

(19) **DANMARK**

(10) **DK/EP 2916985 T3**



(12) **Oversættelse af
europæisk patentskrift**

Patent- og
Varemærkestyrelsen

-
- (51) Int.Cl.: **B 23 C 5/08 (2006.01)** **B 23 C 5/14 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2018-03-19**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2018-01-31**
- (86) Europæisk ansøgning nr.: **13776753.9**
- (86) Europæisk indleveringsdag: **2013-10-07**
- (87) Den europæiske ansøgnings publiceringsdag: **2015-09-16**
- (86) International ansøgning nr.: **EP2013070755**
- (87) Internationalt publikationsnr.: **WO2014072134**
- (30) Prioritet: **2012-11-07 DE 102012220246**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
- (73) Patenthaver: **Haertel, Meiko, Büttenberger Straße 118, 58256 Ennepetal, Tyskland**
- (72) Opfinder: **Haertel, Meiko, Büttenberger Strasse 118, 58256 Ennepetal, Tyskland**
Sprenger, Helmut, Talsperrenweg 33b, 58256 Ennepetal, Tyskland
- (74) Fuldmægtig i Danmark: **Plougmann Vingtoft A/S, Rued Langgaards Vej 8, 2300 København S, Danmark**
- (54) Benævnelse: **RINGFORMET VÆRKTØJ TIL BEARBEJDNING AF ET ARBEJDSSTYKKE**
- (56) Fremdragne publikationer:
CN-Y- 201 140 295
DE-A1- 10 316 371
DE-A1- 19 929 201
DE-U1- 9 316 953
GB-A- 2 354 728
JP-A- 2005 334 981
US-A- 56 033

Description

The invention relates to a ring-shaped tool for processing a workpiece according to the pre-characterising clause of claim 1 and to the use of a tool of this kind, in particular for opening a weld seam.

5

Milling tools are known from the prior art for removing material from workpieces. Milling tools of this kind are capable of immersing into the workpiece and of removing material. One drawback of milling tools of this kind is that they are not suitable for use with handheld machines. This applies in particular if the material to be removed is a material of a weld seam, which is to be removed, in other words opened. The reason for this is the extreme hardness of the material in the region of the weld seam.

10

DE 93 16 953 U1 discloses a cutting tool for milling slits, the tool comprising a carrier rotating around an axis, and having segment elements which are provided around its circumference and protrude beyond the carrier. The segment elements are circular, U-shaped or V-shaped.

15

DE 103 16 371 A1 discloses a profile cutter having a base body which is connectable to a control rod as a carrier for a plurality of cutting tips which are distributed around the circumference of the base body and are affixed thereto in an exchangeable manner using a clamping device comprising clamping screws and clamping surfaces.

20

DE 199 29 201 C2 discloses a tool for chip-removing processing at least one workpiece with a central retaining area for fastening to a driving element and with a ring-shaped working area having teeth distributed around the circumference of the working area for processing the workpiece, wherein the teeth are in each case spherically formed in the working area.

25

WO 2011/136 275 A1 and WO 2003/070 409 A1 disclose a circular cutting disc. DE 10 2004 027 032 A1 discloses a material-removing tool, in particular a milling cutter for disconnecting weld seams, in particular laser weld seams on auto body sheets, comprising a cutting wheel, characterised in that at least on one side of the cutting wheel, at least one spacer disc is arranged having a smaller radius than the material-removing part of the cutting wheel.

A tool having the features of the pre-characterising clause of claim 1 is known from US 56, 033.

30

In contrast thereto, the invention is based on the object of creating an improved tool for processing a workpiece, as well as a method for using a tool of this kind.

The objects underlying the invention are achieved by the features of the independent claims. Preferred embodiments of the invention are given in the dependent claims.

