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(54) ROUGH GRINDING TOOL

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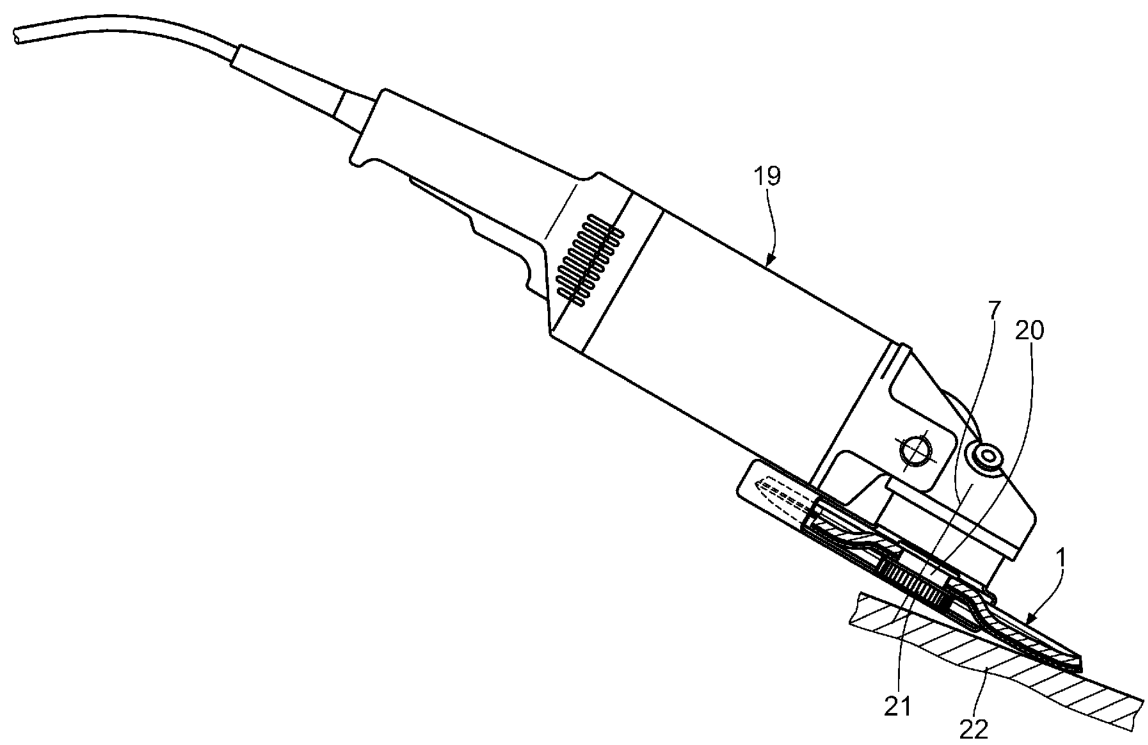
(57) **ABSTRACT**

A rough grinding tool has a support plate with a centre opening arranged concentrically with respect to a centre longitudinal axis for receiving a drive shaft of a drive machine. Supported on the support plate is a fiber grinding disc, which is formed from a fiber disc being used as a carrier and a resin-bound grinding means covering. The fiber grinding disc is glued to the support plate.



