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(54) **TOOL-HOLDING DEVICE FOR AN INSERT TOOL WITH AT LEAST ESSENTIALLY DISK-SHAPED HUB**

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451/359, 358, 344, 541

See application file for complete search history.

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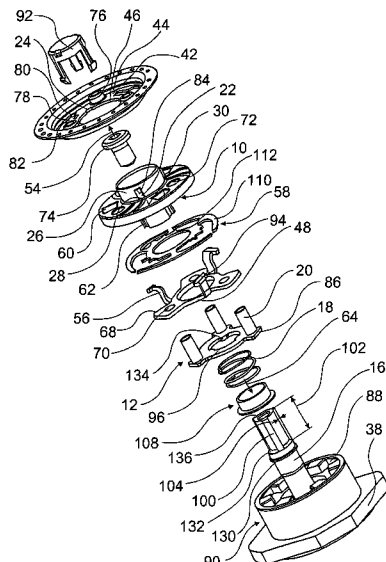
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(57) **ABSTRACT**

A tool-handling device for an insert tool (14) equipped with an at least essentially disk-shaped hub (42), in particular for a hand guided angle grinder (32) or a hand-guided circular saw, having a drive shaft (16) and a drive device (12) equipped with at least one locking element (20) that is supported so that it is able to move in relation to a spring element (18) in order to fix the insert tool (14) in a form-locked manner in the circumference direction (50, 52).

The drive shaft (16) has at least one form-locking element (100) formed onto it in a non-cutting manner in order to connect it in a form-locked manner in the circumference direction (50, 52) to a drive torque-transmitting mechanism of the drive device (12).

12 Claims, 3 Drawing Sheets



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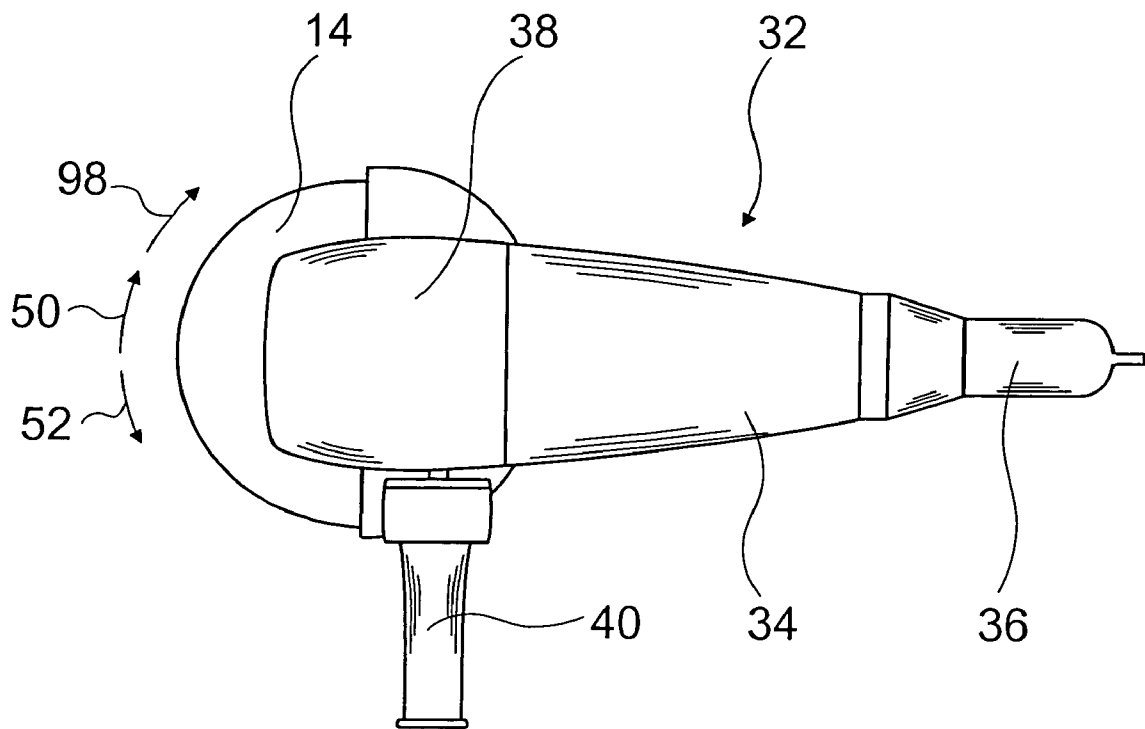


