



(11)

EP 3 421 179 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.01.2019 Bulletin 2019/01

(51) Int Cl.:
B24D 13/14 (2006.01) **B24D 13/20** (2006.01)
B24B 23/02 (2006.01) **B24B 23/04** (2006.01)

(21) Application number: **17178839.1**

(22) Date of filing: **29.06.2017**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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(54) **POLISHING PAD FOR RELEASABLE ATTACHMENT TO A BOTTOM SURFACE OF A
PLATE-LIKE BACKING PAD OF A POWER TOOL, BACKING PAD AND HAND-HELD POWER
TOOL**

(57) The invention refers to a hand-held power tool (1) comprising a plate-like backing pad (9) with a bottom surface (9a) and a polishing pad (11) with a top surface (11a) for releasable attachment of the polishing pad (11) to the bottom surface (9a) of the backing pad (9). The power tool (1) further comprises an electric or pneumatic motor adapted for actuating the backing pad (9), in order to make the backing pad (9) together with the polishing pad (11) attached thereto perform a purely rotating, a random orbital or a roto-orbital working movement. In order to provide for an easy and fast positioning of the

polishing pad (11) in respect to the backing pad (9) it is suggested that the bottom surface (9a) of the plate-like backing pad (9) comprises at least one protrusion (13a; 13b; 13c; 13d) protruding from the bottom surface (9a) of the backing pad (9) and the top surface (11a) of the polishing pad (11) comprises at least one corresponding recess (12a; 12b; 12c; 12d), wherein the at least one protrusion (13a; 13b; 13c; 13d) is received by the at least one recess (12a; 12b; 12c; 12d) when the polishing pad (11) is attached to the backing pad (9).

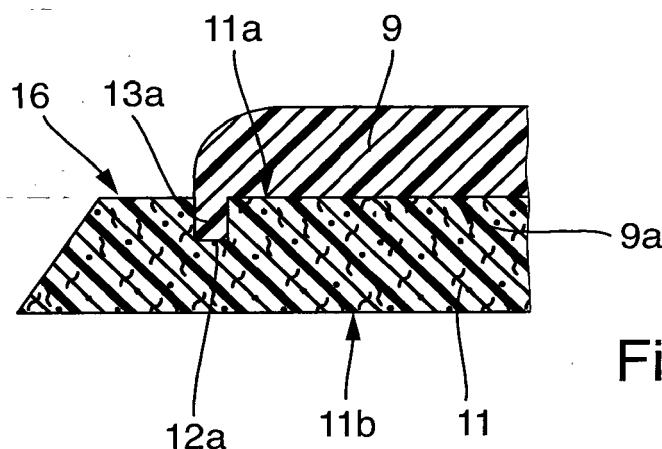


Fig. 2

Description

[0001] The present invention refers to a polishing pad (or polishing pad) comprising a top surface for releasable attachment of the polishing pad to a bottom surface of a plate-like backing pad of a hand-held power tool and a bottom surface directed towards a surface of a workpiece to be polished during an intended use of the hand-held power tool. The backing pad (or backing pad) is actuated by an electric or pneumatic motor of the hand-held power tool, in order to make the backing pad together with the polishing pad attached thereto perform a purely rotating, a random orbital or a roto-orbital working movement.

[0002] The invention also refers to a plate-like backing pad of a hand-held power tool, the backing pad comprising a bottom surface to which a polishing pad is releasably attachable with its top surface. The backing pad is actuated by an electric or pneumatic motor of the hand-held power tool, in order to make the backing pad together with the polishing pad attached thereto perform a purely rotating, a random orbital or a roto-orbital working movement.

[0003] Finally, the invention refers to a hand-held power tool comprising a plate-like backing pad with a bottom surface and a polishing pad with a top surface for releasable attachment of the polishing pad to the bottom surface of the backing pad. The power tool further comprises an electric or pneumatic motor adapted for actuating the backing pad, in order to make the backing pad together with the polishing pad attached thereto perform a purely rotating, a random orbital or a roto-orbital working movement.

[0004] Power tools of the above mentioned kind for polishing a surface of a workpiece, for example a vehicle body or a boat hull, are well known in the art. The polishing pad wears off during the polishing process. Therefore, the polishing pad has to be replaced by a new one from time to time. Furthermore, there are different types of polishing action (different degrees of intensity of the polishing process). For example, foam pads having a large rigidity are adapted for effecting a more intense cutting polishing action of a workpiece to be polished, in order to remove a larger amount of material from a working surface of the workpiece to be polished and to eliminate larger scratches and other defects in the working surface. In contrast thereto, foam pads having a smaller rigidity are adapted for effecting a soft finishing polishing action of the working surface to be polished, in order to delete any swirls or other fine marks which may result from the previous cutting polishing action and to obtain a very even and smooth polished surface. The different rigidities of the foam material are a result either of different materials used (e.g. Polyamide (PA), Polyester, etc.), different cell structures (closed-cell or open-cell structure), different sizes of the cells and different thicknesses of the polishing pads. Therefore, polishing pads will also have to be replaced by other types of polishing pads for conducting another type of polishing action.