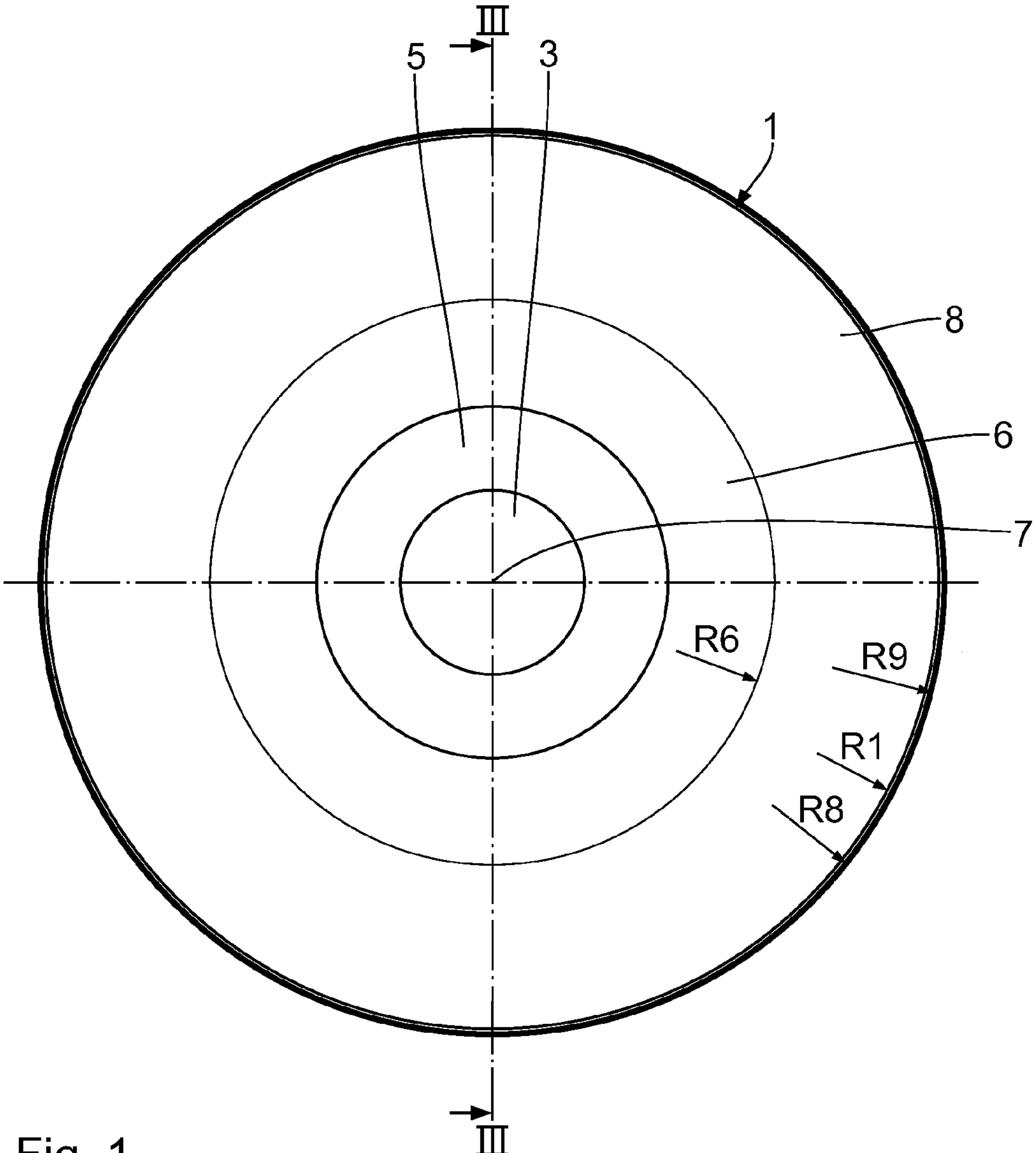


Fig. 1

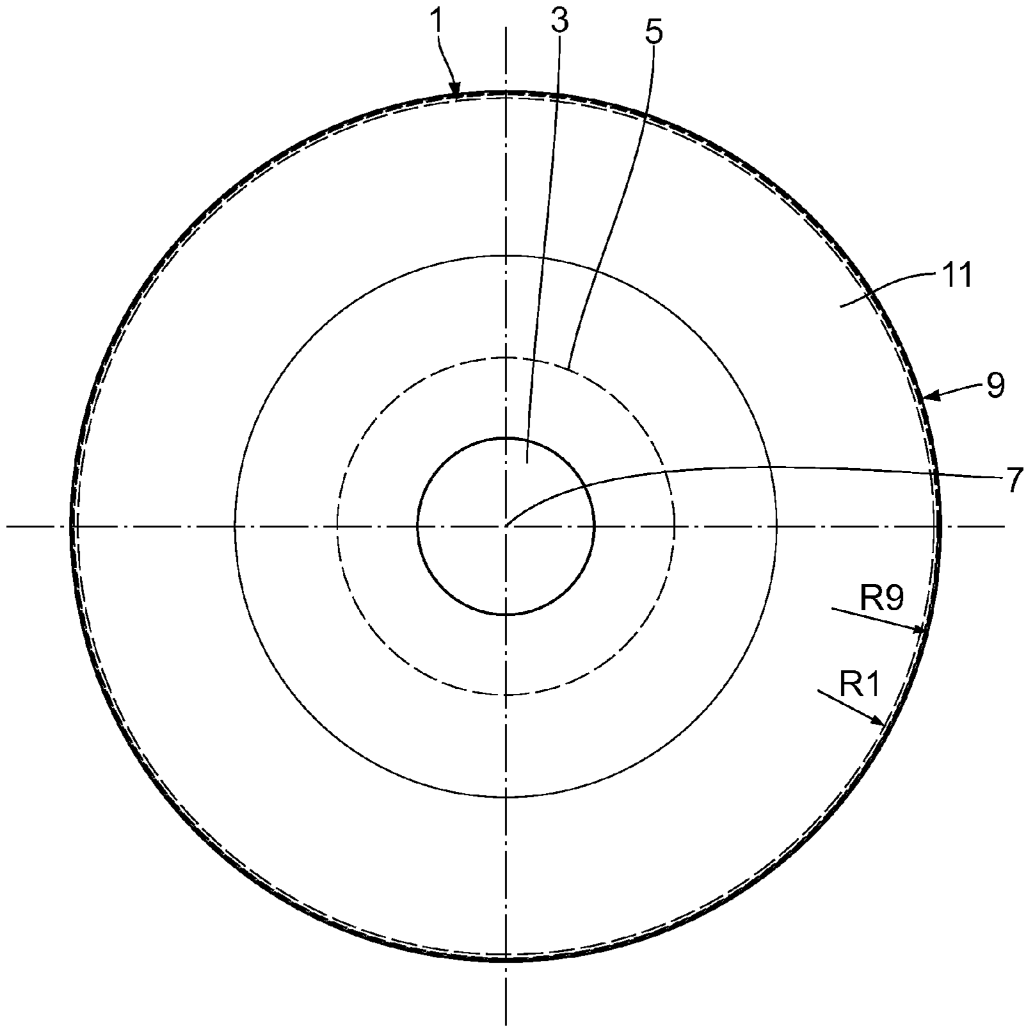


Fig. 2

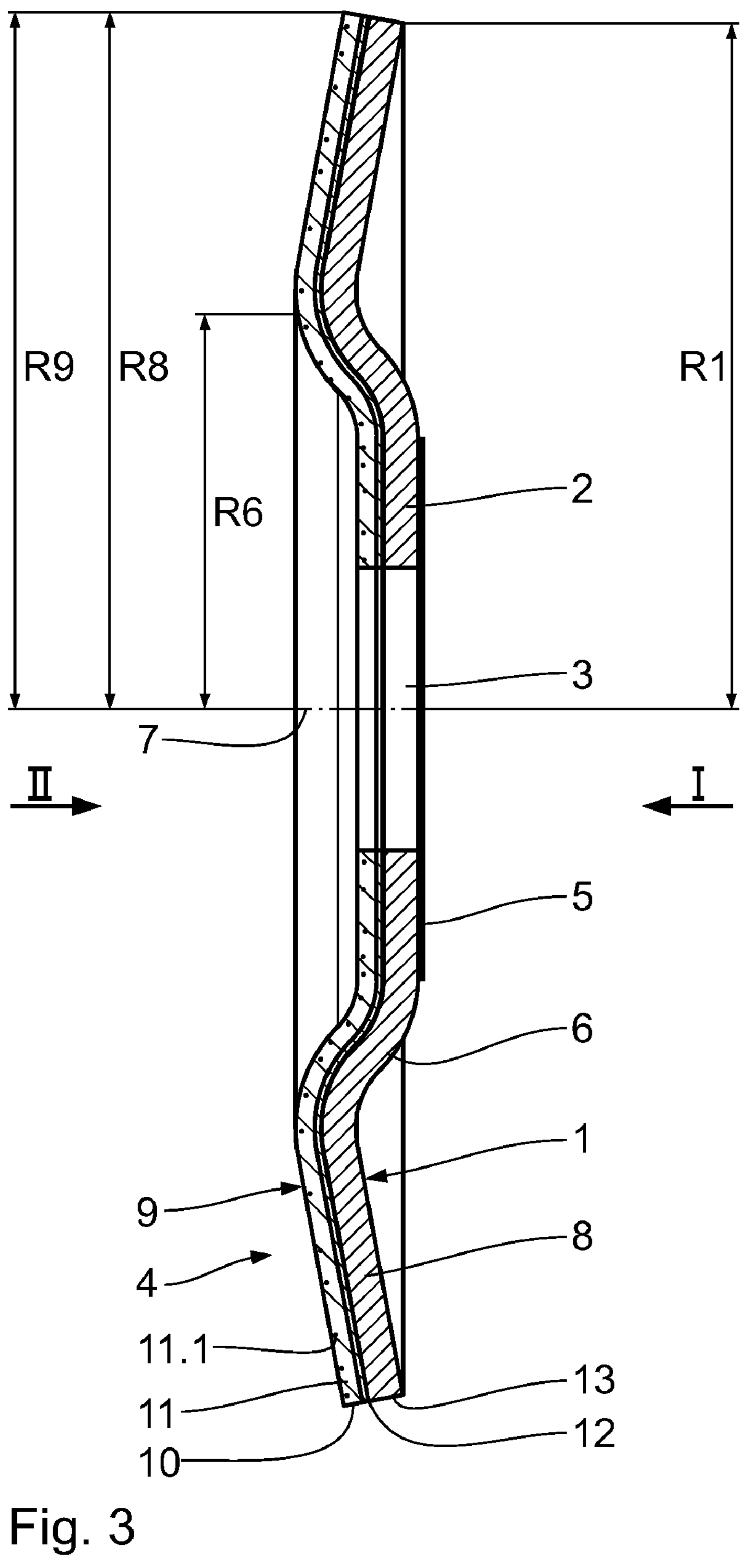


Fig. 3

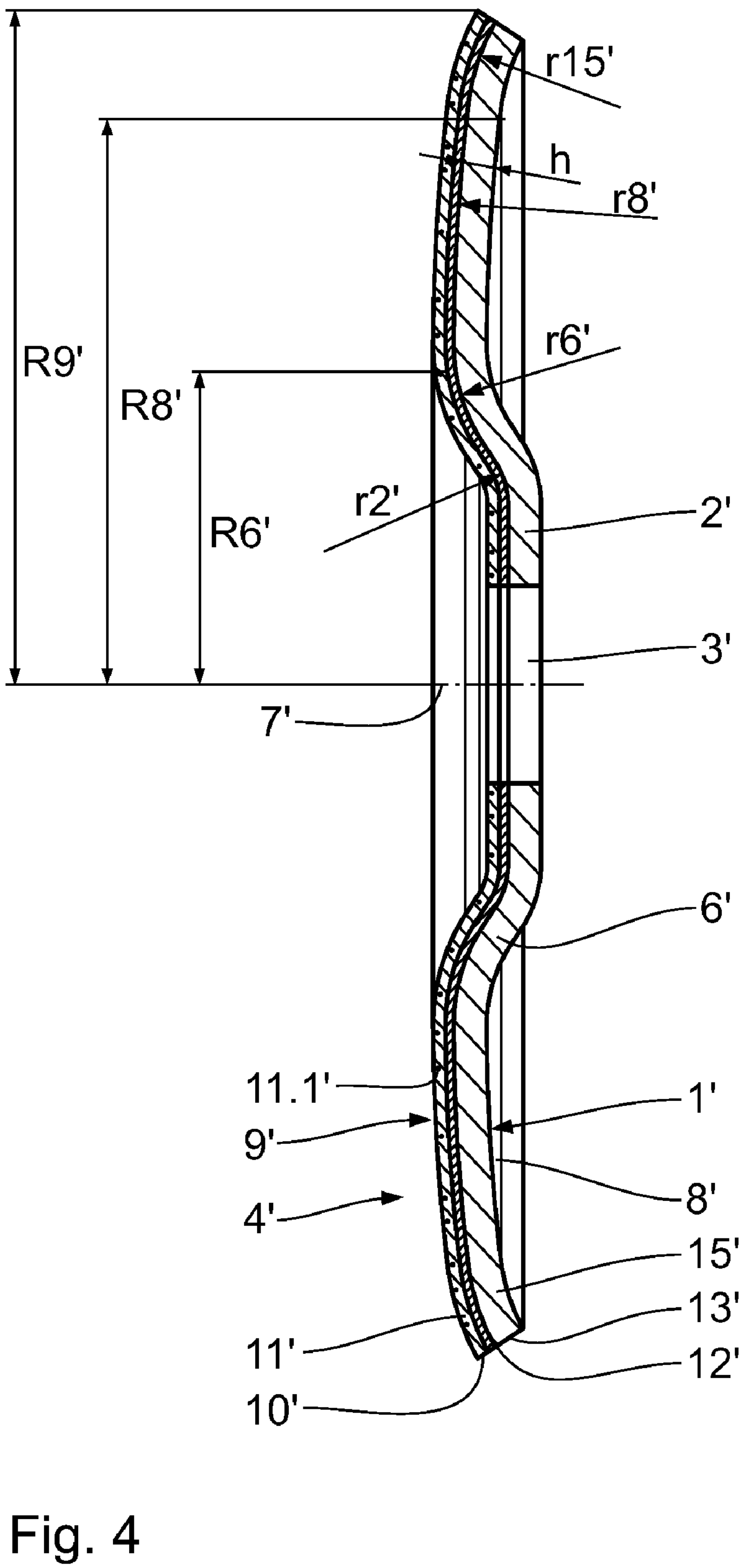


Fig. 4

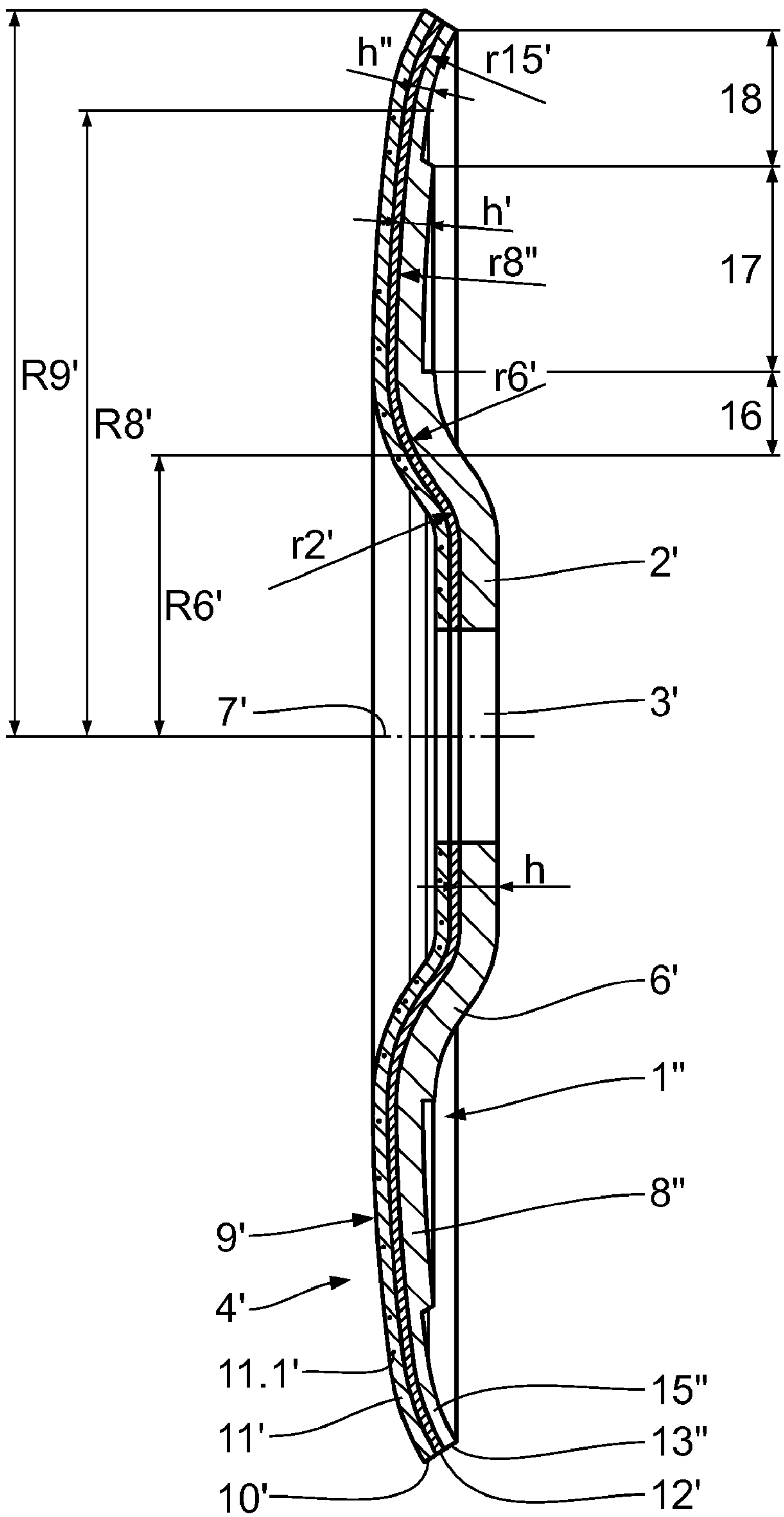


Fig. 5

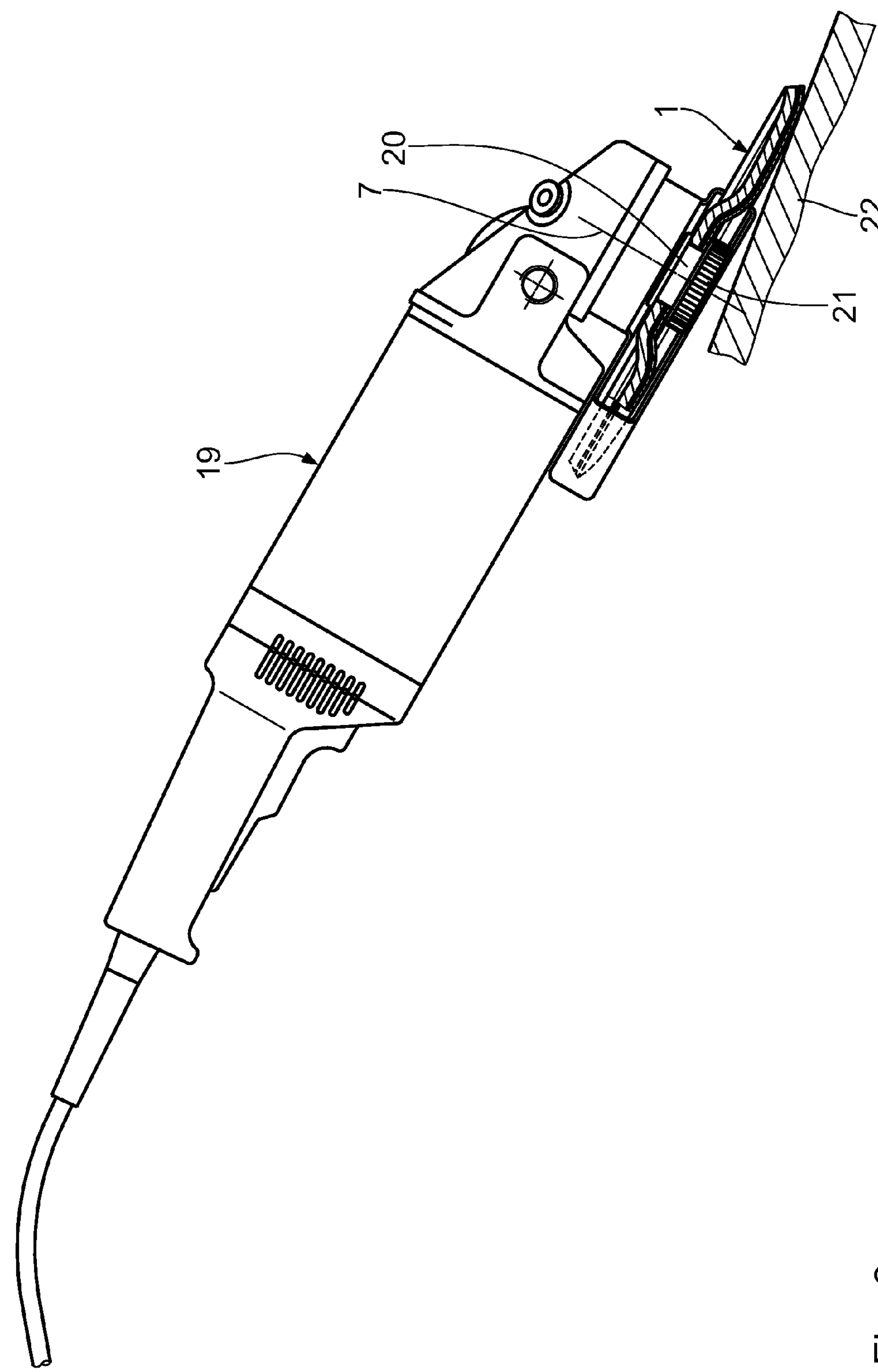


Fig. 6

ROUGH GRINDING TOOL

FIELD OF THE INVENTION

[0001] The invention relates to a rough grinding tool

[0002] with a support plate, which

[0003] is concentrically configured with respect to a centre longitudinal axis and

[0004] has a centre opening for receiving a drive shaft of a drive machine,

[0005] and

[0006] with a fiber grinding disc, which

[0007] consists of a fiber disc, with a resin-bound grinding means covering,

[0008] has an outer annular grinding region arranged radially with respect to the centre longitudinal axis,

[0009] is supported on the support plate and

[0010] has a grinding side.

BACKGROUND OF THE INVENTION

[0011] Rough grinding tools of this type are known in large numbers in practice. Fiber grinding discs of this type are configured flexibly and are detachably attached to the support plate. The fastening on the support plate takes place by means of a flange that can be screwed on in the bend region of the fiber grinding disc. During work, in which uniform surface structures have to be achieved by means of the rough grinding tool on the workpiece to be machined, the service life of the fiber grinding disc is short, for example only about 1 minute. After this time, the grinding grain of the fiber grinding disc shows the first signs of wear, so the surface of the workpiece to be machined no longer becomes completely uniform. The fiber grinding disc is therefore already exchanged after this time.

