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(54) **Hand-held machine tool for sanding or polishing a workpiece**

(57) The invention refers to a hand-held machine tool (1) for sanding or polishing a workpiece. The machine tool (1) comprises a housing (2) and a working element (3) adapted for performing an orbital movement in respect to the housing (2). In the housing (2) there are a motor (4) with a motor shaft (5) adapted for performing a rotational movement around an axis of rotation (6), and means (7, 8) for transforming the rotational movement of the shaft (5) into the orbital movement of the working element (3). In order to allow a fast and easy variation of a rotational position of the working element (3) it is suggested that the working element (3) is supported in respect to the machine tool's housing (2) in order to freely rotate around a longitudinal axis (9), that the housing (2) comprises a plurality of magnetic elements (16) facing the working element (3) and that the working element (3) comprises a plurality of corresponding magnetic elements (17) facing the housing (2). The magnetic elements (16, 17) of the housing (2) and the working element (3), respectively, are adapted to interact with one another, in order to hold the working element (3) in a desired rotational position in respect to the housing (2) by means of magnetic force.

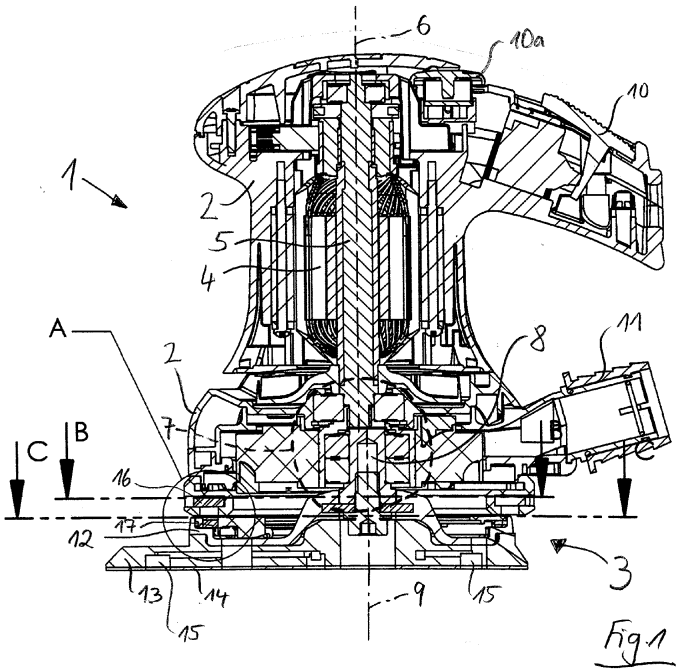

Fig 1

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Description

[0001] The present invention refers to a hand-held machine tool for sanding or polishing a workpiece. The machine tool comprises

- a housing and
- a working element adapted for performing an orbital movement in respect to the housing.

[0002] The machine tool further comprises in the housing

- a motor with a motor shaft adapted for performing a rotational movement around an axis of rotation, and
- means for transforming the rotational movement of the shaft into the orbital movement of the working element.

[0003] Such machine tools are well known in the prior art, for example as orbital sanders or orbital polishers. The working element seen in a plan view may have almost any form. In particular it may have a circular, rectangular, quadratic or triangle form. In many embodiments it has at least three external corners and in particular it has the form of a triangle.

[0004] The working element may comprise a planar base plate made of a rigid material, a planar absorption plate attached to a bottom surface of the base plate and made of a resilient material, and an abrasive or polishing sheet attached to a bottom surface of the absorption plate. Other embodiments of the working element are possible, too.

[0005] Reference is made to a machine tool which, for example but not limited to, is an orbital sander or polisher in which the working element is eccentrically mounted in respect to the axis of rotation of the motor shaft. Rotation of the motor shaft is transformed into an orbital movement of the working element by means of transforming means. These can be some kind of a gear mechanism or, for example but not limited to, an eccentric attachment, eccentrically guiding an eccentric pin connected to the working element. Depending on how the working element is guided in the machine tool it performs an orbital or a random orbital movement. In the present invention only machine tools with an orbitally moving working element are considered. An orbital movement means that the working element moves two-dimensionally in its plane of extension, i.e. forward and backward as well as to both sides, whereby a rotation of the working element is inhibited, that is the rotational position or the orientation of the working element within its plane of extension remains essentially the same.

[0006] Hand-held machine tools of the above identified kind are well known in the prior art. A problem arises in the fact that the working element cannot rotate around a longitudinal axis so that during operation of the machine tool it is always the same part of the working element facing in the same direction. For example, in an orbital sander with a working element having the form of a triangle one of the three corners usually faces to the front of the machine tool. The front corner of the working element, in particular the abrasive or polishing sheet attached to the bottom surface of the working element and/or the planar absorption plate made of a resilient material, is worn up rather quickly in that corner whereas the abrasive or polishing sheet or the planar absorption plate near the other corners would probably still be essentially unused.

[0007] Theoretically, it is possible to rotate the working element in respect to the machine tool's housing around the longitudinal axis. However, this can only be achieved by releasing a mechanical connection between the working element and the eccentric pin which is usually established by means of a screw coupling or similar. Therefore, the abrasive or polishing sheet would have to be detached from the bottom surface of the working element in order to have access to the screw, a nut or a similar fastening element used for the mechanical connection between the working element and the eccentric pin. The fastening element would have to be loosened by means of an appropriate tool, the fastening element detached from the eccentric pin, the working element detached from the eccentric pin, the working element rotated around the longitudinal axis by the desired rotational angle, the working element fitted to the eccentric pin, and the fastening element attached and fastened to the eccentric pin with the appropriate tool and finally the abrasive or polishing sheet would have to be reattached to the bottom surface of the working element again.

[0008] Therefore, there is clearly a need for a hand-guided machine tool with a working element for sanding and/or polishing workpieces, which can be easily and quickly brought into a different rotational position, in order to assure an even and equal use of the corners and edges of the working element.

[0009] In accordance with the present invention this object is achieved by a machine tool according to the preamble of claim 1, wherein the working element is supported in respect to the machine tool's housing such that it is able to rotate around a longitudinal axis in respect to the housing, in that the housing comprises a plurality of magnetic elements facing the working element and in that the working element comprises a plurality of corresponding magnetic elements facing the housing, wherein the magnetic elements of the housing on the one hand and the magnetic elements of the working element on the other hand are adapted to interact with one another, in order to hold the working element in a rotational position in respect to the housing by means of magnetic force.

[0010] The present invention is in particular directed to orbital sanders or polishers with a planar working element performing an orbital movement during operation of the tool. The working element is rotatably mounted to driving means of the machine tool adapted for imposing the desired orbital movement to the working element, in

particular to the eccentric pin of the transmission means. In order to avoid a free rotational movement of the working element around the longitudinal axis during operation of the machine tool, magnetic elements are provided in the housing of the tool as well as in the working element, in order to hold the working element in a desired rotational position in respect to the housing by means of magnetic force. The desired rotational position of the working element corresponds to a desired orientation of the working element in respect to the longitudinal axis.