5 A ring-shaped tool in particular for chip-removing processing a workpiece is disclosed, wherein the tool has a fastening area for fastening onto a rotatable drive shaft, wherein the fastening area is centred with relation to the ring shape of the tool, wherein the tool also has teeth arranged around the circumference of the tool, wherein the teeth are arranged on the head end of the tool, wherein the teeth have an arc shape running in the axial direction in relation to the ring shape, the arc shape having a summit, wherein the teeth are formed mirror symmetrically relative to the ring surface of the tool passing through the summit.

10 As a result of these features, the tool according to the invention has the advantage that manual operation of the tool during immersing and material-removing processing of a workpiece is thereby possible. As a result of the arc shape, the tool first encounters the workpiece only with a minimal contact area, resulting in a minimisation of the forces exerted onto the workpiece by the tool.

15 According to one embodiment of the invention, the teeth extend at least partially from the head end of the tool over the front edge of the tool. This could have the advantage that on the one hand the contact area of the tool with the workpiece increases continuously up to a point defined by the geometry of the tool. The force exerted onto the workpiece by the tool increases continuously and controllably such that the tool can be continuously operated manually. On the other hand, a corresponding geometry could cause the teeth arranged on the front edge of the tool to continuously convey material which is removed to the side of the workpiece. As a result, no build-up of material develops, and the surface processed by the tool will be milled out in a flatter and more even manner. This is relevant in particular if a channel is formed by the material which is removed, which channel should subsequently be filled with a new weld seam.

20 According to the invention, the arc shape is given by two circles which transition tangentially into one another in a contour-less way, the circles having a first circle radius and a second circle radius. The circle centre for the first circle radius is located below the summit and the circle centre for the second circle radius is located below the circle centre of the first circle radius as considered in the radial direction, wherein the first circle radius is smaller than the second circle radius.

25 As a result of these features, the tool according to the invention has the advantage that a highly efficient cutting geometry can be provided which allows for manual operation of the tool in a particularly effective way. Especially the use of the arc shape described above allows for the provision of an optimal

compromise between material removal, manageability and the conveying of material to the side of the workpiece.

For example, the distance between the circle centres of the first circle radius and the second circle radius as considered in the radial direction of the tool is between 0.5 and 0.7 times the difference between the first and the second circle radius. This allows for working very smoothly as a consequence of the slight curvature of the teeth.

According to one embodiment of the invention, the teeth, as considered in the radial direction of the tool, extend from the head end over the front edge of the tool only up to 0.5 times the distance between the circle centres of the first and second circle radius as considered in the radial direction of the tool. This could have the advantage that even with minimal material consumption in respect of the tool, it is possible to conduct the material removal in a manually-operated manner and to convey removed material to the side. Even if the tool is deeply immersed into the workpiece, primarily the head end of the tool still operates to effect material removal. The front edge conveys the material and if necessary broadens the channel created by the removal of material. By dispensing with a further extension of the teeth beyond 0.5 times the distance as considered in the radial direction of the tool, this mode of operation is not affected. In contrast thereto, this mode of operation is supported since the tool becomes lighter and as a result can be manually operated more easily.

According to the invention, the ratio between the second circle radius and the first circle radius is between 14 and 17. This special choice of ratio of the radii could have the effect of ensuring a particularly high level of smooth running during material removal. After immersion of the tool into the workpiece, an optimal compromise between material removal on the head end of the tool as well as on the front edge of the tool results. This could have the effect inter alia that the heat build-up created by the material removal at the tool is uniformly distributed. This increases the longevity of the tool.

According to one embodiment of the invention, the teeth located at the head end of the tool are curved in the radial direction, in other words are designed with a twist. This could support the conveying of the removed material to the side such that the tool can continuously remove material without being hindered. As a result, no contaminations will be left in the channel created by the removal of material, and this simplifies subsequent processing of the channel, for example by welding or filling.

According to one embodiment of the invention, the curvature extends from the head end over the front edge. The curvature is preferably constant from the head end over the front edge. The efficiency of said material removal may also be kept constant thereby independently of the depth of immersion of the

tool into the workpiece for processing. The cutting speed of the tool is thereby nearly constant independently of the depth of immersion.