[0012] In order to allow a rapid exchange of fiber grinding discs of this type, a rapid change system was developed, as shown and described in US 2007-0010184-A1. Fine-grain grinding grain is used for the application mentioned. These fine grains, during grinding, lead to a large thermal load of the workpiece. If, the material to be ground is, for example, high-grade steel, or has low heat conductivity, blooming occurs. For this reason, in the rapid change system mentioned according to US 2007-0010184-A1, cooling channels were provided in the support plate in order to achieve good cooling of the grinding disc.

[0013] If—as conventional in practice—grinding discs with coarse-grain grinding means are used for rough grinding, there is a risk of the base carrying the grinding means tearing. This applies, in particular, if discs being used for the grinding means made of not very strong material are used as the base.

[0014] Grinding means on a base, such as are generally conventional, are known from EP 0 750 539 B1 and EP 0 617 652 B1, which thus consist of a resiliently flexible disc being used as a carrier or base, on which a grinding grain is fastened by means of a synthetic resin.

[0015] So-called fan grinding discs are known from DE 10 2006 010 366 B3 and DE 90 17 256 U1 in which the grinding plates are glued onto a carrier in the conventional manner.

SUMMARY OF THE INVENTION

[0016] The invention is based on the object of configuring a rough grinding tool of the generic type in such a way that it has high service lives with a simple and economical structure.

[0017] This object is achieved according to the invention in a rough grinding tool of the generic type in that the fiber grinding disc is glued to a support plate. It has been surprisingly shown by the gluing of the fiber grinding disc to the support plate that the fiber grinding disc does not tear despite the high loads during the rough grinding. This can be explained by the fact that the torque occurring during the rough grinding does not have to be completely absorbed by the fibers of the fiber disc. To a considerable extent there is a transfer to the support plate. Even with a torque overload and if the outer edge of the fiber grinding disc strikes against a workpiece, a break of the fiber grinding discs does not occur. In other words, no relatively small or large segments detach from the fiber grinding disc, so that injuries to the user are substantially ruled out.

[0018] The fiber disc consists of vulcanized fiber, a material, which has been known for one and a half centuries and is produced on the basis of cotton fibers. Surprisingly, it has also been found that the rough grinding tool is far superior to conventional rough grinding discs both with regard to the machined mass per time unit and also with regard to the total mass that can be machined. This applies, in particular, if ceramic grain is used as the grinding means.

[0019] It has proven to be particularly advantageous if the grinding disc with the grinding means covering is slightly convexly curved toward the grinding side. As rough grinding discs of this type, in other words rough grinding tools, are used on hand-held grinding machines, an exact angle position of the grinding tool compared to the area to be ground is generally not adhered to during use. The slight curvature leads to the fact that no high local surface pressures between the grinding disc and the workpiece to be machined, resulting in a corresponding tearing of the grinding grain, occur. This leads to a substantial increase in the service time or the machining output. If, furthermore, the grinding region is divided into a main grinding region and a radially outer smaller outer grinding region, the outer grinding region being even more strongly curved toward the rear of the grinding tool, the risk of the detachment of the grinding disc from the support plate is further reduced. Furthermore, the grinding tool may also be used herewith briefly for face grinding.

[0020] Further features, advantages and details of the invention emerge from the following description of embodiments with the aid of the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] FIG. **1** shows a first embodiment of a rough grinding tool according to the invention in a rear view according to the viewing arrow I in FIG. **3**,

[0022] FIG. **2** shows a plan view of the grinding side of the rough grinding tool according to the viewing arrow II in FIG. **3**,

[0023] FIG. **3** shows a cross section through the rough grinding tool along the section line III-III in FIG. **1**,

[0024] FIG. **4** shows a cross section through a second embodiment of a rough grinding tool according to the invention,

[0025] FIG. **5** shows a cross section through a third embodiment of a rough grinding tool according to the invention and

[0026] FIG. **6** shows a hand grinding machine with a rough grinding tool according to the invention during grinding use.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0027] The rough grinding tool shown in FIGS. **1** to **3** has a support plate **1**, which consists in the conventional manner of glass fibers which are compressed and impregnated with phenol resin and which, in the conventional manner, has a flat, annular clamping region **2**, in which an also circular opening **3** is configured to receive a drive shaft of a drive machine. The annular clamping region **2** surrounding the opening **3** is provided with a metal ring **5** on the rear of the support plate **1** remote from a grinding side **4**. A bend region **6** adjoins the clamping region **2** and is also annular and rises radially with respect to the axis **7** of the support plate **1** toward the grinding side **4**. An annular grinding region **8** adjoins the bend region **6** and is inclined radially with respect to the axis **7** counter to the bend region **6**, and specifically radially with respect to the axis **7** outwardly away from the grinding side **4**. This configuration of a support plate **1** is generally known and conventional.