[0011] The magnetic force must be large enough to assure that the working element can be safely held in the rotational position during operation of the machine tool. Even a shock or strong vibrations must not suspend the adherence of the working element in its rotational position in respect to the housing. Of course, the orbital movement of the working element in respect to the housing is not inhibited by the magnetic force acting between the working element and the housing. To this end a gap is provided between the working element and the housing providing clearance and allowing a free movement between the two, which is only restricted or limited by the magnetic force effective between the magnetic elements of the housing on the one hand and the respective magnetic elements of the working element on the other hand.

[0012] Nonetheless, despite the magnetic force effective between the working element and the housing, preferably the rotational position of the working element can be changed by applying a rotational force onto the working element, thereby overcoming the magnetic force effective between the magnetic elements. The rotational force could be applied, for example, manually by gripping the working element and by simply turning it around the longitudinal axis, thereby overcoming the magnetic force. Preferably, the rotational position of the working element is changed when the motor of the machine tool is turned off, or at least when the working element does not execute its working movement (orbital or random orbital movement). For facilitating the rotational movement of the working element around the longitudinal axis, it is possible to automatically or manually reduce the magnetic force effective between the magnetic elements, as soon as the working element no longer executes its working movement and/or the motor is turned off. This could be achieved, for example, by embodying at least some of the magnetic elements as solenoids, which exert a magnetic force only with current running through their coils, and by automatically or manually reducing the current when the working element no longer executes its working movement and/or the motor is turned off.

[0013] Of course, the magnetic elements do not necessarily have to be located inside the housing and the working element, respectively. It is understood that one set of magnetic elements is associated with the housing and the other set of magnetic elements is associated with the working element. How and where the sets of magnetic elements are fixed to the housing and the working element, respectively, is of no account for a proper working of the invention.

[0014] Without the magnetic force acting between the machine tool's housing and the working element, the working element would probably effect a rotary orbital movement when the motor is turned on. Hence it would not only perform the orbital movement but also rotate around the longitudinal axis. However, during operation of the motor or during execution of the working movement by the working element, respectively, the rotational movement of the working element is inhibited by the magnetic force acting between the magnetic elements of the working element and the housing.

[0015] Of course, the magnetic force does not necessarily have to be effective between all magnetic elements of the housing and the working element, respectively. It would be sufficient if in each desired rotational position at least one of the magnetic elements associated with the housing interacts with at least one corresponding magnetic element associated with the working element. In order to provide for a safer holding of the working element in its respective rotational position it is suggested that in each desired rotational position there are at least two, preferably three, magnetic elements associated with the housing which interact with a corresponding number of magnetic elements associated with the working element. Hence, the desired rotational positions the working element can be rotated into is defined by the number and the position of the magnetic elements in the housing and the working element, respectively.

[0016] According to a preferred embodiment of the present invention, the number, the magnetic characteristics, the dimensions and/or the positions of the magnetic elements are designed such that the working element is held in the desired rotational position at least when the motor is activated and the tool is in an idle state. The tool is in an idle state if the motor is turned on but the bottom surface of the working element has no contact with the workpiece to be sanded or polished. Preferably, the lines of magnetic flux of the magnetic field in the air gap between the housing and the working element run perpendicularly to the vibration or oscillations plane of the working element during its intended use. The closer two opposing magnetic elements of the housing and the working element are located the larger the magnetic force is. Further, the larger the surface of a magnetic element facing an opposing magnetic element is, the larger the magnetic force is. The magnetic susceptibility and the magnetic permeability are characteristics of the magnetic elements which can influence the intensity and strength of the magnetic force.

[0017] According to another preferred embodiment of the present invention, the number, the magnetic characteristics, the dimensions and/or the positions of the magnetic elements are designed such that the working element is held in the desired rotational position at least when the motor is activated and the tool is in its intended use with a maximum of 30% of an overall bottom surface of the working element, to which an abrasive or polishing

sheet is attached, being used for sanding or polishing the workpiece. According to this embodiment, the working element is held in its rotational position during most of the time it is used for sanding or polishing the workpiece. An occasional rotation of the working element around its longitudinal axis during the intended use of the tool may be provoked. Such a rotation is provoked if during the intended use of the tool a rotational force acts on the working element which overcomes the magnetic force. Usually, the working element is rotated only into the next rotational position defined by the positions of the magnetic elements in the housing and the working element. Even this embodiment with an occasional rotation of the working element around the longitudinal axis has the advantages of the present invention.

[0018] However, it is particularly preferred that the number, the magnetic characteristics, the dimensions and/or the positions of the magnetic elements are designed such that the working element is held in the desired rotational position when the motor is activated and the tool is in its intended use with a maximum of 100% of an overall bottom surface of the working element, to which an abrasive or polishing sheet is attached, being used for sanding or polishing the workpiece. According to this particularly preferred embodiment, the overall magnetic force acting between the magnetic elements of the housing and the working element is so strong that the working element is held in its rotational position no matter how intensive the tool is used. In any case the working element remains in its desired rotational position and will be moved into the next desired position only if the user decides to and explicitly acts to provoke the rotation of the working element around the longitudinal axis.

[0019] Preferably, at least some of the magnetic elements are permanent magnets or solenoids. Permanent magnets create a static magnetic field and are made of, for example, magnetized low carbon steel, cobalt, nickel, a ferrite or a Rare Earth Element. The other magnetic elements could be embodied as ferromagnetic elements (for example low carbon steel, cobalt, nickel or a ferrite), which are adapted to magnetically interact with the permanent magnets and solenoids, respectively. The ferromagnetic elements are attracted by a permanent magnet or a solenoid if they are located in a magnetic field generated by the magnet or the solenoid. Preferably, the ferromagnetic elements do not create their own magnetic field.

[0020] If the magnetic elements comprised permanent magnets a rotation of the working element into a new desired rotational position could be achieved in the following way: A user would simply grip the working element with his hand when the machine tool is turned off and imply a rotational force on the working element. The rotational force must overcome the magnetic force, in order to achieve a turning of the working element around the longitudinal axis to the next desired rotational position, in which the magnetic force acts again between the sets of magnets associated to the working element and the housing, respectively.

[0021] If the magnet elements comprised solenoids, it would be possible to electrically turn off the solenoids (for example by pressing a switch and interrupting the current running through the solenoids), thereby interrupting the magnetic force effective between the magnetic elements of the housing on the one hand and the magnetic elements of the working element on the other hand. Then the working element could easily be rotated around the longitudinal axis into the next desired rotational position without having to overcome a magnetic force. Then the solenoids could be turn on again in order to generate the magnetic force again acting between the sets of magnets associated to the working element and the housing, respectively, and holding the working element in the new rotational position.