Fig. 1

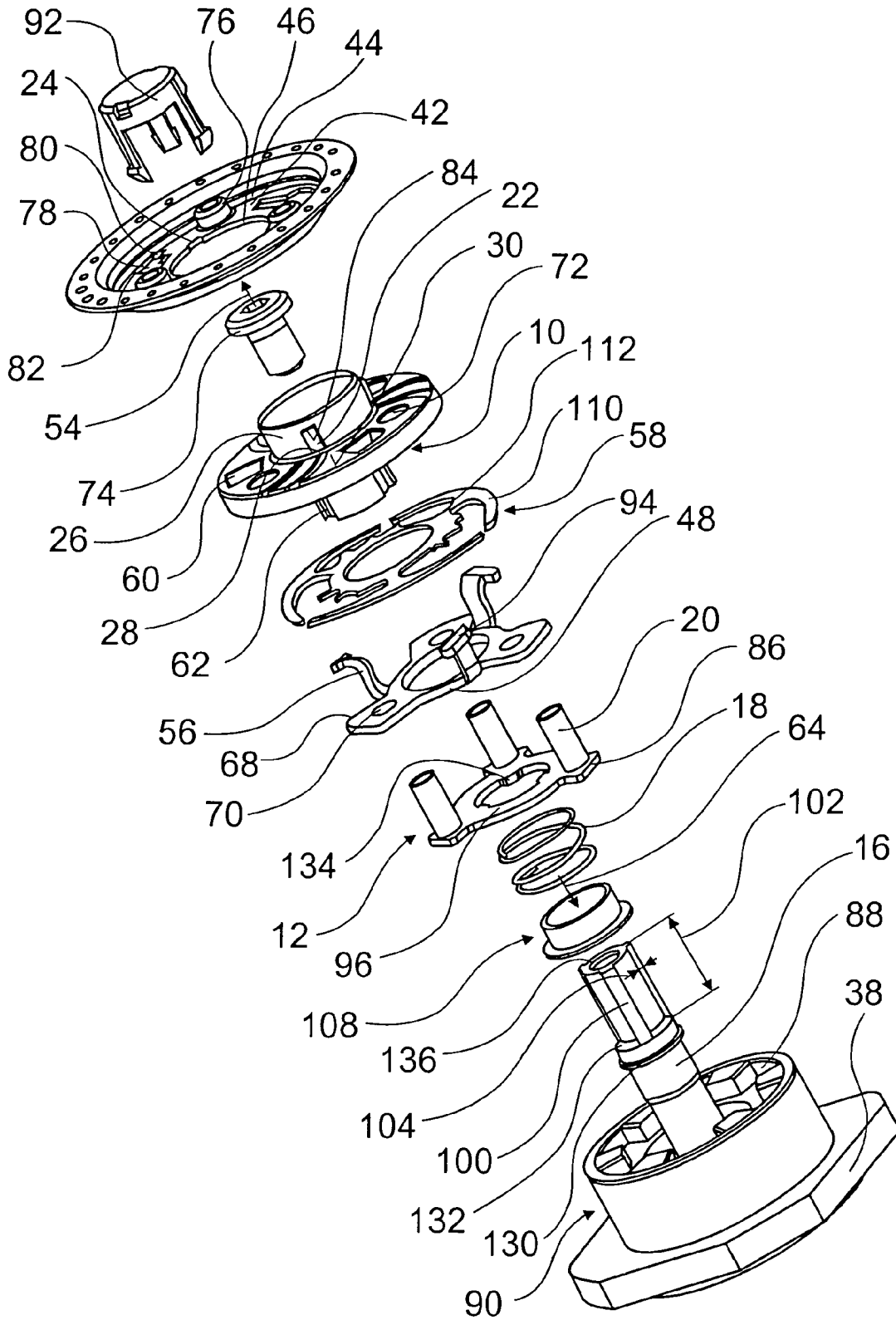


Fig. 2

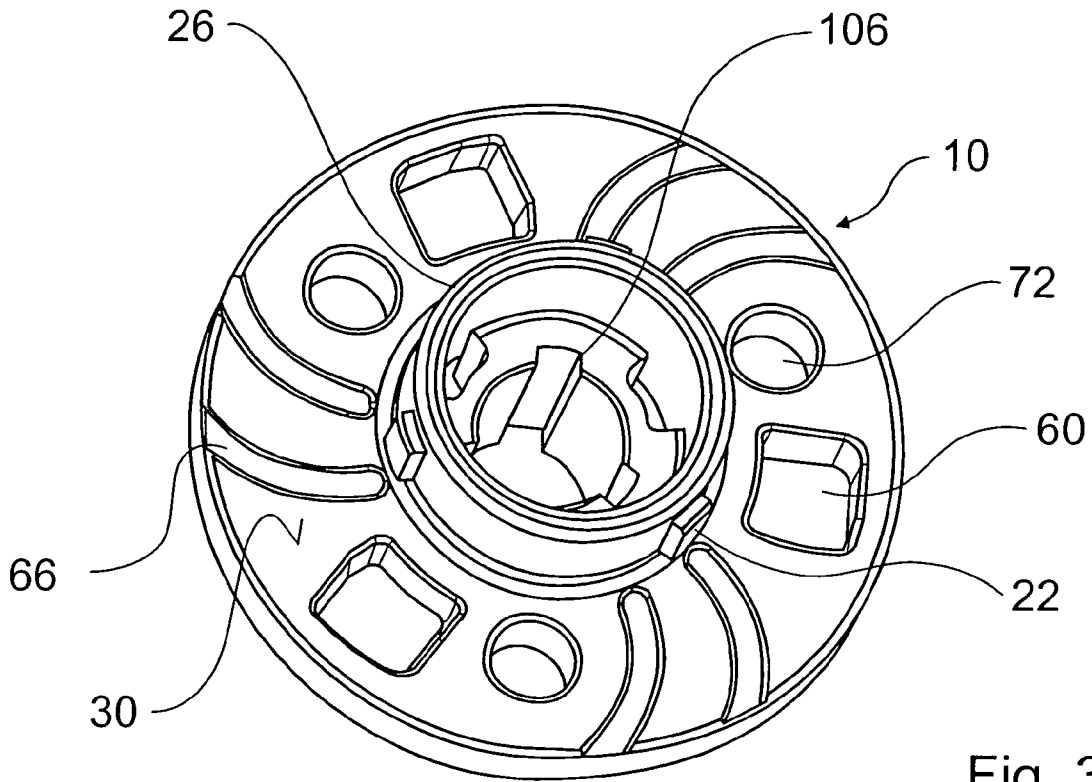


Fig. 3

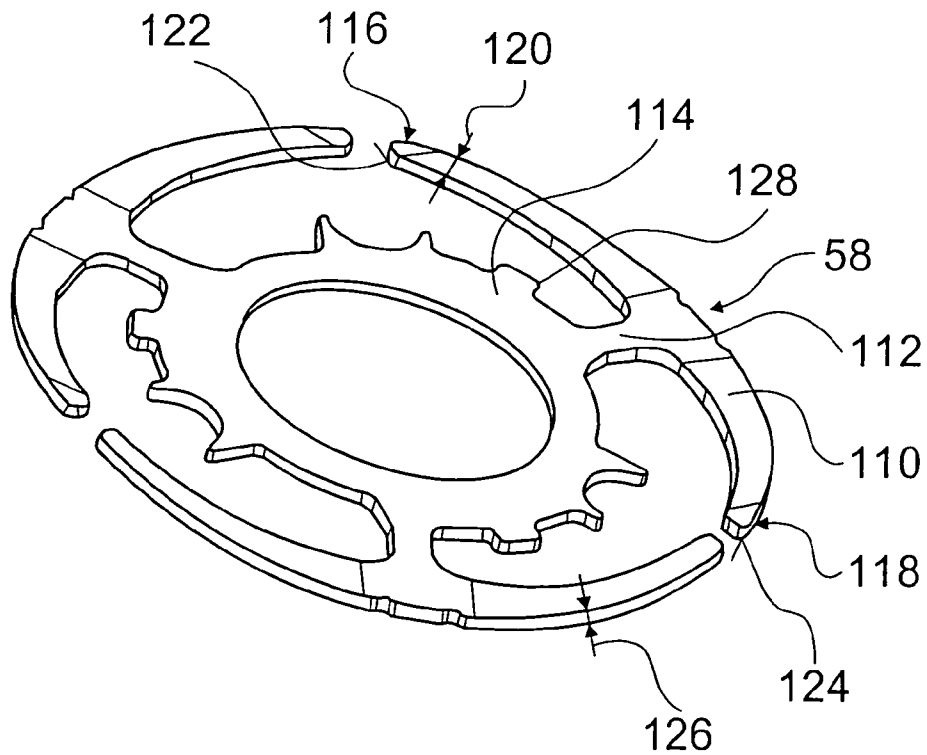


Fig. 4

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**TOOL-HOLDING DEVICE FOR AN INSERT
TOOL WITH AT LEAST ESSENTIALLY
DISK-SHAPED HUB**

