US007722445B2

(12) **United States Patent**
Kraenzler et al.

(10) **Patent No.: US 7,722,445 B2**
(45) **Date of Patent: *May 25, 2010**

(54) **INSERTION TOOL FOR AN ANGLE GRINDER**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 65 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **10/564,667**

(22) PCT Filed: **Nov. 9, 2004**

(86) PCT No.: **PCT/EP2004/052876**

§ 371 (c)(1),
(2), (4) Date: **Jan. 13, 2006**

(87) PCT Pub. No.: **WO2005/061180**

PCT Pub. Date: **Jul. 7, 2005**

(65) **Prior Publication Data**

US 2007/0060029 A1 Mar. 15, 2007

(30) **Foreign Application Priority Data**

Dec. 20, 2003 (DE) 103 60 248

(51) **Int. Cl.**

B24B 21/18	(2006.01)
B24B 33/00	(2006.01)
B24B 47/26	(2006.01)
B24B 55/00	(2006.01)
B24B 21/00	(2006.01)
B24D 15/00	(2006.01)
B24B 27/08	(2006.01)

(52) **U.S. Cl.** **451/442**; 451/303; 451/508

(58) **Field of Classification Search** 451/442, 451/393, 508, 425

See application file for complete search history.

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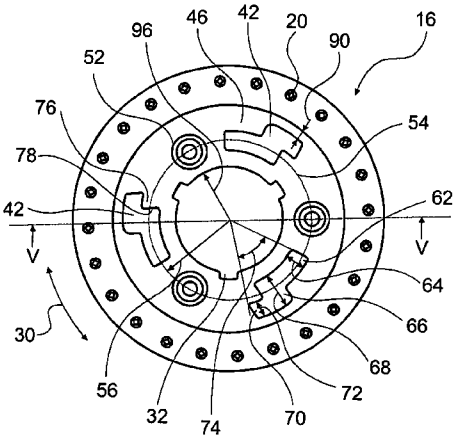
(57) **ABSTRACT**

An insertion tool (**12**) for an angle grinder (**2**) that has a hub (**16**) with at least a first fastening means for fastening the hub (**16**) to a driving device (**22**) of the angle grinder (**2**). The first fastening means if located on a partial circle (**54**) with a radius (**56**) of between 12 mm and 25 mm.

33 Claims, 4 Drawing Sheets



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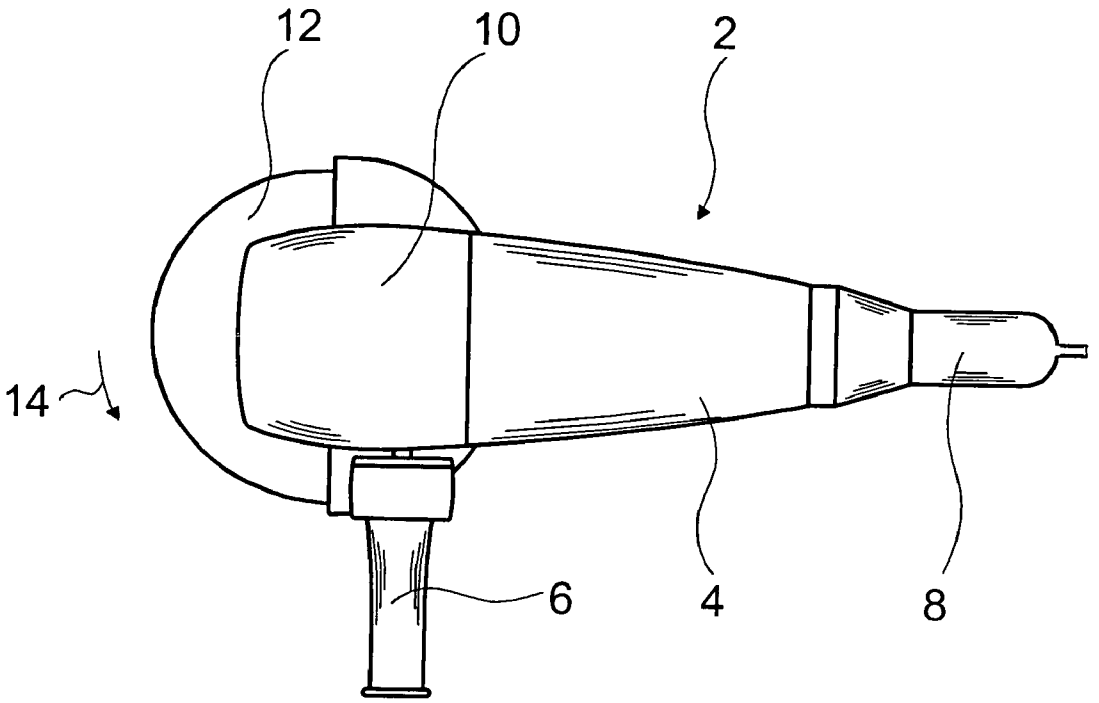