5 The tool according to the invention can be provided for opening a weld seam. Because of the particular material hardness of weld seams and the necessary precision in tool guidance when opening the weld seam, said tool could be particularly suited to this kind of work. Despite the material hardness, the tool uniformly removes the material due to its cutting geometry and still provides a very high level of smooth running such that even manual operation is possible. In addition, the arc shape of the tool results in a channel in the machined workpiece, which can subsequently be welded up very easily.

10 According to one embodiment of the invention, the tool is formed in one piece. As a result, it is inexpensive to produce and the mechanical durability is increased.

In a further aspect the invention relates to the use of a tool described above for application with hand tools or with cutting machines.

According to one embodiment of the invention, the application is the opening of a weld seam.

15 Preferred embodiments of the invention will be described in more detail in the following with reference to the drawings, in which:

Fig. 1 shows a perspective view of a tool having driving means.

Fig. 2 shows a schematic cross-sectional view of a tool having driving means.

Fig. 3 shows a perspective side view of a tool having driving means.

Fig. 4 shows a schematic view of method steps for processing a workpiece.

20 In the following, similar elements are denoted with the same reference numerals.

Fig. 1 shows a perspective view of a tool 100 having driving means 102, for example a manually operable angle grinding machine. The driving means 102 rotationally drives the tool 100 using a shaft 104. Using teeth 106 of the tool, the tool can remove material from a workpiece. The tool 100 has a ring-shaped form, with the teeth 106 being arranged over the circumference of the tool.

25 Fig. 2 shows a schematic cross-sectional view of the tool 100 shown in Fig. 1, wherein it is now apparent that the shaft 104 acts on a fastening area 200 of the tool 100. Furthermore, the cut through a single

tooth 106 can be seen in the cross-sectional view in Fig. 2, with the tooth 106 extending at least partially from the head end 202 over the front edge 204 of the tool. As considered in the axial ring direction (in other words from left to right in Fig. 2), the tooth 106 has an arc shape having a summit and is formed mirror symmetrically relative to the ring surface of the tool passing through the summit. As a result, the teeth are formed on both sides of the tool and the teeth on the left side have a right-hand twist and are right-hand cutting while the teeth on the right side, which is facing towards the driving element, have a left-hand twist and are left-hand cutting.

The arc shape can be described in Fig. 2 by two circles which transition tangentially into one another in a contour-less way. The arc shape described by the two circles can be defined by two circle radii, namely a first radius 206 and a second radius 208. A particularly high level of smooth running of the tool during removal of material results due to the ratio of a factor of 15 between the two radii.

As is further illustrated in Fig. 2, the tooth 106 only extends approximately to the circle centre of the second radius 204 on the front edge 204. As considered in the radial direction of the tool 100, the distance 210 between the circle centres of the first and second circle radii is approximately 0.6 times the difference between the first and the second circle radii.

Fig. 3 shows in a perspective side view of the tool 100 that the teeth 106 are curved from the head end of the tool as considered in the radial direction and that the curvature 300 extends from the head end over the front edge. This serves the efficient removal of material (chip removal) when using the tool for cutting applications. This results in increased smooth running of the tool. This may be increased further by the fact that along the curvature 300 the teeth are interrupted in a continuous or discontinuous way.

To find an optimal compromise between manual operability of the tool, smooth running of efficiency of material removal, for example for processing aluminium, the cutting angle of the teeth could be -20° the clearance angle $+10^\circ$ and the twist 30° . The teeth are preferably made of tungsten carbide.

Fig. 4a shows a workpiece 404 having a weld seam 406. The tool 100 now serves to open the weld seam, in other words the welded root, the tool being set into rotatory motion in the direction 400 by a drive (not shown here). The tool 100 is placed onto the weld seam 406 in the direction 402 and then continuously removes material.

Fig. 4b shows the result, with the created channel 408 having the tooth shape of the tool 100. The channel 408 can now be welded again or be otherwise filled with material.

