, 11. The grain size or tothing of the surface of the second grinding and polishing stage 11 is particularly preferably finer than the grain size or tothing of the surface of the first grinding and polishing stage 10.

In the course of a separating cut in a radial feed direction, the surface of the first grinding and polishing stage 10 first comes into engagement with at least one cutting surface of the separating cut and reworks the at least one separating cut surface. By continuing the disk-shaped tool 1, in particular a separating-grinding-polishing disk, in a radial working direction VR, the surface of the second grinding and polishing stage 11 also comes into engagement and completes the grinding and polishing process of the at least one surface of the separating cut to the desired surface quality.

In addition to the shaded areas of the first and second grinding and polishing stage, Fig. 2 shows the dotted surfaces 12 of the channels 8 that are not initially engaged in a grinding and polishing process and the exposed region of the base body 2 that is shown as a white region.

Further preferred embodiments of the disk-shaped tool 1 according to the invention, in particular a cutting-grinding-polishing disk, can be designed with a higher or even a lower number of different grinding and polishing stages.

Fig. 3 shows, in a side view of a disk flank 4, a representation of the layer structure of a particularly preferred embodiment of the disk-shaped tool 1 according to the invention, in particular a cutting-grinding-polishing disk.

In the particularly preferred embodiment shown, a total of 3 layers of grinding and polishing agent 20, 21, 22 are applied to a base body 2 in an abrasive paper-like form by gluing.

Alternative embodiments of disk-shaped tools 1 according to the invention, in particular cutting-grinding-polishing disks, in which the structure of the grinding and polishing agent layers 20, 21, 22 is realized by means of a different method, for example by spraying, are conceivable as well.

The dotted regions identify a single layer 30 of a first grinding layer 20 applied to the base body 2.

The regions alternating with solid and dashed lines identify two-layer layers 31 of a first grinding layer 20 and a second grinding layer 21 applied to the base body 2.

The regions shaded with continuous lines identify three-layer layers 32, consisting of three grinding layers 20, 21, 22.

The increase in the thickness of the grinding and polishing agent layers from a single layer 30 and a two-layer layer 31 to a three-layer layer 32, with the layers being aligned parallel to the radial feed direction VR, leads to the recognizable gradations 40.

The use of the disk will lead to a degradation of the grinding layers 20, 21, 22. The removal of the layer lying on the outside in the radial direction, starting at the outer circumferential region 3, reveals the respective layer

underneath, so that, both in the axial and in the radial working direction, the desired sequence of grinding stages one and two 10, 11, is preserved until the disk-shaped tool 1 according to the invention, in particular a cutting-grinding-polishing disk, is worn.

Fig. 4 shows a front view, not to scale, of the outer circumferential region 3 with the cutting edges 5 (not shown), a base body 2 with the structure of the grinding and polishing layers 20, 21, 22 of a disk-shaped tool 1 according to the invention, in particular a cutting-grinding-polishing disk. The one-layer layers 30, two-layer layers 31 and three-layer layers 32 of the grinding and polishing agent structure are clearly shown. The layers 30, 31, 32 are clearly separated from one another by gradations 40.

The radial feed direction VR and the axial feed direction VA are illustrated by arrows.

Fig. 5 shows an exploded view of a disk-shaped tool 1 according to the invention, in particular a cutting-grinding-polishing disk, in a side view of a particularly preferred embodiment with an optical wear indicator, in particular for the cutting, grinding and polishing components. The grinding and polishing agent layers are formed by differently colored segments. The segments are arranged one above the other and next to one another on a base body 2 in the axial direction of the base body 2 in such a way that progressive wear can be recognized and the remaining useful life can be determined by using the recognizable color codes 41, 42, 43, 44.

In a particularly preferred embodiment, the grinding and polishing elements with a color code one 41 form the grinding and polishing agent layer closest to the base body of the surfaces of the grinding and polishing stage two 11 described

in more detail in Fig. 2. The grinding and polishing elements with the color code one 41 are applied to the base body 2 in such a way that gaps between the elements promote the formation of channels 8 in the above grinding and polishing agent layers 20, 21, 22. In the axial direction of the base body 2, elements with a color code two 42 and a color code three 43 are arranged successively on the grinding and polishing elements with the color code one 41. The progressive wear of the surfaces of the grinding and polishing stage two 11 can thus be read from the color code one 41, the color code two 42 and the color code three 43. If the color code one 41 becomes visible, the surfaces of the grinding and polishing stage two are approaching the wear limit.

A color code four 44 is provided to evaluate the surfaces of the grinding and polishing stage one 10. If, for example, due to the radial wear of a base body 2 made of composite material, the usable surface of grinding stage one decreases, this decrease can be recognized and assessed by using the color code four 44. A wear of the surfaces of grinding step one 10 in an axial direction is recognized by the fact that instead of the color code four 44, the color of the base body 2 can be seen.

In a particularly preferred embodiment of the disk-shaped tool 1 according to the invention, in particular a cutting-grinding-polishing disk, the dimensions of the cutting, grinding, and polishing elements are matched in such a way that they can be replaced as simultaneously as possible.