Fig. 1

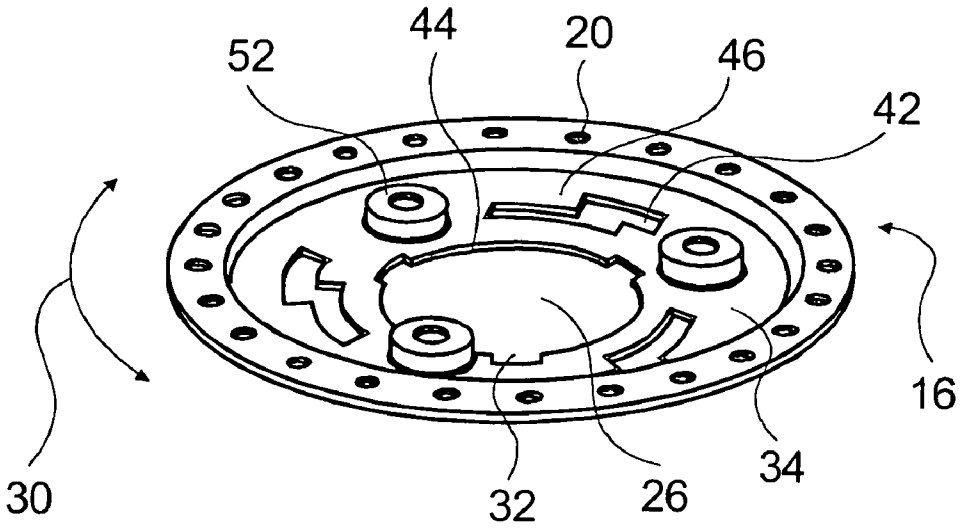


Fig. 2