LIST OF REFERENCE NUMERALS

	100	tool
	102	driving element
5	104	shaft
	106	tooth
	200	fastening area
	202	head end
	204	front edge
10	206	first radius
	208	second radius
	210	distance
	300	curvature
	400	direction of rotation
15	402	direction
	404	workpiece
	406	welded root
	408	channel

Patentkrav

1. Ringformet værktøj (100) til bearbejdning af et arbejdsstykke, hvor værktøjet (100) har et fastgørelsesområde (200) til fastgørelse på en roterbar drivaksel (104), hvor fastgørelsesområdet er centreret i forhold til ringformen af værktøjet, hvor værktøjet (100) også har tænder (106) anbragt omkring omkredsen af værktøjet (100), hvor tænderne (106) er anbragt på hovedsiden (202) af værktøjet (100), hvor tænderne (106) har en bueform, der løber i den aksiale retning i forhold til ringformen, hvor bueformen har et toppunkt, hvor bueformen er givet af to cirkler med en første cirkelradius (206) og en anden cirkelradius (208), hvor cirkelmidtpunktet for den første cirkelradius (206) er placeret under toppunktet, og hvor cirkelmidtpunktet for den anden cirkelradius (208) er placeret under cirkelmidtpunktet for den første cirkelradius (206) i den radiale retning, hvor den første cirkelradius er mindre end den anden cirkelradius, **kendetegnet ved, at** tænderne (106) er dannet spejlsymmetrisk i forhold til ringfladen af værktøjet (100), der passerer igennem toppunktet, hvor de to cirkler overgår konturløst tangerende til hinanden, hvor forholdet mellem den anden cirkelradius (208) og den første cirkelradius (206) er mellem 14 og 17.
2. Værktøjet (100) ifølge krav 1, hvor tænderne (106) strækker sig mindst delvist fra hovedsiden (202) over forsiden (204) af værktøjet (100).
3. Værktøjet (100) ifølge krav 1, hvor afstanden (210) mellem cirkelmidtpunkterne af den første cirkelradius og den anden cirkelradius i den radiale retning af værktøjet (100) er mellem 0,5 og 0,7 gange forskellen mellem den første cirkelradius (206) og den anden cirkelradius (208).
4. Værktøjet (100) ifølge krav 1, hvor tænderne (106), som set i radial retning af værktøjet (100), strækker sig fra hovedsiden (202) over forsiden (204) af værktøjet (100) kun op til 0,5 gange afstanden (210) mellem cirkelmidtpunkterne

af den første og den anden cirkelradius som set i den radiale retning af værktøjet (100).

5. Værktøjet (100) ifølge et hvilket som helst af de foregående krav, hvor
5 tænderne (106) at hovedsiden (202) af værktøjet (100) er krumme (300) i den radiale retning.

6. Værktøjet (100) ifølge krav 5, hvor krumningen (300) strækker sig fra hovedsiden (202) over forsiden (204).

10

7. Værktøjet (100) ifølge krav 6, hvor krumningen (300) er konstant fra hovedsiden (202) over forsiden (204).

8. Værktøjet (100) ifølge et hvilket som helst af de foregående krav, hvor
15 værktøjet (100) er dannet i ét stykke.

9. Anvendelse af et værktøj (100) ifølge et hvilket som helst af de foregående krav til anvendelse med håndværktøj eller med skæremaskiner.

20 10. Anvendelsen ifølge krav 9, hvor anvendelsen er åbningen af en svejsesøm (406).