PRIOR ART

The present invention is based in particular on a tool-holding device according to the preamble to claim 1.

DE 100 17 458 A1 has disclosed a species-defining tool-holding device of an angle grinder for an insert tool with a disk-shaped hub. The tool-holding device has a drive shaft and a drive device; the insert tool can be operationally connected to the drive device by means of three locking elements of the drive device that are supported so that they can move in relation to a spring element, which locking element engages in a locking fashion in the operating position of the insert tool and fixes the insert tool in a form-locked manner in the circumference direction. The drive shaft is connected to a drive flange of the drive device in a frictionally engaging manner in the circumference direction.

ADVANTAGES OF THE INVENTION

The present invention is based on a tool-holding device for an insert tool with an at least essentially disk-shaped hub, in particular for a hand-guided angle grinder or a hand-guided circular saw, having a drive shaft and a drive device that has at least one locking element movably supported against a spring element for fixing the insert tool in a form-locked manner in the circumference direction.

According to the present invention, the drive shaft has at least one form-locking element formed onto it in a non-cutting manner in order to connect it in a form-locked manner in the circumference direction to a drive torque-transmitting mechanism of the drive device. A structurally simple, inexpensive connection between the drive shaft, the mechanism of the drive device, in particular a drive flange, and the insert tool can be achieved that is able to transmit powerful torques, particularly in that inexpensive, large transmission surface areas can be achieved at least without significant material weakening. The design according to the invention is thus particularly suited for high-powered machines, in particular for line-powered machines. The drive shaft can essentially be constituted by a motor shaft, an output shaft of a transmission, in particular an angle transmission, or by a shaft that adjoins an output shaft of a transmission in the direction toward the insert tool.

The form-locking element can be constituted by an integrally formed groove in which an additional, for example tooth-like transmission mechanism can be fastened, which permits the material properties of this transmission mechanism to be selectively brought into line with the stresses that are present, or the form-locking element can advantageously be used to directly contact the mechanism of the drive device or the drive flange, which makes it possible to reduce the number of additional components, complexity of assembly, and costs.

If the form-locking element is formed onto the drive shaft by means of a pressing procedure, then this can be advantageously implemented inexpensively and within strict tolerances. In addition to a pressing procedure, however, there are also other conceivable methods that those skilled in the art will deem suitable for forming the form-locking element onto the drive shaft in a non-cutting fashion, for example a casting process, etc.

In another embodiment of the present invention, the form-locking element has a greater longitudinal span in the axial

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direction of the drive shaft than its height, which makes it possible to achieve, in a particularly space-saving manner, large transmission surface areas and the resulting low surface pressures and low wear.

5 If the drive shaft has at least three form-locking elements, then an advantageously uniform force distribution can be achieved with a large total transmission surface area. It is also conceivable, however, to provide only one or two form-locking elements.

10 In another embodiment, the inner circumference of the mechanism of the drive device has at least one continuous axial groove that constitutes a form-locking element, which makes it possible to achieve a particularly inexpensive manufacture of the mechanism, particularly if this is comprised of a sintered part.

15 If the mechanism of the drive device is comprised with a drive flange that constitutes a contact surface for the insert tool, then it is possible to reduce the number of additional components, the amount of space required, the complexity of assembly, and costs.

20 In another embodiment of the present invention, the mechanism of the drive device is supported on the drive shaft by means of a spacer element. The manufacturing process-induced transitions between the form-locking element and adjoining regions can advantageously be bridged over by the spacer element, thus making it unnecessary to provide the mechanism of the drive device with expensive contours corresponding to the transitions. The spacer element is advantageously comprised of a sleeve that is easy to install and makes it possible to achieve a uniform support in a structurally simple way.