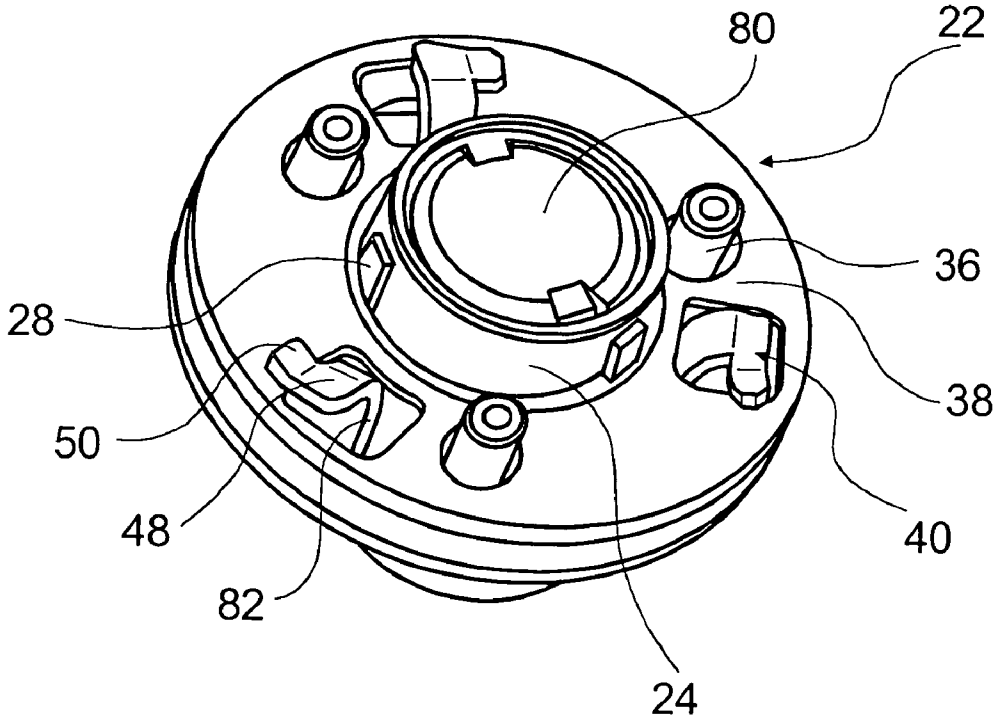
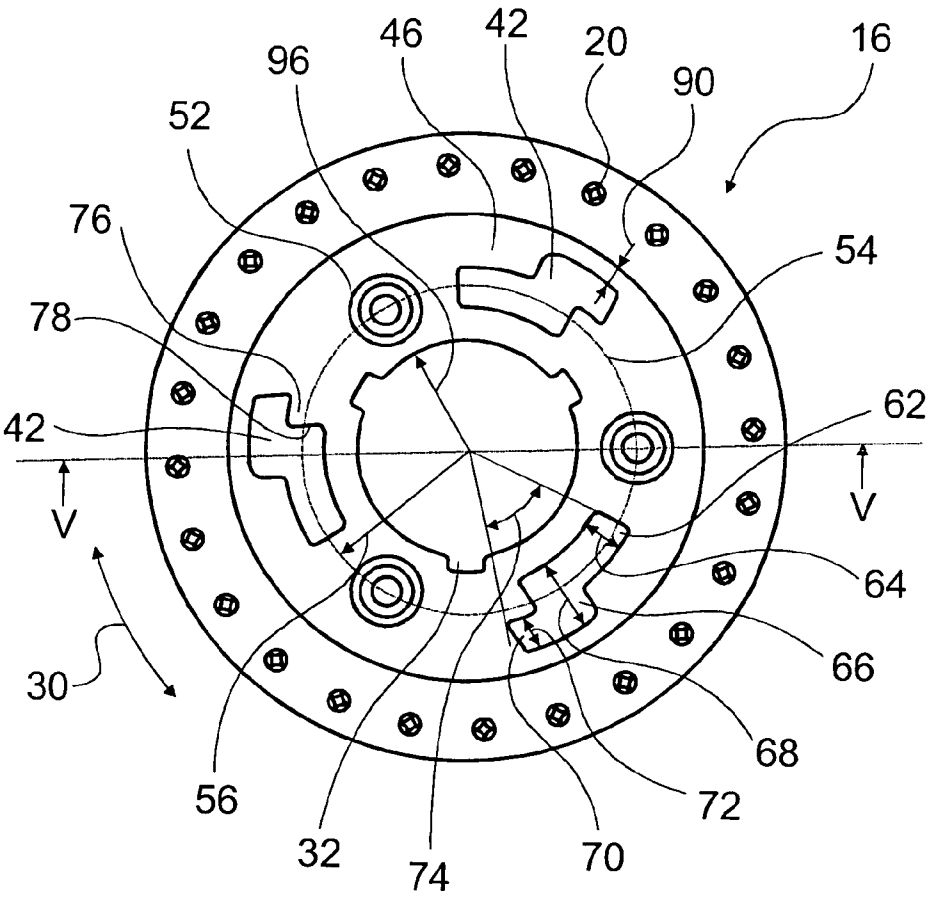