Fig. 1

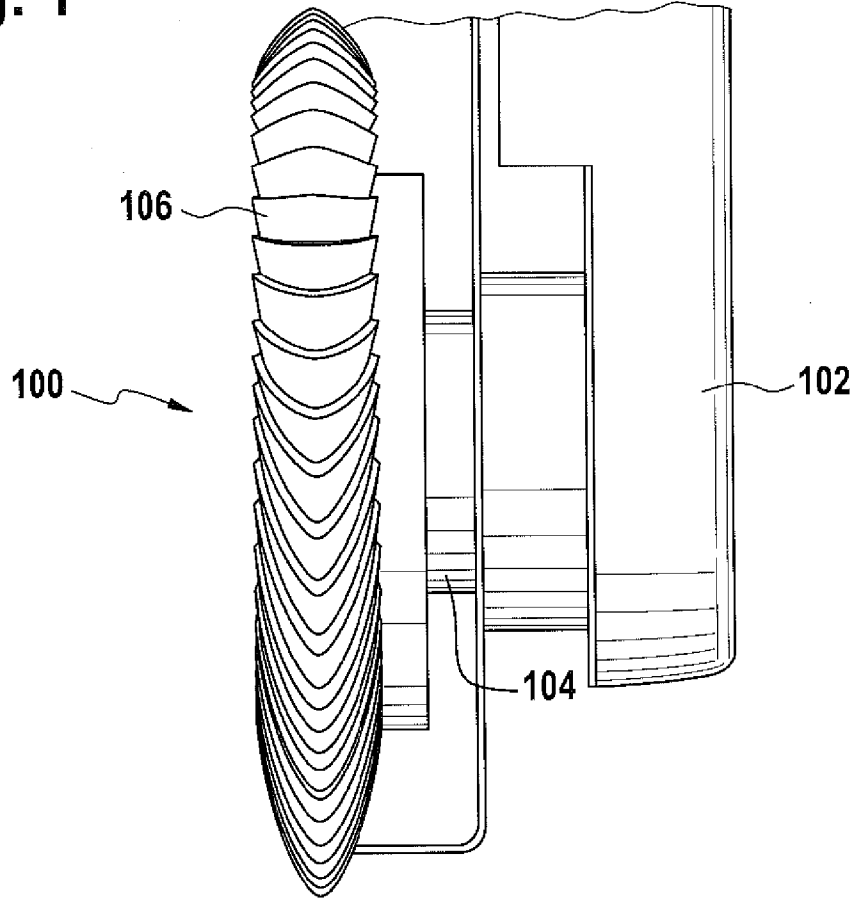


Fig. 2

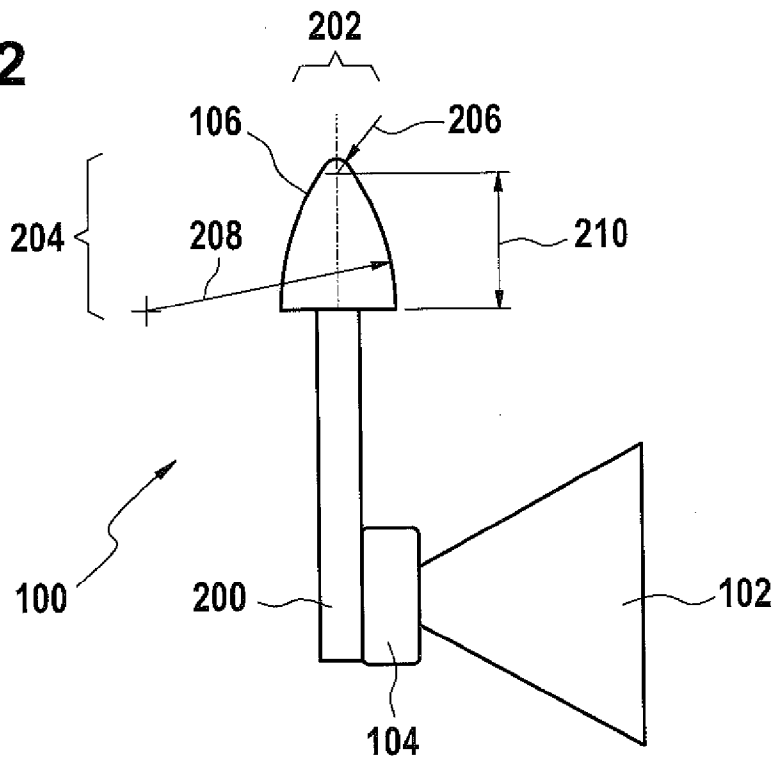


Fig. 3