[0022] According to a preferred embodiment of the present invention, the magnetic elements of the housing are permanent magnets and wherein the magnetic elements of the working element are ferromagnetic elements. The ferromagnetic elements can be, for example, small and light weight plates made of low carbon steel or a similar material with ferromagnetic properties. Locating these on or in the working element has the advantage that the orbital movement of the working element is not affected too much by the additional weights located eccentrically to the longitudinal axis and the eccentric pin, respectively.

[0023] Preferably, the magnetic elements of the housing are located around the longitudinal axis having the same given distance to the longitudinal axis and being circumferentially evenly spaced apart from one another. Similarly, it is preferred that the magnetic elements of the working element are located around the longitudinal axis having the same given distance to the longitudinal axis and being circumferentially evenly spaced apart from one another. Preferably, the distances of the magnetic elements to the longitudinal axis are the same for the magnetic elements of the housing and for the magnetic elements of the working element. This assures that the magnetic elements of the housing can effectively interact with the magnetic elements of the working element in the desired rotational positions.

[0024] According to another preferred embodiment, the number of magnetic elements of one of the housing and the working element is a multiple of the number of magnetic elements of the other one of the housing and the working element. Preferably, the number of magnetic elements of the housing is a multiple of the number of magnetic elements of the working element. In particular, it is suggested that the number of magnetic elements of one of the housing and the working element is twice the number of magnetic elements of the other one of the housing and the working element.

[0025] Hence, the number of the magnetic elements associated to the housing and the number of the magnetic elements associated to the working element does not necessarily have to be the same. Quite to the contrary

in order to reduce the orbiting masses of the working element, it is suggested that the working element comprises less magnetic elements than the housing. Due to the larger number of magnetic elements in the housing the working element can still be brought into a larger number of rotational positions, that is into more rotational positions than there are magnetic elements in the working element.

[0026] According to yet another preferred embodiment, the working element seen in a plan view has at least three external corners and in particular has the form of a triangle. Preferably, the working element has a so-called delta-shape, which seen in the plan view corresponds to a triangle-shape with the edges arcuated to the outside. This kind of working element is preferably used for working workpieces in hard-to-reach internal corners and/or along inner edges of the workpiece. In that case preferably the number of magnetic elements of the housing is six and the number of magnetic elements of the working element is three. Of course, it is understood that the number of six magnetic elements in the housing and three magnetic elements in the working element could also be used in machine tools having a working element with a form other than a triangle form.

[0027] Preferably, the machine tool is one of an orbital sander and an orbital polisher.

[0028] Further characteristics and advantages of the present invention are described hereinafter with reference to the accompanying drawings. The drawings show a preferred embodiment of the present invention without, however, limiting the invention to the described embodiment. Rather, there are many possible alternative embodiments of the present invention besides the embodiment explicitly described hereinafter and shown in the figures. The figures show:

Fig. 1 a vertical cross section of an orbital sander having a delta-shaped working element;

Fig. 2 a detail A of the orbital sander of figure 1;

Fig. 3 a horizontal cross section along line B-B of the orbital sander of figure 1;

Fig. 4 a horizontal cross section along line C-C of the orbital sander of figure 1;

Fig. 5 a perspective view of the orbital sander of figure 1 with the working element in a first rotational position; and

Fig. 6 a perspective view of the orbital sander of figure 1 with the working element in a second rotational position.

[0029] With reference to the attached figures a preferred embodiment of a hand-held and hand-guided machine tool according to the present invention is described. The machine tool shown by way of example in the figures is an orbital sander 1. The orbital sander 1 comprises a housing preferably made of plastic material. Of course, at least part of the housing 2 could be made of other materials, for example metal or carbon fibre. Further, the sander 1 comprises a working element 3 adapted for performing an orbital movement in respect to the housing 2. Within the housing 2 the sander 1 comprises a motor 4 with a motor shaft 5 adapted for performing a rotational movement around an axis 6 of rotation. In this embodiment the motor 4 is an electric motor. Of course, it could also be a pneumatic motor. Further, means 7 for transforming the rotational movement of the shaft 5 into the orbital movement of the working element 3 are provided. In this embodiment the transforming means 7 are embodied as an eccentric mechanism including an eccentric pin 8 having a longitudinal axis 9. The eccentric pin 8 is located eccentrically to the motor shaft 5, which can be seen by the displacement of the shaft's rotational axis 6 and the pin's longitudinal axis 9. Of course, the transforming means 7 could be embodied as any other kind of gear mechanism, too.

[0030] The sander 1 also comprises a switch 10 for activating/deactivating the sander 1 and a wheel 10a for controlling the speed of the working plate's orbital movement. Furthermore, the sander 1 comprises a self-generated dust extraction system comprising venting means in the inside of the housing 2 blowing dust generated during operation of the sander 1 from the working surface to a dust suction connection tube 11. A hose from a vacuum cleaner or from any other dust suction device can be connected to the connection tube 11, in order to improve the dust extraction from the sander 1.

[0031] The working element 3 preferably comprises a planar base plate 12 made of a rigid material, a planar absorption plate 13 attached to a bottom surface of the base plate 12 and made of a resilient material, and an abrasive or polishing sheet 14 attached to a bottom surface of the absorption plate 13. Holes 15 are provided in the sheet 14 and in the absorption plate 13 in order to allow the evacuation of dust from the working surface.

[0032] According to the present invention the working element 3 is supported in respect to the housing 2 such that it is able to rotate around a longitudinal axis, which in this embodiment corresponds to the eccentric pins's longitudinal axis 9. However, it may well be that the pin's axis 9 is displaced in respect to the longitudinal axis of rotation for the working element 3. Further, the housing 2 comprises a plurality of magnetic elements 16 facing the working element 3 and the working element 3 comprises a plurality of magnetic elements 17 facing the housing 2. The magnetic elements 16 of the housing 2 on the one hand and the magnetic elements 17 of the working element 3 on the other hand are adapted to interact with one another, in order to hold the working element 3 in a rotational position in respect to the housing 2 by means of magnetic force. Hence, the working element 3 would be freely rotable about the longitudinal axis

9 if it was not held in a desired rotational position by the magnetic force acting between the housing 2 and the working element 3 and exercised by the interaction of the magnetic elements 16, 17.

[0033] A detailed view of the sander 1 in the region where the magnetic force acts between the housing 2 and the working element 3 (detail A) is shown in figure 2. It can be seen that the magnetic element 16 is connected to the housing 2. It can be connected to the housing directly or indirectly by means of one or more additional elements 18 (for example made of metal) which are connected to the housing 2. Preferably, the magnetic element 16 is a permanent magnet. However, it could also be embodied as a solenoid or a ferromagnetic element. The magnetic element 16 is inserted into a receiving cavity 19 through an opening 20 from the side. The cavity 19 is located in the housing 2 or the additional element 18. After having reached its working position, the magnetic element 16 can be fixed within the cavity 19. An opening 21 below the magnetic element 16 and directed towards the working element 3 can serve for allowing the magnetic force to better interact with the corresponding magnetic element 17 of the working element 3 and for accessing the magnetic element 16, for example for removing it from the cavity 19 if necessary.