Fig. 3


46
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16
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52
76
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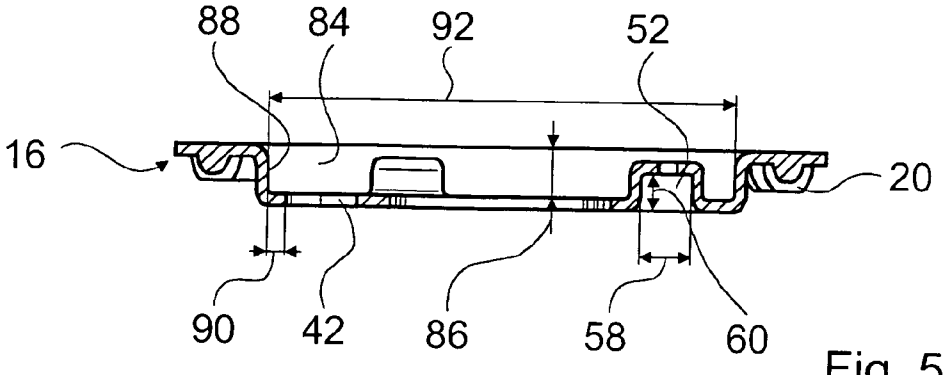
74
70

Fig. 4


88
84
92
52
16
20
90
42
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60

Fig. 5

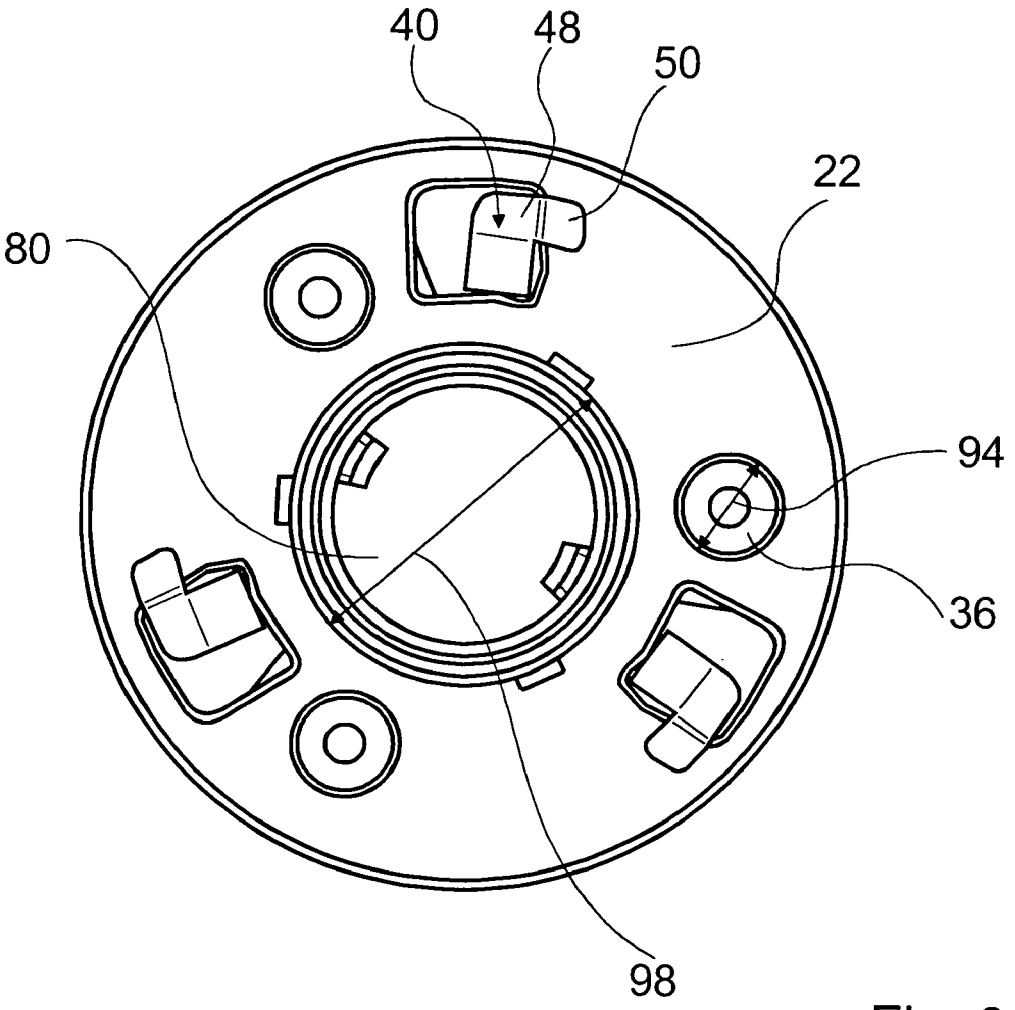

Fig. 6

INSERTION TOOL FOR AN ANGLE GRINDER

CROSS-REFERENCE TO A RELATED APPLICATION

The invention described and claimed hereinbelow is also described in German Patent Application DE 103602248.8 filed on Dec. 20, 2003. This German Patent Application, whose subject matter is incorporated here by reference, provides the basis for a claim of priority of invention under 35 U.S.C. 119(a)-(d).

BACKGROUND INFORMATION

The present invention is directed to an insertion tool for an angle grinder. The present invention is also directed to a system composed of an insertion tool with a hub and a driving device for an angle grinder.

Publication WO 03/097299 makes known an insertion tool—which represents the general class—for an angle grinder that includes a hub with a plurality of fastening means in the form of recesses. The insertion tool can be advantageously clamped onto a driving device of the angle grinder using a keyless system, which is also known from the publication cited above.

SUMMARY OF THE INVENTION

The present invention is directed to an insertion tool for an angle grinder that has a hub with at least one fastening means for fastening the hub to a driving flange of the angle grinder.

The present invention is also directed to a system composed of an insertion tool with a hub and a driving device for an angle grinder, the hub including at least a first fastening means, and the driving device including at least a first fastening element for interacting with the first fastening means and for fastening the hub to the driving device.

It is provided that the first fastening means is located on a partial circle with a radius between 12 mm and 25 mm.

Due to the proposed dimension of the partial circle, an insertion tool can be obtained that is reliably and easily installable on an angle grinder, using a keyless system in particular. An insertion tool that is advantageously well-designed and matched to the driving flange can be obtained, and advantageous force distributions in the insertion tool and into the driving flange while working with the insertion tool can be achieved.

The means of achieving the object according to the present invention can be used with all insertion tools for angle grinders that appear suitable to one skilled in the art, such as rubber backing pads, cutting discs, rough grinding discs, grinding discs, etc. The hub can be made of a material out of which the abrasive body is made, or out of another material, such as sheet steel.