25 According to another embodiment, the tool-holding device includes a leaf spring unit that has at least one freely extending spring piece that extends at least partially in the circumference direction, which makes it possible to inexpensively produce a space-saving leaf spring unit that has an easy-to-manufacture contour and achieves an advantageous transmission of force. In this context, the term "freely extending spring piece" is understood to be a spring piece with at least one freely extending end.

30 If the spring piece is connected to a retaining ring by means of at least one connecting piece extending at least essentially in the radial direction, in particular radially inward, then it is possible to achieve an advantageous stress distribution in the leaf spring unit that is particularly easy to predetermine. Basically, however, the spring piece could also extend outward essentially without a radial connecting piece, for example in a spiral shape.

DRAWINGS

35 Other advantages ensue from the following description of the drawings. The drawings show an exemplary embodiment of the present invention. The drawings, the specification, and the claims contain numerous features in combination. Those skilled in the art will also suitably consider the features individually and unite them in other meaningful combinations.

40 FIG. 1 schematically depicts a top view of an angle grinder,

FIG. 2 is an exploded view of a tool-holding device with a hub of an insert tool,

45 FIG. 3 is an enlarged depiction of a drive flange from FIG. 2, and

50 FIG. 4 is an enlarged depiction of a leaf spring unit from FIG. 2.

DESCRIPTION OF THE EXEMPLARY EMBODIMENT

FIG. 1 shows a top view of an angle grinder 32 with an electric motor, not shown in detail, supported in a housing 34. The angle grinder 32 can be guided by means of a first handle 36 extending in the longitudinal direction and integrated into the housing 34 at an end oriented away from the insert tool 14 and by means of a second handle 40 extending transversely in relation to the longitudinal direction, attached to the transmission housing 38 in the region of the insert tool 14. The electric motor can drive the insert tool 14 to rotate via an angle transmission, not shown in detail, and a tool-holding device that includes a drive shaft 16 and a drive device 12 (FIG. 2).

For drive torque transmission, the drive shaft 16 comprised of an output shaft of the angle transmission, at its free end, has three form-locking elements 100 formed onto it in a non-cutting way by means of an extrusion process for a form-locked connection in the circumference direction 50, 52 to a drive flange 30 of the drive device 12, which flange constitutes a contact surface 30 for the insert tool 14. After the extrusion process, an internal thread 136 is let into the drive shaft 16, the drive shaft 16 is remachined by means of turning, then case hardened, and then ground in certain regions, particularly in bearing regions.

The form-locking elements 100 have a longitudinal span 102 in the axial direction 64 of the drive shaft 16 that is greater than their height 104 and are embodied with a rectangular cross sectional area.

In the assembled state, the form-locking elements 100 of the drive shaft 16, in order to transmit drive torque directly to the drive flange 10, engage in form-locking elements 106 constituted by continuous grooves (FIGS. 2 and 3) formed into the inner circumference of the drive flange 10, which is comprised of a sintered component. The drive flange 10 is centered by the outer surfaces of the form-locking elements 100 oriented radially outward.

In the axial direction 64, the drive flange 10 is supported on a collar 130 of the drive shaft 16 by means of a spacer element 108 embodied in the form of a sleeve. The spacer element 108 covers over a manufacture-induced transition 132 between a region at the free end of the drive shaft 16 characterized by the form-locking elements 100 and a region adjoining it in the axial direction 64.

On a side oriented toward the insert tool 14, the drive flange 10 has a collar 26 formed onto it, which radially centers the insert tool 14 with its centering bore 46 when the insert tool is in the installed position. The collar 26 has three shaped elements 22 situated on it, which are constituted by projections extending radially outward. The shaped elements 22 integrally joined to the collar 26 are distributed uniformly around an outer circumference of the collar 26 and in the axial direction 54, 64, are spaced a distance 28 apart from the contact surface 30. With its end oriented toward the insert tool 14, the collar 26 protrudes beyond the shaped elements 22 in the axial direction 54.

On a side of the drive flange 10 oriented away from the insert tool 14, there is a sheet metal plate 48 equipped with three clamping hooks 56 integrally formed onto it that are uniformly distributed in the circumference direction 50, 52 and extend in the axial direction 54, which are for axially fixing the insert tool 14. The clamping hooks 56 are formed onto the sheet metal plate 48 in a bending process.