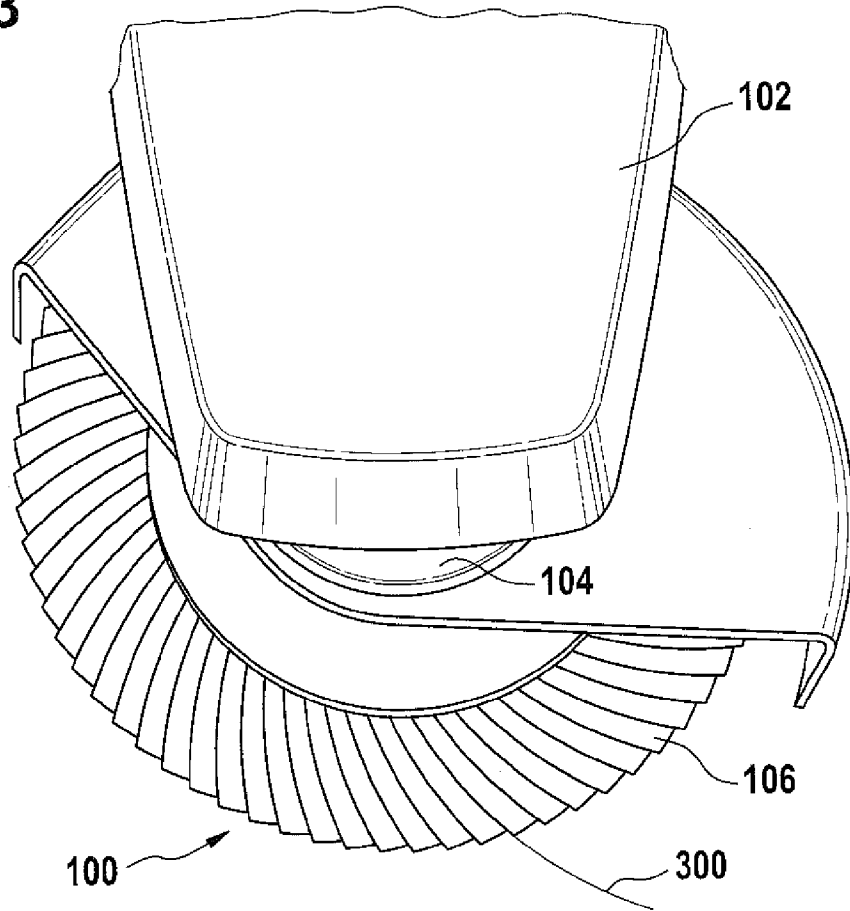


Fig. 4a

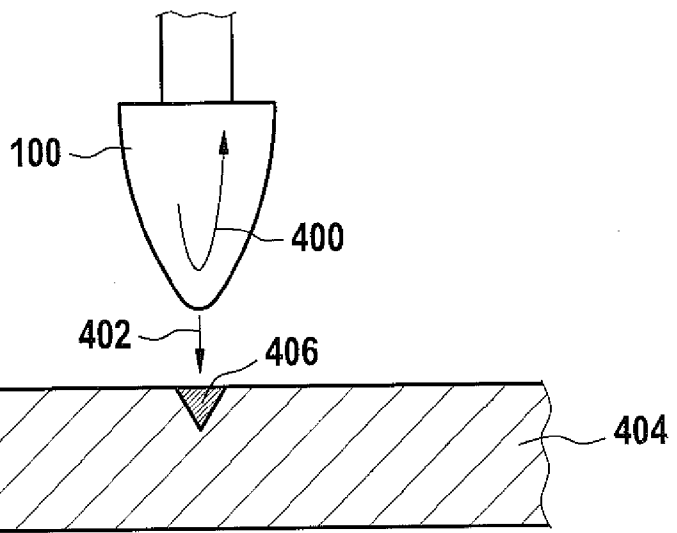


Fig. 4b