[0034] The magnetic element 17 can be fixed to any part of the working element 3. In this embodiment, it is fixed indirectly to the planar base plate 12 by means of one or more additional elements 12a made of a rigid material. However, it would be possible to fix the magnetic element 17 directly to the rigid base plate 12, too. The magnetic element 17 is inserted into a cavity from the top through an opening 22 of the cavity. The cavity is located in the additional element 12a or the base plate 12. The opening 22 can be closed after insertion of the magnetic element 17. Closing of the opening 22 can be performed by means of a suitable plug element or by injecting a plastic material into the cavity through the opening 22. After hardening the injected material will securely close the opening 22. Closing of the openings 22 has the advantage that the magnetic elements 17 are fixedly secured within the cavity and that humidity, dust and dirt is prevented from entering into the cavities. It is preferred that the magnetic elements 17 are inserted into the working element 3 during its production so no additional manufacturing step is necessary for fixing the magnetic elements 17 to the working element 3 and for closing the openings 22. Of course, it is not necessary to close the openings 22 after insertion of the magnetic elements 17. The magnetic elements 17 can be fixed within the cavities by means of glue, clamping or the like.

[0035] The magnetic element 17 may be a permanent magnet or a ferromagnetic element. The ferromagnetic element may be a small and light weight plate made of low carbon steel or a similar material with good ferromagnetic properties.

[0036] A gap 23 between the housing 2 and the working element 3 is provided in order allow the orbital movement of the working element 3 in respect to the housing 2. The magnetic field which is built up between the magnetic elements 16 of the housing and the magnetic elements 17 of the working element 3 runs across the gap 23. The magnetic field is strong enough to provoke a magnetic force which can safely and securely hold the working element 3 in the desired rotational position in respect to the housing 2 even if the sander 1 is exposed to vibrations and mechanical shocks.

[0037] Figure 3 shows a sectional view of the sander 1 of figure 1 in the plane B-B. It can be seen that the working element 3 has a so-called delta-shape, which seen in the plan view corresponds to a triangle-shape with the edges arcuated to the outside. Figure 3 is a section through the additional element 18 actually making part of the housing 2. It can be seen that there are a total of six magnetic elements 16. The magnetic elements 16 are located around the axis of rotation 6 each having the same given distance to the axis 6 and being circumferentially evenly spaced apart from one another. The magnetic elements 16 are preferably permanent magnets.

[0038] Figure 4 shows a sectional view of the sander 1 of figure 1 in the plane C-C. The delta-shape of the working element 3 can be clearly seen. Figure 4 is a section through the planar base plate 12 actually making part of the working element 3. It can be seen that there are a total of three magnetic elements 17. The magnetic elements 17 are located around the longitudinal axis 9 each having the same given distance to the longitudinal axis 9 and being circumferentially evenly spaced apart from one another. The magnetic elements 17 are preferably ferromagnetic elements, in particular small plates made of low carbon steel.

[0039] Preferably the distances of the magnetic elements 16 to the axis of rotation 6 and of the magnetic elements 17 to the longitudinal axis 9 are designed in order to make sure that in the desired rotational positions of the working element 3 the magnetic elements 16, 17 face each other to achieve the maximum magnetic force acting between the magnetic elements 16, 17. Preferably, the distances of the magnetic elements 16, 17 to their respective axes 6, 9 are identical. In this embodiment there are a total of six possible rotational positions in which the working element 3 can be held by the magnetic force. The rotational positions differentiate from each other by a rotational angle of 60°. Of course, it would be easily possible within the sense of the present invention to provide for more or less magnetic elements 16, 17 in the housing 2 and the working element 3, respectively.

[0040] Figure 5 shows a perspective view of the sander 1. It can be seen that in the current rotational position of the working element 3 one of the corners 25 is facing to the front of the sander 1. This corner 25 or rather the absorption plate 13 and the abrasive or polishing sheet 14 located at that corner 25 are used for a sanding or polishing operation, in particular in a hard-to-reach internal corner or along an inner edge of a workpiece. There-

fore, these parts of the working element 3 will be worn out and used up rather quickly whereas the rest of the working element 3, in particular near the other corners 26 facing backwards, will still be almost unused. In order to provide for an even and equal use of the working element 3, in particular of the absorption plate 13 and the abrasive or polishing sheet 14 near the corners 25, 26, the present invention allows a rotation of the working element 3 around the longitudinal axis 9 in the direction of arrow 27 into desired rotational positions in respect to the housing 2. The working element 3 is held in the rotational positions by means of magnetic force. Preferably, in each of the desired rotational positions one of the corners 25, 26 of the working element 3 is directed to the front of the sander 1.

[0041] Furthermore, it may be desirable when working with the sander 1 of figure 5 to have one of the edges 28 facing to the front of the sander 1 instead of the corner 25. This may be desirable, for example, for sanding or polishing, in particular along a hard-to-reach inner edge of a workpiece. To this end, further rotational positions of the working element 3 are defined in which one of the edges 28 of the working element 3 is directed to the front of the sander 1. Summing up, in the present embodiment the working element 3 can be rotated into different discrete rotational positions in steps of 60° in order to have either one of the corners 25, 26 or one of the edges 28 facing to the front of the sander 1. Figure 6 shows the sander 1 of figure 5 after the working element 3 has been rotated by 60°, 180° or 300° into a defined rotational position with one of the edges 28 facing to the front. If the working element 3 of sander 1 of figure 5 was rotated by 120° or 240° into other defined rotational positions one of the corners 26 would be facing to the front (not shown). The hand-held machine tool 1 of the preferred embodiment shown in the figures has a total of six discrete rotational positions. Of course, within the sense of the present invention, by providing a different number of magnetic elements 16, 17 and/or by changing their position in the housing 2 and the working element 3, respectively, it would be possible to define a different number of rotational positions. Further, the various rotational positions do not necessarily have to be spaced apart from one another by equal angles. It would also be possible to provide for different angles between the various rotational positions, for example: 20°, 40°, 20°, 40°, 20°, 40°, 20°, 40°, 20°, 40°, 20°, and 40° summing up to a total of 12 rotational positions. Of course, other embodiments are possible, too.

Claims

1. Hand-held machine tool (1) for sanding or polishing a workpiece, the machine tool (1) comprising

   - a housing (2) and
   - a working element (3) adapted for performing an orbital or a random orbital movement in respect to the housing (2), and the machine tool (1) further comprises in the housing (2)
   - a motor (4) with a motor shaft (5) adapted for performing a rotational movement around an axis of rotation (6), and
   - means (7, 8) for transforming the rotational movement of the shaft (5) into the orbital or a random orbital movement of the working element (3), **characterized in that** the working element (3) is supported in respect to the machine tool's housing (2) such that it is able to rotate around a longitudinal axis (9) in respect to the housing (2), **in that** the housing (2) comprises a plurality of magnetic elements (16) facing the working element (3) and **in that** the working element (3) comprises a plurality of corresponding magnetic elements (17) facing the housing (2), wherein the magnetic elements (16) of the housing (2) on the one hand and the magnetic elements (17) of the working element (3) on the other hand are adapted to interact with one another, in order to hold the working element (3) in a desired rotational position in respect to the housing (2) by means of magnetic force.