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List of reference signs:

1	Disk-shaped tool, especially a cutting-grinding-polishing
5	disk
2	Base body
3	Outer peripheral region
4	Disk flank
5	Cutting edge
10	6 Grinding and polishing surface
7	Fastening opening, especially bore
8	Channel
10	Surface grinding and polishing stage one
15	11 Surface grinding and polishing stage two
12	Surface channel
20	20 First grinding and polishing agent layer
21	Second grinding and polishing agent layer
20	22 Third grinding and polishing agent layer
30	One-layer layer
31	Two-layer layer
32	Three-layer layer
25	
40	Gradation
41	Color code one
42	Color code two
43	Color code three
30	44 Color code four
VR	Radial feed direction
VA	Axial feed direction
D	Direction of rotation
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Claims

1. A disc-shaped separating tool, for rotating (D) cutting
of an elongated, stationarily clamped workpiece, at
exclusively radial feed (VR) of the separating tool in
relation to its rotation axis at least roughly in the
direction of the clamped workpiece, with
geometrically undetermined separating blades (5) in a
radially outer circumferential area (3) of the
separating tool,
two opposing disc flanks (4) in a radially inner area
in relation to the circumferential area (3), and
with an axial attachment opening (7) on the radial
inside,

characterised in that

the separating tool is formed as a separating-grinding-
polishing disc (1), specifically
for rotating (D) cutting of the workpiece clamped at
least roughly orthogonally to the radial feed (VR)
along its rotation axis via the separating blades (5)
radially arranged on the outside, and
for rotating grinding, with the disc flanks (4) being
at least partly applied with grinding media and
optionally also with polishing media (6, 20, 21, 22).

2. The disc-shaped separating tool in accordance with
claim 1,
characterised in that it has a defined flexibility and
a defined imbalance.

3. The disc-shaped separating tool in accordance with
claims 1 or 2, characterised in that it has a disc-
shaped basic body (2) made of a composite material,
e.g. using a synthetic resin matrix, or of a composite

material that already contains separating agent of a defined grain.

4. The disc-shaped separating tool in accordance with one
5 of the preceding claims,
characterised by at least one area with the separating
blades (5), acting in the radial working direction
(VR), and at least one grinding area acting in the
axial working direction (VA), and optionally also a
10 polishing area (6), wherein preferably wearing binding
materials of the grinding grains responsible for
separation are used as separating blades (5), and
wherein its radial wear generally is possible up to the
tool holder of an operating machine.

15 5. The disc-shaped separating tool in accordance with one
of the preceding claims,
characterised in that the grinding media and optionally
also the polishing media (6) are made of geometrically
20 undetermined blades, wherein the grinding media and
optionally also the polishing media (6) have a finer
grain or serration or are designed for a lower material
removal than the separating media (5) and/or that at
least one of the two disc flanks (4) is thickened in
25 one or multiple steps as compared to the material
thickness in the radially outer circumferential
area (3) from the radial outside to the radial inside,
in particular by way of the grinding media and
optionally also the polishing media (6).

30 6. The disc-shaped separating tool in accordance with one
of the preceding claims,
characterised in that, from the radial outside to the
radial inside, initially grinding areas and, at least
35 increasingly towards the radial inside or eventually

exclusively at the radial inside, polishing areas on at least one of the disc flanks (4), are arranged.

7. The disc-shaped separating tool in accordance with one
5 of the preceding claims,
characterised in that different geometrically
undetermined tool blades and/or materials of different
grains are arranged in the circumferential area (3) and
on at least one of the disc flanks (4), in particular
10 with increasingly fine grinding and polishing materials
towards the disc centre.
8. The disc-shaped separating tool in accordance with one
of the preceding claims,
15 characterised in it that there is at least one wear
display (41 to 44).
9. The disc-shaped separating tool in accordance with
claim 8,
20 characterised in that the wear display (41 to 44)
reacts independently to mechanical wear of the
separating tool, in particular by a different colour
appearing or becoming evident, particularly preferably
detectable in the radial and axial directions each.
- 25
10. A radial separating method for processing axially
elongated workpieces by way of a disc-shaped separating
tool with geometrically undetermined separating blades
(5),
30 **characterised in that** it is performed with a disc-
shaped separating tool in accordance with one of claims
1 to 9 and that a clamped workpiece is cut and/or
polished during a single strictly radial feed movement
of the separating tool, and, optionally, wherein a
35 lateral deflection of the axially stationarily rotating

separating tool brings this into grinding and/or polishing axial active contact with the workpiece to be processed at least with one laterally attached grinding and polishing surface (6, 20, 21, 22).

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11. The radial separating method in accordance with claim 10, characterised in that the lateral deflection of the rotating separating tools is achieved by a flexibility and a defined imbalance of the separating tool, wherein combined geometrical and kinematic properties of the separating tool lead to a lateral deflection of the separating tool as soon as the separating tool rotating at working speed touches a workpiece with its outer circumference (3) or its separating blade (5) in the radial feed direction (VR).

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12. The radial separating method in accordance with claim 11, characterised in that the total lateral deflection is about 10 percent of the width of the separating-grinding-polishing disc (1).

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13. The radial separating method in accordance with one of claims 10 to 12, characterised in that the operating revolutions of the separating-grinding-polishing disc (1) has a value that corresponds to a multiple of one of the natural frequencies of the separating-grinding-polishing disc (1).

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14. The radial separating method in accordance with claims 10 to 13, characterised in that a thickening of the disc flanks (4) supports the axial interlock of the at least one grinding and polishing medium (6, 20, 21, 22).

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15. The radial separating method in accordance with one of claims 10 to 14,
characterised in that a wear display (41 to 44)
5 displays a remaining residual usage capacity, in particular a remaining cutting volume and/or a remaining usage time.
16. The radial separating method in accordance with claim
10 15, characterised in that the wear display reacts independently to mechanical wear of the tool, in particular by a different colour appearing or becoming evident.