During assembly of the drive device 12, the drive flange 10, a leaf spring unit 58, and the sheet metal plate 48 are preassembled. To accomplish this, the leaf spring unit 58 is slid onto a collar of the drive flange 10 that points in the direction

away from the insert tool 14. Then, the clamping hooks 56 of the sheet metal plate 48, whose free ends have a hook-shaped extension with an inclined surface 94 oriented in the circumference direction 52, are guided in the axial direction 54 through openings 60 in the drive flange 10 (FIGS. 2 and 3). By pressing the sheet metal plate 48 and the drive flange 10 together and rotating them in relation to each other, the leaf spring unit 58 is preloaded and the sheet metal plate 48 and the drive flange 10 are connected in a form-locked manner in the axial direction 54, 64 (FIGS. 2 and 3). The sheet metal plate 48, loaded by the leaf spring unit 58, is then supported against the contact surface 30 of the drive flange 10 via edges of the hook-shaped extensions, which point axially in the direction away from the insert tool 14.

The leaf spring unit 58 has three structurally identical, freely extending spring pieces 110 extending in the circumference direction 50, 52, each of which is connected integrally to a retaining ring 114 by means of a connecting piece 112 extending radially inward (FIG. 4). The connecting piece 112 and the spring piece 110 are essentially T-shaped, the spring piece 110 extending in an arc shape with two free ends and the connecting piece 112 adjoining the spring piece 110 in its middle. The spring piece 110 has a width 120 that decreases towards its free ends 116, 118 and has a thickness 126 of approx. 0.9 mm. The leaf spring unit 58 rests with its retaining ring 114 against the drive flange 10; starting from the connecting piece 112 and extending toward their free ends 116, 118, the spring pieces 110 are each curved in the direction oriented away from the drive flange 10 and are supported against the tabs 68 of the sheet metal plate 48. In order to avoid a linear contact, contact surfaces 122, 124 that are comprised of flattened areas are formed onto the free ends 116, 118 or else the free ends 116, 118 of the spring pieces 110 are bent slightly in the direction of the drive flange 10.

In order to prevent an incorrect assembly, in particular a laterally offset installation of the leaf spring unit 58, next to the connecting pieces 112, the outer circumference of the retaining ring 114 has encoding means 128 formed onto it, which extend radially outward and correspond to the clamping hooks 56 and pins 20 of the drive device 12 during assembly. If the leaf spring unit 58 is installed in a laterally offset position, the clamping hooks 56 of the sheet metal plate 48 can in fact be guided through recesses in the leaf spring unit 58 in a laterally offset position, but then the pins 20 of a drive disk 96 can no longer be guided through the leaf spring unit 58 due to the presence of the encoding means 128.

After the sheet metal plate 48 with the clamping hooks 56 formed onto it, the leaf spring unit 58, and the drive flange 10 have been preassembled, then a spring element 18 comprised of a helical compression spring and the drive disk 96 with its three pins 20, which are distributed uniformly over the circumference and extend in the axial direction 54, are slid onto the drive shaft 16 (FIG. 2).

Then, the preassembled unit comprised of the sheet metal plate 48, the leaf spring unit 58, and the drive flange 10 is mounted onto the drive shaft 16. During assembly, the pins 20 are guided by tabs 68, which are formed onto the circumference of the sheet metal plate 48 and contain bores 70, and are also guided by bores 72, which are situated in the drive flange 10; in the assembled state, the pins 20 reach through the bores 72. The form-locking elements 100 on the drive shaft 16 are inserted into the form-locking elements 106 of the drive flange 10. In addition, shapes 134 extending radially inward from the inner circumference of the drive disk 96 are inserted into grooves 62 let into the outer circumference of the drive flange 10. The pins 20 prevent the sheet metal plate 48 and drive disk 96 from rotating in relation to each other.

The drive device **12** is secured to the drive shaft **16** with a screw **74**. The insert tool **14** comprised of a cutting wheel has an essentially disk-shaped sheet metal hub **42** comprised of a separate component, which has three cup-shaped recesses **76** uniformly distributed one after another in the circumference direction **50, 52** and extending in the axial direction **54**, whose diameter is slightly larger than the diameter of the pins **20**. The sheet metal hub **42** also has three openings **78** that are uniformly distributed in the circumference direction **50, 52** and extend in the circumference direction **50, 52**, each having a narrow region **80** and a wide region **82**.