Further advantages result from the description of the drawing, below. An exemplary embodiment of the present invention is shown in the drawing. The description of the drawing contains numerous independent features, each of which independently improves the means of achieving the object according to the present invention. The means of achieving the object according to the present invention can be improved by one or more of these features without the need to add additional features from the description of the drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** Shows an angle grinder with a cutting disc,
FIG. **2** Shows a hub of the cutting disc of the angle grinder,
FIG. **3** Shows a driving flange of the angle grinder,
FIG. **4** Shows a top view of the hub in FIG. **2**,
FIG. **5** Shows a sectional illustration of the hub in FIG. **2**, and
FIG. **6** Shows a top view of the driving flange in FIG. **2**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** shows an angle grinder **2** from above with an electric motor (not shown) supported in a housing **4**. Angle grinder **2** is guidable using two handles **6**, **8**. An insertion tool **12** is drivable in direction of rotation **14** via the electric motor, a not-shown transmission in a transmission housing **10**, and a drive shaft (not shown).

When angle grinder **2** is viewed not from the top, as in FIG. **1**, but from the bottom, a hub **16** of insertion tool **12** can be seen. This hub is shown in a perspective view in FIG. **2**. An abrasive body **18**, shown in FIG. **1**, of insertion tool **12** is located around hub **16**, abrasive body being fastened to hub **16** with the aid of fastening means **20**. Fastening means **20** are located in a radially outer region of hub **16** on a second partial circle, the entirety of which extends in the region of hub material. There are therefore no recesses located between fastening means **20**, thereby allowing a stable outer region of hub **16** to be obtained.

Hub **16** of insertion tool **12** configured as a rough grinding disc is designed to be inserted on a driving device **22** of angle grinder **2**, which is shown in FIG. **3**. Driving device **22** surrounds a centering collar **24**, onto which hub **16** with a centering opening **26** can be slid. After insertion, hub **16** rests with its radially innermost part on three encoding raised areas **28** that extend radially outwardly away from centering collar **24**. When resting on encoding raised areas **28**, hub **16** can be rotated in tangential direction **30** until three radial recesses **32** are aligned with three encoding raised areas **28**. In this position, hub **16**, and with it, entire insertion tool **12**, drops down slightly until it comes to rest with its inner plate **34** on three snap-in bolts **36**.

These three snap-in bolts **36** are spring-loaded and can be pressed downward by an operator of angle grinder **2** by pressing on insertion tool **12**. Hub **16** can now be pressed with its lower plate **34** until it reaches a base **38** of driving flange **22**. As a result, fastening elements **40** configured as hooks pass through openings **42** in lower plate **34** of hub **16**.

To fasten insertion tool **12** onto driving flange **22**, hub **16** can now be rotated in the clockwise direction, which allows a radially innermost region **44** of lower plate **34** to be guided underneath encoding raised areas **28**. At the same time, a retaining region **46** adjacent to openings **42** in lower plate **34** is slid under a slanted ramp element **48** of fastening element **40**, fastening element **40** being pulled slightly upward against the force of a non-shown, preloaded spring. An exact description of driving flange **22**, spring-loaded snap-in bolt **36** and fastening elements **40** is provided in publication WO 03/097299 described initially.

When insertion tool **12** is rotated further in the clockwise direction, retaining region **46** is slid under a retaining element **50** oriented parallel to base **38** of driving flange **22** that presses hub **16** onto base **38** with the aid of the preloaded,

not-shown spring. When a fastening position is reached, snap-in bolts **36** are aligned with pot-shaped recesses **52** in hub **16** and engage into these recesses **52** by snapping upward. Recesses **52** are designed as deformations of lower plate **34**; they are shown in FIG. **2** as cylindrical raised areas. Hub **16** and, with it, entire insertion tool **12**, is now fixed in tangential direction **30** by snap-in bolts **36** in pot-shaped recesses **52**, and are retained in the axial direction by spring-loaded retaining elements **50**.

FIG. **4** shows a top view of hub **16** of insertion tool **12**. Hub **16** includes three identical first fastening means configured as pot-shaped recesses **52** that extend out of the plane of the drawing, as seen from above. Pot-shaped recesses **52** include a circular cross section, the center point of which is located on a partial circle **54** with a radius **56** of 16.7 mm. Pot-shaped recesses **52** have a circular cross section with an inner diameter **58** of 6 mm (FIG. **5**) and an inner depth **60** of 3.85 mm.