[0028] A fiber grinding disc **9** is fastened to the grinding side **4**. This is a so-called grinding means on a base, which consists of a fiber disc **10** as the carrier or base and a resin-bound grinding means covering **11**. The fiber disc **10** consists of vulcanized fiber, being a bound, compressed material based on cotton fibers. The grinding means covering **11** is formed by ceramic grain **11.1**, which is produced from a microgranulate by sintering. Micro granulates break out of the respective grain individually, so the service life of the ceramic grain **11.1** in comparison to conventional grinding means is thereby considerably increased. The resin-bound grinding means covering **11** is connected in the conventional manner to the fiber disc **10**. The fiber disc **10** of the fiber grinding disc **9** is connected to the grinding side **4** of the support plate **1** by means of an adhesive layer **12**.

[0029] The radius R**1** of the support plate **1**—as can be inferred from FIG. **1**—is slightly smaller than the radius R**9** of the fiber grinding disc **9**, without the fiber grinding disc **9** projecting radially with respect to the axis **7** over the outer edge **13** of the support plate **1**. The bend region **6**, at the transition to the main grinding region **8**, has a radius R**6** from the axis **7**. The main grinding region **8** has a radius R**8** from the axis **7** which is equal to the radius R**9** of the fiber grinding disc **9**. The following applies with respect to the radii R**6** and R**8** in relation to the radius R**9**:

$$0.45\ R9 \leqq R6 \leqq 0.7\ R9$$

$$R9 = R8$$

[0030] The use of the grinding tool takes place in the conventional manner at an angle to the axis **7**.

[0031] If in the second embodiment according to FIG. **4**, the same or similar parts or regions are present as in the embodiment according to FIGS. **1** to **3**, the same reference numerals are used with a superscripted dash. The support plate **1'** consists of a glass fabric impregnated with epoxy resin. It has—as in the embodiment according to FIGS. **1** to **3**—a constant thickness h. The also annular clamping region **2'** is also configured with a circular opening **3'** to receive a drive shaft of a drive machine. The flat clamping region **2'** surrounding the opening **3'**, in this embodiment, is not reinforced with a metal ring. The bend region **6'** adjoining the clamping region **2'** is also annular and rises radially with respect to the axis **7'** of the support plate **1'** toward the grinding side **4'**. The flat clamping region **2'** passes with a radius of curvature r**2'** into the bend region **6'**. The bend region **6'** is in turn adjoined by an annular main grinding region **8'**, which is inclined radially with respect to the axis **7'** counter to the bend region **6'**, specifically radially with respect to the axis **7'** outwardly away from the grinding side **4'**. Viewed outwardly, from the axis **7'**, the grinding region **8'** is thus inclined away from the grinding side **4'**. In the configuration according to FIG. **4**, a fiber grinding disc **9'** is also fastened to the grinding side **4'** of the support plate **1'**. This is a so-called grinding means on a base, which consists of a fiber disc **10'** as a support or base and a resin-bound grinding means covering **11'**. The fiber grinding disc **9'** is thus a grinding disc, which is independent per se, which could be used, as was described above with regard to the prior art according to US 2007-0010184-A1. It is flexible, in other words bendable. The structure of the fiber grinding disc **9'** corresponds to that already described above with respect to FIGS. **1** to **3**. The grinding means covering **11'** in other words has ceramic grain **11.1°**. In the embodiment according to FIG. **4**, the fiber disc **10'** of the fiber grinding disc **9'** is also connected to the support plate **1'** by means of an adhesive layer **12'**

[0032] As can be inferred from FIG. **4**, the bend region **6'** passes into the grinding region **8'** with a radius of curvature r**6'**. The main grinding region **8'** itself is also curved, specifically slightly convexly to the grinding side **4'** with a radius of curvature r**8'**.

[0033] The outer grinding region **15'** adjoining the main grinding region **8'** is inclined away, viewed radially outwardly, from the grinding side **4'** and convexly curved with respect to the grinding side **4'** with a radius of curvature r**15'**.

[0034] The curvatures with the radii of curvature r**6'**, r**8'** and r**15'** are configured convexly to the grinding side **4'**; the reason for this is that the use of the rough grinding tool in the conventional manner takes place at an angle to the axis **7'**. The fiber disc **10'** ends—as can be inferred from FIG. **4**—flush with the outer edge **13'** of the support plate **1'**. The following relationships apply to the radii of curvature r**2'**, r**6'**, r**8'** and r**15'**:

$$15\text{ mm} \leqq r2' \leqq 30\text{ mm and preferably } 20\text{ mm} \leqq r2' \leqq 25\text{ mm}$$

$$15\text{ mm} \leqq r6' \leqq 40\text{ mm and preferably } 15\text{ mm} \leqq r6' \leqq 20\text{ mm}$$

$$190\text{ mm} \leqq r8' \leqq 300\text{ mm and preferably } 200\text{ mm} \leqq r8' \leqq 250\text{ mm}$$

$$17\text{ mm} \leqq r15' \leqq 40\text{ mm and preferably } 15\text{ mm} \leqq r15' \leqq 20\text{ mm}$$

[0035] The fiber grinding disc **9'** has a radius R**9'** from the axis **7'**. The bend region **6'** at the transition to the main grinding region **8'** has a radius R**6'** from the axis **7'**. The main grinding region **8'** has a radius R**8'** from the axis **7'**, which is only equal to the radius R**9'** of the fiber grinding disc **9'** if no separate more strongly curved outer grinding region **15'** is present. With respect to the radii R**6'** and R**8'**, the following applies in relation to the radius R**9'**:

$$0.45\ R9' \leqq R6' \leqq 0.7\ R9'$$

$$0.75\ R9' \leqq R8' \leqq R9'$$

[0036] The embodiment according to FIG. **5** differs from that according to FIG. **4** in that the support plate **1"** has a radially outwardly increasing resilience, in other words a lower rigidity or greater flexibility. All the parts or regions coinciding with FIG. **4** are therefore designated by the same reference numerals and all the similar parts or regions are in each case designated by the same reference numerals as were used in FIG. **4**, supplemented by a superscripted double dash, without another description being necessary.