2. Machine tool (1) according to claim 1, wherein the number, the magnetic characteristics, the dimensions and/or the position of the magnetic elements (16, 17) is designed such that the working element (3) is held in the desired rotational position at least when the motor (4) is activated and the tool (1) is in an idle state.

3. Machine tool (1) according to claim 1 or 2, wherein the number, the magnetic characteristics, the dimensions and/or the position of the magnetic elements (16, 17) is designed such that the working element (3) is held in the desired rotational position at least when the motor (4) is activated and the tool (1) is in use with a maximum of 30% of an overall bottom surface of the working element (3), to which an abrasive or polishing sheet is attached, being used for sanding or polishing the workpiece.

4. Machine tool (1) according to one of the claims 1 to 3, wherein the number, the magnetic characteristics, the dimensions and/or the position of the magnetic elements (16, 17) is designed such that the working element (3) is held in the desired rotational position at least when the motor (4) is activated and the tool (1) is in use with a maximum of 100% of an overall bottom surface of the working element (3), to which an abrasive or polishing sheet is attached, being used for sanding or polishing the workpiece.

5. Machine tool (1) according to one of the preceding claims, wherein the rotational position of the working

element (3) can be changed in respect to the housing (2) by overcoming the magnetic force effective between the magnetic elements (16) of the housing (2) on the one hand and the magnetic elements (17) of the working element (3) on the other hand.

6. Machine tool (1) according to one of the preceding claims, wherein at least part of the magnetic elements (16, 17) are permanent magnets or solenoids.

7. Machine tool (1) according to one of the preceding claims, wherein at least part of the magnetic elements (16, 17) are ferromagnetic elements.

8. Machine tool (1) according to one of the preceding claims, wherein the magnetic elements (16) of the housing (2) are permanent magnets and wherein the magnetic elements (17) of the working element (3) are ferromagnetic elements.

9. Machine tool (1) according to one of the preceding claims, wherein the magnetic elements (16) of the housing (2) are located around the axis of rotation (6) having the same given distance to the axis (6) and being circumferentially evenly spaced apart from one another.

10. Machine tool (1) according to one of the preceding claims, wherein the magnetic elements (17) of the working element (3) are located around the longitudinal axis (9) having the same given distance to the longitudinal axis (9) and being circumferentially evenly spaced apart from one another.

11. Machine tool (1) according to claim 9 or 10, wherein the distances of the magnetic elements (16) to the axis of rotation (6) and of the magnetic elements (17) to the longitudinal axis (9) are designed in order to make sure that in the desired rotational positions of the working element (3) the magnetic elements (16, 17) face each other.

12. Machine tool (1) according to one of the preceding claims, wherein the number of magnetic elements (16) of the housing (2) is a multiple or a fraction of the number of magnetic elements (17) of the working element (3).

13. Machine tool (1) according to claim 12, wherein the number of magnetic elements (16) of the housing (2) is twice or half the number of magnetic elements (17) of the working element (3).

14. Machine tool (1) according to claim 12, wherein the number of magnetic elements (16) of the housing (2) is three times or one third the number of magnetic elements (17) of the working element (3).

15. Machine tool (1) according to one of the preceding claims, wherein the working element (3) seen in a plan view has at least three external corners (25, 26) and in particular has the form of a triangle.

16. Machine tool (1) according to claim 15, wherein the number of magnetic elements (16) of the housing (2) is six and the number of magnetic elements (17) of the working element (3) is three.