Hub **16** also includes three identically configured openings **42** as the second fastening means. These second fastening means are configured in the shape of two parallel slots oriented in tangential direction **30**. The slots are substantially right-angled and abut each other along part of one of their long sides. Openings **42** include a first retaining region **62** formed by the radially inward slot with a radial width **64** of 3.9 mm. In a releasing region **66** formed by the two slots, opening **42** has a radial width **68** of 7.1 mm. In a third region **70** which also belongs to retaining region **66**, radial width **72** of opening **42** is 3.4 mm. In the circumferential direction **30**, each of the three openings **42** extends across an angular range **74** of approximately 60°. Openings **42** also include blocking elements **76** designed as bulges, each of which abuts the radially inner slot and extends into releasing region **66**. Blocking elements **76**, in turn, include a stop **78** provided to limit a releasing motion of fastening element **40** in opening **42**.

Due to the fact that openings **42** are formed by two right-angled slots, a particularly stable retention of hub **16** on driving device **22** in the axial direction can be achieved using fastening elements **40** that are simple and economical to produce. In addition, with the dimensions indicated, a laterally-reversed installation of insertion tool **12** onto an identical driving flange without encoding raised areas **28** can be effectively prevented, since fastening element **40** cannot be inserted through a laterally-reversed opening **42** if it has the dimensions indicated below.

To release hub **16** from driving device **22** shown in FIG. **6** in a top view, an actuating button **80** is pressed, by way of which snap-in bolts **36** are pressed downward and out of recesses **52**. Hub **16** is now rotatable in the counterclockwise direction, by way of which fastening elements **40** move in a release motion in tangential direction **30** away from retaining regions **62** toward releasing regions **66** of openings **42**. The release motion can be carried out by an operator of angle grinder **2** until a segment **82** of fastening element **40** hits stop **78** of opening **42** and/or blocking element **76**. The dimensions of opening **42** and its position relative to recesses **32** are designed such that, when segment **82** hits stop **78**, recesses **32** are flush with encoding raised areas **28**. In this position, hub **16** can be lifted off of driving device **22**. Due to the shape and dimensions of opening **42** with blocking element **76** and third region **70**, fastening element **40** can have retaining element **50** that extends further in the release direction than segment **82** of fastening element **40**. This enables a particularly simple and economical manufacture of a stable fastening element **40** and a stable retention of hub **16** on driving device **22**.

In its radially inward region, hub **16** is designed with a well-shaped recess **84** with a well depth **86** of approximately 6 mm and an inner diameter **92** of 47 mm. An inner well wall **88** is thereby formed, with openings **42** being located at minimum distance **90** of approximately 2 mm from inner well wall **88**. As a result of this relatively radially far outward positioning of openings **42** in hub **16**, a stable axial fixing of hub **16** on driving device **22** via retaining elements **50** can be obtained.

When snap-in bolts **36** designed as fastening elements engage in recesses **52**, snap-in bolts **36**—which have an outer diameter **94** of 5.5 mm—are located in recesses **52** with a play of 0.5 mm. This relatively large amount of play makes it possible for snap-in bolts **36** to also engage in recesses **52** when snap-in bolts **36** or recesses **52** are very dirty. As a result, a secure fixing of insertion tool **12** in tangential direction **30** can be ensured, even when insertion tool **12** is very dirty.

Due to the large amount of play—which serves to provide operational reliability—between snap-in bolts **36** and recesses **52**, hub **16** cannot be retained in a centered position on driving device **22** by snap-in bolts **36**. Centering of this type, which is necessary, is achieved by the dimensions of centering opening **26** and centering collar **24**, the play of which relative to each other is less—by a factor of approximately **17**—than the play between snap-in bolts **36** and recesses **52**. Inner radius **96** of centering collar **26** is 11.1 mm, while the outer radius **98** of centering collar **24** is 11.115 mm. Since centering collar **24** and centering opening **26** are circular in design, the play between centering collar **24** and centering opening **26** is 0.03 mm.

Due to the relatively large amount of play between snap-in bolts **36** and recesses **52**, the contact surface between snap-in bolts **36** and recesses **52** attainable via elastic deformation can be very small during operation of insertion tool **12**. So that the resultant wear of snap-in bolts **36** remains minimal, snap-in bolts **36** are made of a hardened steel, while recesses **52** in hub **16** are made of an unhardened metal, e.g., unhardened steel sheet. During operation of insertion tool **12**, snap-in bolts **36** can extend into recesses **52** and deform them slightly, so that a sufficiently large contact surface between snap-in bolts **36** and recess **52** results, which results in low wear of snap-in bolts **36** even when insertion tool **12** undergoes strong vibration.