The diameter of the centering bore **46** of the sheet metal hub **42** is selected so that it is also possible to clamp the insert tool **14** to a conventional angle grinder using a conventional clamping system equipped with a clamping flange and a spindle nut. This assures so-called backward compatibility.

The sheet metal hub **42** of the insert tool **14** has three shaped elements **24**, which are distributed uniformly in the circumference direction **50, 52** over the circumference of the centering bore **46** (FIG. 2). The shaped elements **24** here are embodied in the form of recesses.

The shaped elements **22** of the tool-holding device and the shaped elements **24** of the insert tool **14** are reciprocally matching, corresponding shaped elements designed to facilitate mounting of the insert tool **14**. In addition, the corresponding shaped elements **22, 24** constitute an encoding means to prevent installation of an inadmissible insert tool of the same kind. To this end, the corresponding shaped elements **22, 24** are matched to each other with regard to a diameter of the insert tool **14** so that insert tools intended for insertion into high-speed machines have a wide shaped element or a wide encoding means and insert tools intended for insertion into lower-speed machines have a narrow shaped element or a narrow encoding means.

The sheet metal hub **42** of the insert tool **14** is firmly attached to and pressed together with an abrasive via a riveted connection and is cup-shaped due to the presence of a formation **44** oriented in the axial direction **64**.

When the insert tool **14** is being mounted, the insert tool **14** is slid with its centering bore **46** onto the part of the collar **26** protruding beyond the shaped elements **22** in the axial direction **54** and is radially precentered. In the process of this, the insert tool **14** comes to rest against contact surfaces **84** of the shaped elements **22**. Rotating the insert tool **14** in the circumference direction **50, 52** brings the shaped elements **22, 24** into alignment. The insert tool **14** and/or the sheet metal hub **42** can then slide in the axial direction **64** toward the contact surface **30** and the sheet metal hub **42** comes to rest against the pins **20**.

A subsequent pressing of the sheet metal hub **42** against the contact surface **30** of the drive flange **10** causes the pins **20** to slide into the bores **72** and causes the drive disk **96** to be slid axially in the direction **64** oriented away from the insert tool **14**, counter to a spring force of the spring element **18** on the drive shaft **16**. This causes shapes **86** oriented radially outward on the drive disk **96** to travel into corresponding locking pockets **88** of a support flange **90** connected to the transmission housing **38** and lock the drive shaft **16**.

When the sheet metal hub **42** is pressed down against the contact surface **30**, the clamping hooks **56** automatically travel into in the wide regions **82** of the openings **78** in the sheet metal hub **42**.

If the hook-shaped extensions of the clamping hooks **56** are guided through the wide regions **82** of the openings **78** of the sheet metal hub **42** and the sheet metal hub **42** is fully depressed, then the sheet metal hub **42** can be rotated counter to a drive direction **98**. The rotation of the sheet metal hub **42**

on the one hand permits the rim of the centering bore **46** of the sheet metal hub **42** to be slid into the space **28** between the shaped elements **22** and the contact surface **30** of the drive flange **10** and also permits the shaped elements **22** to prevent it from falling down in the axial direction. On the other hand, the rotation of the sheet metal hub **42** causes the hook-shaped extensions to slide into the arc-shaped, narrow regions **80** of the openings **78** of the sheet metal hub **42**. In the course of this, beveled surfaces that are not shown in detail allow the sheet metal plate **48** with the clamping hooks **56** to slide axially in the direction **54**, counter to the pressure of the leaf spring unit **58**, until the contact surfaces of the hook-shaped extensions come to rest in the arc-shaped, narrow regions **80** situated laterally next to the openings **78** of the sheet metal hub **42**. For self-cleaning purposes, the contact surface **30** of the drive flange **10** is provided with arc-shaped grooves **66**, which can convey undesirable particles on the contact surface **30** outward, ejecting them from the drive device **12**.

In an operating position of the insert tool **14**, the pressure of the spring element **18** causes the drive disk **96** to slide upward. The pins **20** engage in the cup-shaped recesses **76** of the sheet metal hub **42** and secure it in a form-locked manner in the circumference direction **50, 52**. At the same time, the shapes **86** of the drive disk **96** disengage from the locking pockets **88** of the support flange **90** and release the drive shaft **16**.