[0037] The increasing resilience of the support plate **1"** in the direction of the outer edge **13"** is achieved in that the support plate **1"** has a plurality of respective annular portions **16**, **17** or **18**, which have a different, radially outwardly decreasing thickness. In the embodiment according to FIG. **5**, the portion **16** extends approximately to the transition from the bend region **6'** into the main grinding region **8"**; it has the thickness h here. The annular portion **17** adjoining this radially outwardly extends radially up to in front of the outer grinding region **15"**. The portion **17** has a thickness h'; the outer portion **18** has a thickness h", wherein h>h'>h". Basically, in a stepped configuration according to FIG. **5**, it is to be assumed that at least two portions of this type and at most five portions of this type are provided. The above relationships apply to the radii R**6'**, R**8"** and R**9'**.

[0038] The use of the rough grinding tool according to the invention on hand grinding machines **19** emerges from FIG. **6**. The rough grinding tool is placed on an output shaft **20** of the hand grinding machine **19**, which is placed through the opening **3** of the grinding tool, so the axis **7** coincides with the centre axis of the output shaft **20**. The fastening of the grinding tool on the output shaft **20** takes place by means of a clamping nut **21**.

[0039] The convex curvature of the main grinding region **8"** toward the grinding side **4'** means that during surface grinding of workpieces **22**, in other words, in the main use region of grinding tools of this type, even with unavoidable oscillating movements of the grinding tool, a uniform load of the grinding means covering **11'** occurs, in other words, no extreme surface pressures occur. In these rough grinding tools always used on hand grinding machines, this leads to lower wear and therefore a higher service time and a higher removal output of the grinding disc. This advantageous effect is further reinforced by the outwardly increasing resilience of the grinding tool according to FIG. **5**.

[0040] The greater curvature in the outer grinding region **15'** or **15"** means that when the outer edge **13'** or **13"** of the grinding disc strikes against an object, no detachment of the fiber grinding disc **9'** together with the grinding means covering **11** from the support plate ' or **1"** takes place.

1. A rough grinding tool comprising
a support plate, which
is concentrically configured with respect to a centre longitudinal axis and
has a centre opening for receiving a drive shaft of a drive machine,
and
a fiber grinding disc, which
consists of a fiber disc, with a resin-bound grinding means covering,
has an outer annular grinding region arranged radially with respect to the centre longitudinal axis,
is supported on the support plate and
has a grinding side,
wherein the fiber grinding disc is glued to the support plate.

2. A rough grinding tool according to claim **1**, wherein the fiber grinding disc is glued to the support plate by means of an adhesive layer.

3. A rough grinding tool according to claim **1**, comprising ceramic grain as the grinding means.

4. A rough grinding tool according to claim **1**, wherein the grinding region is convex toward the grinding side with a radius of curvature r**8'**.

5. A rough grinding tool according to claim **1**, wherein the grinding region has a main grinding region and an outer grinding region which adjoins radially outwardly with respect to the axis and which grinding region is convex toward the grinding side with a radius of curvature r**15'**.

6. A rough grinding tool according to claim **5**, wherein the grinding region is convex toward the grinding side with a radius of curvature r**8'** and wherein with regard to the radius of curvature r**15'** in relation to the radius of curvature r**8'** there applies: r**15'**<r**8'**.

7. A rough grinding tool according to claim **4**, wherein with regard to the radius of curvature r**8'** there applies:

$$190\ \text{mm} \leqq r8' \leqq 300\ \text{mm}.$$

8. A rough grinding tool according to claim **5**, wherein with regard to the radius of curvature r**15'** there applies:

$$17\ \text{mm} \leqq r15' \leqq 40\ \text{mm}.$$

9. A rough grinding tool according to claim **1**, wherein the grinding region has an inner radius R**6'** and an outer radius R**8'** and the fiber grinding disc has an outer radius R**9'** wherein there applies:

$$0.45\ R9' \leqq R6' \leqq 0.7\ R9' \text{ and}$$

$$0.5\ R9' \leqq R8' \leqq R9'.$$

10. A rough grinding tool according to claim **1**, wherein the support plate has an outwardly increasing resilience radially with respect to the axis.

11. A rough grinding tool according to claim **10**, wherein the resilience increases step-wise radially outwardly.

12. A rough grinding tool according to claim **11**, wherein the support plate has a plurality of annular portions, which in each case have a thickness h, h', h" outwardly decreasing radially with respect to the axis.

13. A rough grinding tool according to claim **1**, wherein, the fiber disc consists of vulcanized fiber.

14. A rough grinding tool according to claim **7**, wherein with regard to the radius of curvature r**8'** there applies:

$$200\ \text{mm} \leqq r8' \leqq 250\ \text{mm}.$$

15. A rough grinding tool according to claim **8**, wherein with regard to the radius of curvature r**15'** there applies:

$$15\ \text{mm} \leqq r15' \leqq 20\ \text{mm}.$$

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