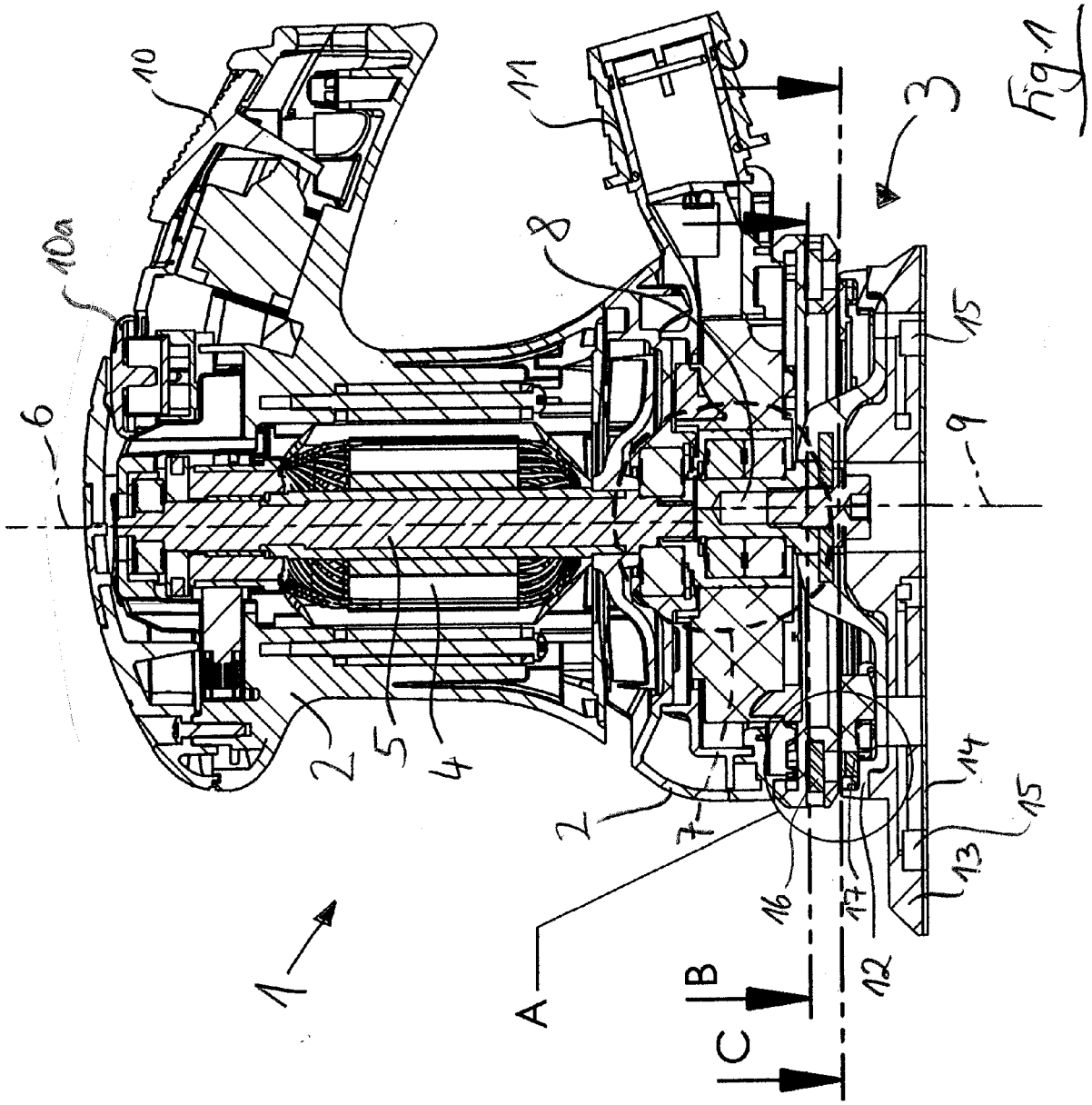


Fig.1

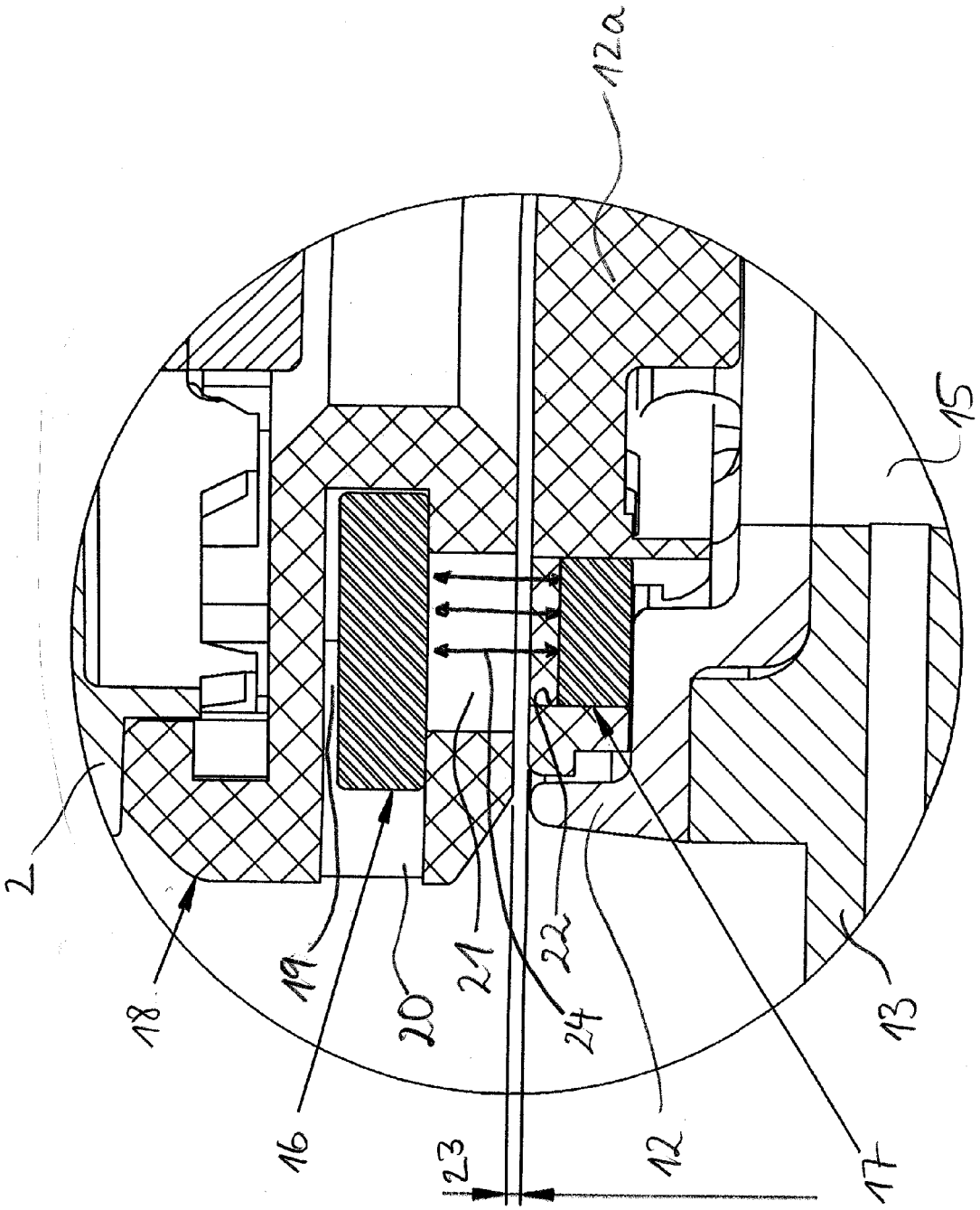
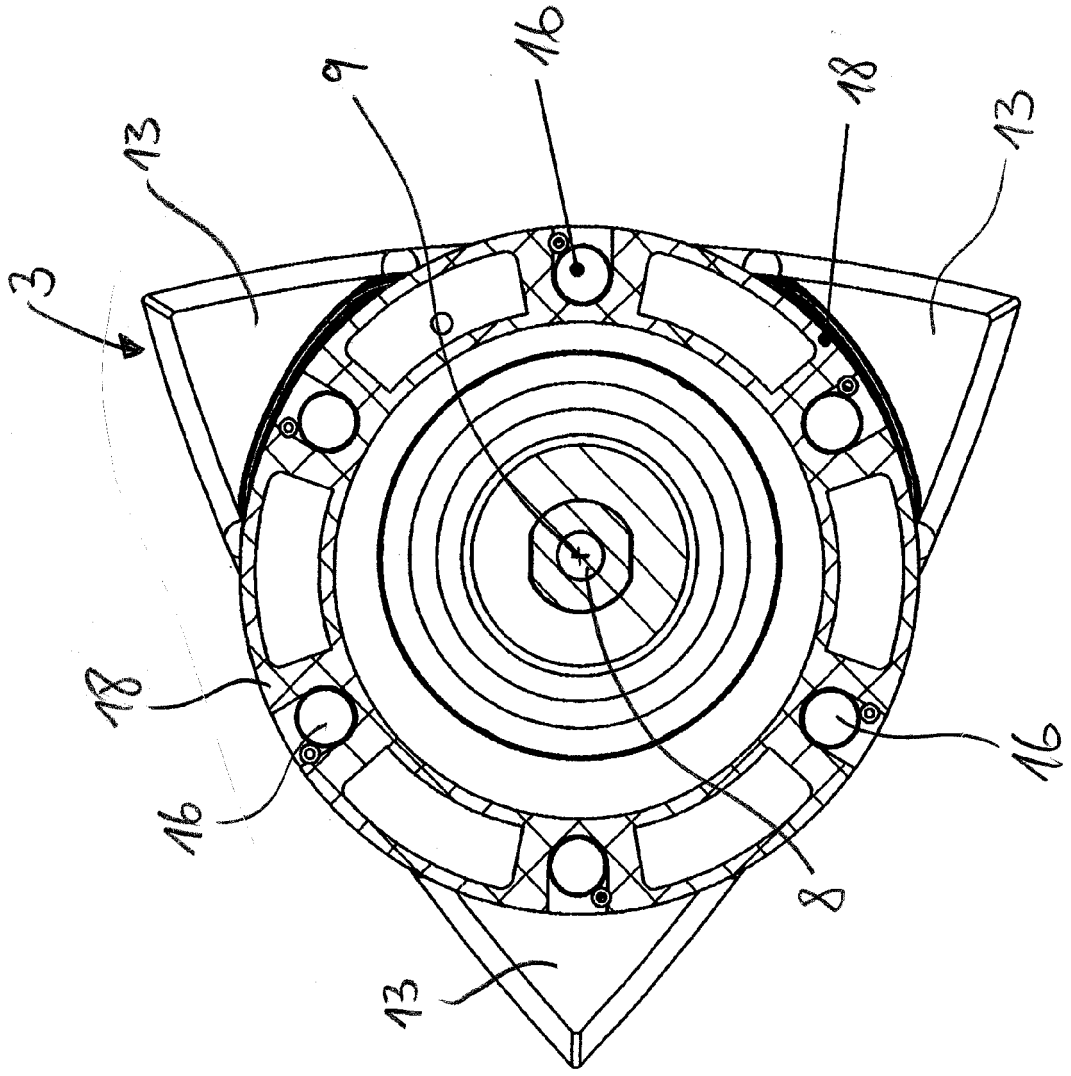