What is claimed is:

1. An insertion tool (**12**) for an angle grinder (**2**) that has a hub (**16**) with at least a first fastening means for fastening the hub (**16**) to a driving device (**22**) of the angle grinder (**2**), wherein the first fastening means is located on a partial circle (**54**) with a radius (**56**) dimensioned to provide reliable and easy installation of the insertion tool on the angle grinder using a keyless system that enables handy use with sufficient working material and equal to between 12 mm and 25 mm, wherein the hub (**16**) includes a second fastening means, wherein said second fastening means is formed by two slots that abut each other along part of their long sides,

wherein the second fastening means is configured as an opening (**42**);

wherein the opening (**42**) includes a retaining region (**62**), a releasing region (**66**) and a third region (**70**);

wherein said opening (**42**) includes a blocking element (**76**) which is designed as a bulge and abuts a radially inner slot and extends into the releasing region (**66**);

wherein said blocking element (**76**) includes a stop (**78**) provided to limit a releasing motion of the insertion tool (**12**); and

wherein the third region (**70**) is embodied as a recess which facilitates the releasing of the insertion tool (**12**).

2. The insertion tool (12) as recited in claim 1, wherein the first fastening means has a circular cross section with a center point on a partial circle (54) with a radius (56) of 16.5 mm to 17.0 mm.

3. The insertion tool (12) as recited in claim 1, wherein the first fastening means is configured as a pot-shaped recess (52) with an inner diameter (58) of 5.7 mm to 6.5 mm.

4. The insertion tool (12) as recited in claim 1, wherein the first fastening means is configured as a pot-shaped recess (52) with an inner depth (60) over 3.5 mm to 4.5 mm.

5. The insertion tool (12) as recited in claim 1, characterized by a second fastening means with a retaining region (62) formed by a first slot with a width of 3.5 mm to 4.5 mm, and a releasing region (66) with a width of 6.5 mm to 7.5 mm.

6. The insertion tool (12) as recited in claim 5, wherein the second fastening means has a region (70) formed by a second slot having a width of 2.5 mm to 4.5 mm.

7. The insertion tool (12) as recited in claim 5, wherein the second fastening means extends in the circumferential direction (30) across an angular range (74) of 55° to 65°.

8. The insertion tool (12) as recited in claim 5, wherein the second fastening means is located in a well-shaped region with an inner well wall (88), and the second fastening means is located less than 3 mm from the inner well wall (88).

9. The insertion tool (12) as recited in claim 1, wherein at least three third fastening means (20), located on a second partial circle, for fastening an abrasive body (18) to the hub (16) extends, in entirety, outside the third fastening means (20) in the region of hub material.

10. The insertion tool (12) as recited in claim 1, wherein the second fastening means is configured in the shape of two parallel slots oriented in a tangential direction (30).

11. The insertion tool (12) as recited in claim 1, wherein the second fastening means is configured as an opening (42) which includes a first retaining region (62) formed by a radially inner slot with a radial width (64) of 3.9 mm.

12. The insertion tool (12) as recited in claim 1, wherein the second fastening means is configured as an opening (42) which includes a blocking element (76) designed as a bulge.

13. The insertion tool (12) as recited in claim 12, wherein the blocking element (76) abuts the radially inner slot and extends into a releasing region (66).

14. The insertion tool (12) as recited in claim 12, wherein the blocking element (76) includes a stop (78) configured for limiting a releasing motion of a fastening element (40) in the opening (42).

15. The insertion tool as recited in claim 11, wherein a contour of the opening is formed step-like respectively at opposite sides of the opening.

16. The insertion tool as recited in claim 11, wherein a first long slot is composed of a radially inner long slot and a second long slot is composed of a radially outer long slot, wherein the opening includes a retaining region, a releasing region and a third region, wherein the retaining region is formed by the radially inward inner long slot, the releasing region is formed by the two long slots and the third region is a part of the releasing region.

17. The insertion tool as recited in claim 16, wherein the retaining region extends in a circumferential direction over a greater angular range than the third region.

18. The insertion tool as recited in claim 16, wherein the releasing region extends radially over the two long slots.

19. The insertion tool as recited in claim 16, wherein the retaining region forms in a radial direction an insert region of the opening and the third region forms in the radial direction an outward region of the opening.

20. The insertion tool as recited in claim 16, wherein the retaining region and the third region respectively have a radial width that is smaller than a radial width of the releasing region.

21. The insertion tool as recited in claim 1, wherein the long slots are constructed to be right-angled.

22. The insertion tool as recited in claim 1, wherein the two long slots arranged displaced to each other in a tangential direction.

23. The insertion tool as recited in claim 1 wherein a first long slot is composed of a radially inner long slot and a second long slot is composed of a radially outward long slot.

24. The insertion tool as recited in claim 23, wherein the radially inward long slot in a circumferential direction is longer than the radially outward long slot.