In order to remove the insert tool **14**, a release button **92** is pushed in the axial direction **64**. The release button **92** presses to the drive disk **96** in the axial direction **64** and the shapes **86** of the drive disk **96** engage with the locking pockets **88**. The drive shaft **16** is locked in position. This causes the pins **20** to disengage from the recesses **76** of the sheet metal hub **42**, permitting the sheet metal hub **42** to be rotated in the circumference direction **52** until the clamping hooks **56** can slide a through the openings **78**. This causes the shaped elements **22, 24** to move into a corresponding position and permits the sheet metal hub **42** to be removed in the axial direction **54**.

10 drive flange
12 drive device
14 insert tool
16 drive shaft
18 spring element
20 locking element
22 shaped element
24 shaped element
26 collar
28 distance
30 contact surface
32 angle grinder
34 housing
36 handle
38 transmission housing
40 handle
42 hub
44 shape
46 centering bore
48 sheet metal plate
50 circumference direction
52 circumference direction
54 axial direction
56 clamping hook
58 leaf spring unit
60 opening
62 groove
64 axial direction
66 groove
68 tab
70 bore

72 bore
 74 screw
 76 recess
 78 opening
 80 region
 82 region
 84 contact surface
 86 shape
 88 locking pocket
 90 support flange
 92 release button
 94 beveled surface
 96 drive disk
 98 drive direction
 100 form-locking element
 102 longitudinal span
 104 height
 106 form-locking element
 108 spacer element
 110 spring piece
 112 connecting piece
 114 retaining ring
 116 end
 118 end
 120 width
 122 contact surface
 124 contact surface
 126 thickness
 128 encoding means
 130 collar
 132 transition
 134 shape
 136 internal thread

What is claimed is:

1. A tool-holding device for an insert tool (14) equipped with an at least essentially disk-shaped hub (42), for a hand-guided angle grinder (32) or a hand-guided circular saw, having a drive shaft (16) and a drive device (12) equipped with at least one locking element (20), wherein the locking element (20) is supported so that the locking element (20) is able to move in relation to a spring element (18) in order to fix the insert tool (14) in a form-locked manner in the circumference direction (50, 52), wherein the drive shaft (16) has at least one form-locking element (100) formed onto the drive shaft (16) in a non-cutting manner in order to connect the drive shaft (16) in a form-locked manner in the circumference direction (50, 52) to a drive torque-transmitting mechanism

of the drive device (12), wherein the mechanism of the drive device (12) is comprised of a drive flange (10) that constitutes a contact surface (30) of the insert tool (14), wherein the contact surface (30) is oriented opposite with respect to a machine tool side of the drive flange (10), and is provided with arc-shaped grooves (66) for self-cleaning purposes and wherein the mechanism of the drive device (12) is supported on the drive shaft (16) by means of a spacer element (108).

2. The tool-holding device as recited in claim 1, wherein the form-locking element (100) is formed onto the drive shaft (16) by means of a pressing procedure.

3. The tool-holding device as recited in claim 1, wherein the form-locking element (100) has a longitudinal span (102) in the axial direction (64) of the drive shaft (16) that is greater than its height (104).

4. The tool-holding device as recited in claim 1, wherein the drive shaft (16) has at least three form-locking elements (100).

5. The tool-holding device as recited in claim 1, wherein the inner circumference of the mechanism of the drive device (12) has at least one continuous axial groove that constitutes a form-locking element (106).

6. The tool-holding device as recited in claim 1, wherein the mechanism of the drive device (12) is comprised of a sintered part.

7. The tool-holding device as recited in claim 1, wherein the spacer element (108) is comprised of a sleeve.

8. The tool-holding device as recited in claim 1, wherein the drive device (12) includes a leaf spring unit (58) that has a freely extending spring piece (110) that extends at least partially in the circumference direction (50, 52) and the leaf spring unit (58) is able to fix the insert tool (14) in the axial direction (64) by means of a spring force.

9. An angle grinder equipped with a tool-holding device as recited in claim 1.

10. A hand-guided circular saw equipped with a tool-holding device as recited in claim 1.

11. The tool-holding device as recited in claim 1, wherein the spacer element (108) covers a manufacture-induced transition (132) between a region at the free end of the drive shaft (16) and a region adjoining the free end of the drive shaft (16).

12. The tool-holding device as recited in claim 11, wherein said region at the free end of the drive shaft (16) is characterized by the form-locking element (100) and said region adjoining the free end of the drive shaft (16) is axial to the form-locking element (100).

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