Fig. 2

Fig. 3



B-B:

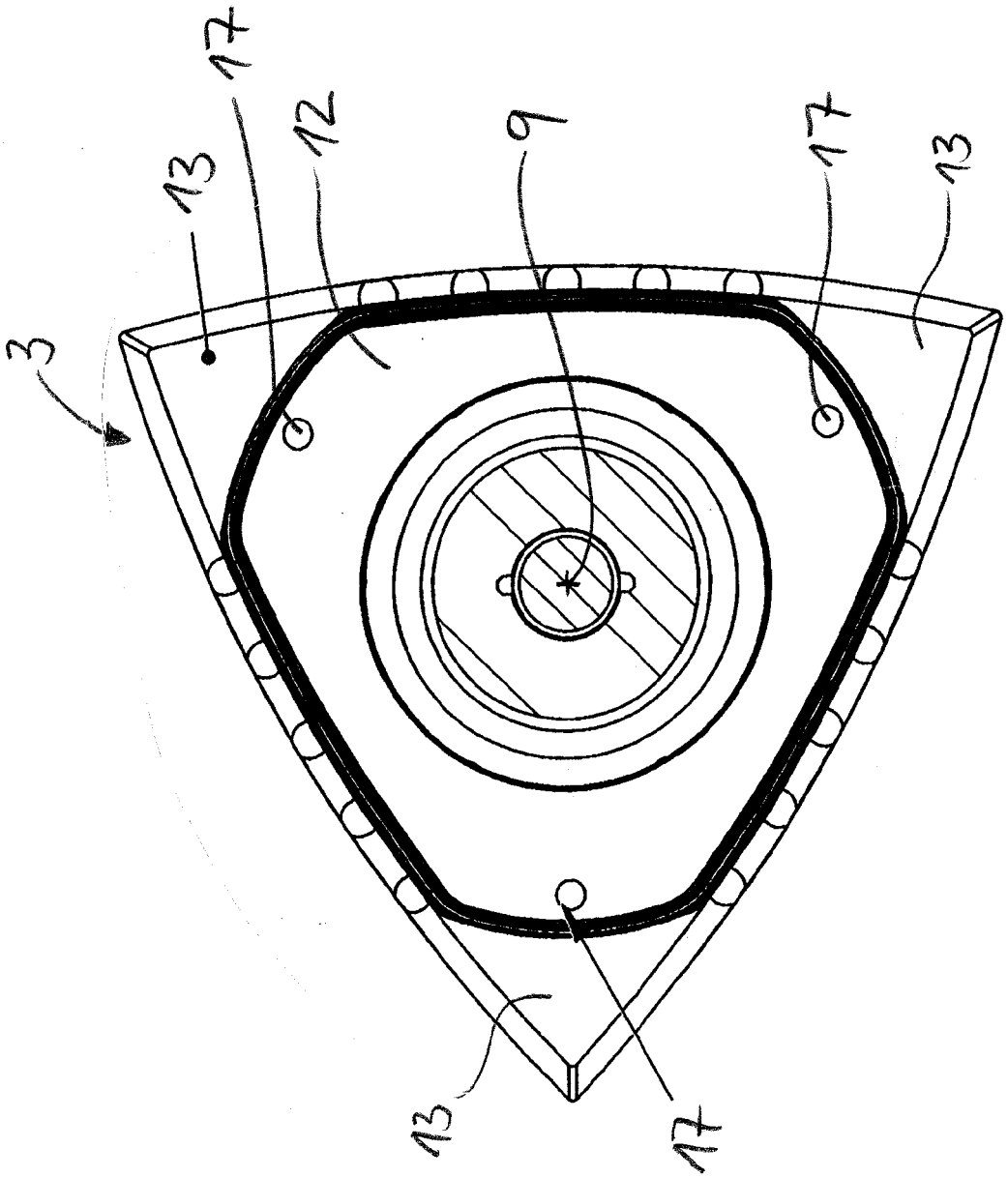


Fig. 4

C-C''