25. A system composed of an insertion tool (12) with a hub (16) and a driving device (22) for an angle grinder (2), the hub (16) having at least a first fastening means, and the driving device (22) having at least a first fastening element for interacting with the first fastening means of the hub and for fastening the hub (16) to the driving device (22), wherein the first fastening means of the hub is located on a partial circle (54) with a radius (56) dimensioned to provide reliable and easy installation of the insertion tool on the angle grinder using a keyless system that enables handy use with sufficient working material and equal to between 12 mm and 25 mm, wherein the hub (16) includes a second fastening means, wherein said second fastening means of the hub is formed by two slots that abut each other along part of their long sides, the driving device (22) includes a fastening means (40), wherein said fastening means (40) of the driving device (22) is configured as a hook with a retaining element (50);

wherein the second fastening means of the hub (16) is configured as an opening (42);

wherein the opening (42) includes a retaining region (62), a releasing region (66) and a third region (70);

wherein said opening (42)includes a blocking element (76) which is designed as a bulge and abuts a radially inner slot and extends into the releasing region (66),

wherein said blocking element (76) includes a stop (78) provided to limit a releasing motion of said fastening means (40) of the driving device (22), and wherein the third region (70) is embodied as a recess which facilitates the releasing of said retaining element (50) of said fastening means (40) of the driving device (22) during a releasing process of the insertion tool (12) from the driving device (22).

26. The system as recited in claim 25, wherein the first fastening means has a pot-shaped recess (52) with an inner diameter (58) of 5.7 mm to 6.5 mm, and the first fastening element has a bolt shape with an outer diameter (94) that is more than 0.3 mm smaller than the inner diameter (58).

27. The system as recited in claim 25, wherein the hub (16) includes a centering opening (26) capable of being inserted on a centering collar (24) of the driving device (22), the play between the centering opening (26) and centering collar (24) being less than the play between the fastening means and fastening element by a factor of at least 5, preferably at least by a factor of 10.

28. The system as recited in claim 27, wherein the centering opening (26) has an inner radius (96) that is smaller than an outer radius (98) of the centering collar (24) by a maximum of 0.1 mm.

29. The system as recited in claim 25, wherein the first fastening element is made of a hardened steel, and the hub (16) is made of an unhardened metal in the region of the first fastening means.

30. The system as recited in claim 25, wherein the hub (16) is insertable on the driving device (22) and includes at least a second fastening means through which a second fastening element (40) of the driving device (22) is guidable, the second fastening means including a blocking element (76) that prevents the second fastening element (40) from being inserted when the hub (16) has been installed in a laterally-reversed manner.

31. The insertion tool as recited in claim 30, wherein a first long slot is composed of a radially inner long slot and a second long slot is composed of a radially outer long slot and the radially inward long slot includes the blocking element.

32. An insertion tool for an angle grinder that has a hub with at least a first fastening means for fastening the hub to a driving device of the angle grinder,

wherein the first fastening means is located on a partial circle with a radius dimensioned to provide reliable and easy installation of the insertion tool on the angle grinder using a keyless system, wherein said radius is between 12 mm and 25 mm,

wherein said hub includes a second fastening means, wherein said second fastening means is formed by two right-angled long slots that abut each other along a part of respective long sides, wherein the two right-angled long slots are arranged displaced along a circumferential direction to each other, wherein the second fastening means is configured as an opening, and wherein a contour of the opening is formed step-like, respectively, at opposite sides of the opening.

33. An insertion tool for an angle grinder that has a hub with at least a first fastening means for fastening the hub to a driving device of the angle grinder,

wherein the first fastening means is located on a partial circle with a radius dimensioned to provide reliable and easy installation of the insertion tool on the angle grinder using a keyless system, wherein said radius is between 12 mm and 25 mm,

wherein the hub includes a second fastening means, wherein said second fastening means is formed by two long slots that abut each other along part of respective long sides, wherein the second fastening means is configured as an opening, wherein the opening includes a retaining region, a releasing region, and a third region,

wherein a first long slot is composed of a radially inner long slot and a second long slot is composed of a radially outer long slot,

wherein the retaining region is formed by the radially inner long slot and the releasing region is formed by the two long slots,

wherein the releasing region of a radially outer long slot which also belongs to the releasing region includes the third region,

wherein the hub is insertable on the driving device and includes at least a second fastening means through which a second fastening element of the driving device is guidable, wherein the second fastening means includes a blocking element that prevents the second fastening element from being inserted when the hub has been installed in a laterally-reversed manner,

wherein the radially inward long slot includes a blocking element and forms the retaining region, wherein the third region forms an outer region of the opening in a radial direction, and wherein the retaining region and the third region offer a radial width that is smaller than a radial width of the releasing region.

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