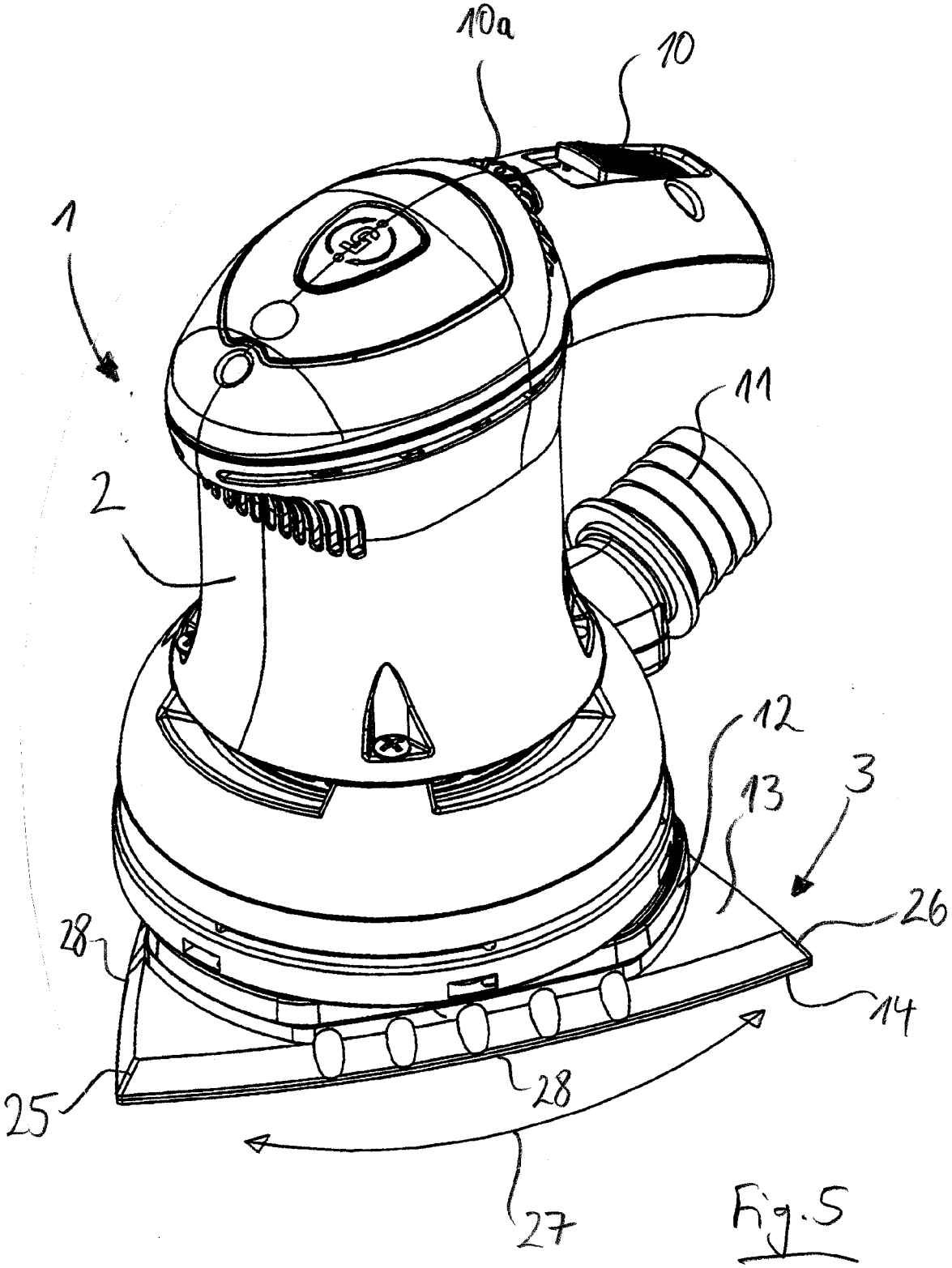


Fig.5

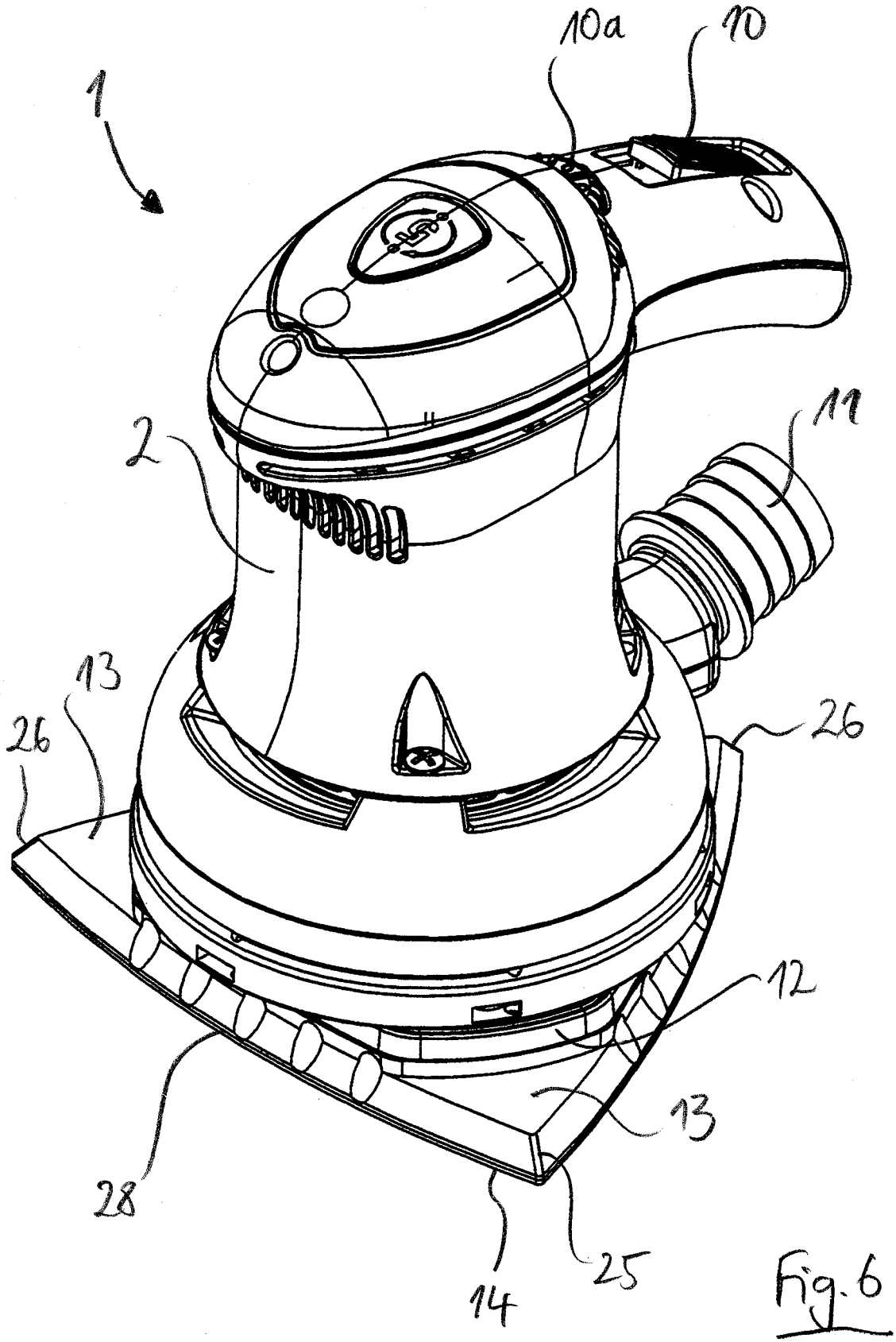


Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 12 19 4112

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 40 11 761 A1 (TENTEC GMBH WERKZEUGE MASCHINE [DE]) 17 October 1991 (1991-10-17) * column 3, lines 3-41 * * column 5, lines 42-57; claims 1,3,25,26; figures 1,6,6A *	1-16	INV. B24B23/04 B24B45/00
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 June 2013	Koller, Stefan

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