[0005] The bottom surface of conventional backing pads is flat or even. Similarly, the top surface of conventional polishing pads is flat or even. Conventional polishing pads are usually attached to the bottom surface of a backing pad by means of releasable attachment means, for example a hook-and-loop fastener (e.g. Velcro®), comprising hooks on one of the corresponding surfaces (e.g. bottom surface of the backing pad) and loops on the other one of the corresponding surfaces (e.g. top surface of the polishing pad). The hooks and loops interact with one another in order to provide for a releasable attachment of the polishing pad to the backing pad. Alternatively, the attachment means may also comprises an appropriate adhesive on at least one of the corresponding surfaces. Conventional polishing pads can be attached to conventional backing pads in almost any (translational and rotational) position and alignment.

[0006] One problem of the known power tools is the positioning of the polishing pads on the bottom surface of the backing pad. If the polishing pad is attached not exactly concentrically to the backing pad or its rotational axis, respectively, the entire power tool will be subject to rather strong vibrations which are detrimental to a proper long term use of the power tool and can make working with the power tool even impossible. Furthermore, the backing pad and the polishing pad may be provided with corresponding through holes for realizing an air flow running from the working surface through the through holes and at least part of the power tool to a filter or a suction device, such as a vacuum cleaner. The air flow serves for removing dust, particles of abrasive paste and other pulverulent particles from the working surface of the work piece. It is a precondition for a proper functioning of the dust suction device that the through holes in the backing pad on the one hand and in the polishing pad on the other hand are properly positioned in respect to one another, in particular aligned in respect to each other.

[0007] It is an object of the present invention to provide for an easy and efficient way of properly positioning and aligning the polishing pad in respect to the backing pad during attachment of the polishing pad to the backing pad radially in respect to the rotational axis of the backing pad as well as in a proper rotational (angular) position in respect to the rotational axis of the backing pad.

[0008] This object is solved by a polishing pad with the features of claim 1, by a backing pad with the features of claim 7 and by a hand-held power tool with the features of claim 14.

[0009] In particular, it is suggested that the top surface of the polishing pad comprises at least one recess adapted for receiving at least one corresponding protrusion located at and protruding from the bottom surface of the plate-like backing pad. When placing the polishing pad on the bottom surface of the backing pad, it is positioned and aligned such that the at least one protrusion enters into the at least one corresponding recess. Therefore, the at least one protrusion and recess provide for a precise positioning and possibly also alignment of the pol-

ishing pad in respect to the bottom surface of the backing pad. In particular the co-operation of the at least one recess on the top surface of the polishing pad with the at least one corresponding protrusion on the bottom surface of the backing pad allows an exact and fast positioning and attachment of the polishing pad in respect to the backing pad. The positioning can be effected in a translational direction (e.g. providing for an easy centering of the polishing pad in respect to the bottom surface of the backing pad) as well as in a desired rotational (angular) direction (e.g. providing for an easy alignment of dust suction holes in the backing pad with respective openings in the polishing pad).

[0010] There are many different possibilities for realizing the at least one protrusion on the bottom surface of the plate-like backing pad and the corresponding at least one recess on the top surface of the polishing pad within the realm of the present invention.

[0011] According to a preferred embodiment of the present invention it is suggested that the at least one recess in the polishing pad comprises an annular groove extending in the top surface of the polishing pad in an equidistant manner in respect to a rotational axis of the polishing pad. Accordingly, the at least one protrusion of the plate-like backing pad comprises an annular collar protruding from the bottom surface of the backing pad and extending in an equidistant manner in respect to a rotational axis of the backing pad. The rotational axis of the backing pad is preferably congruent with the rotational axis of the polishing pad. The distances of the annular groove on the one hand and of the annular collar on the other hand in respect to these axes are preferably identical. Hence, when attaching the polishing pad to the backing pad the collar enters into and is received by the groove. This allows a precise positioning of the polishing pad in the plane of extension of the bottom surface of the backing pad. However, the polishing pad can be attached to the backing pad in any desired rotational alignment in respect to the rotational axis of the backing pad. In order to allow attachment of the polishing pad in only one or more discrete rotational positions, the backing pad could be provided with at least one further protrusion located eccentrically on the bottom surface of the backing pad and the polishing pad could be provided with one or more corresponding further recesses for receiving the at least one protrusion. For example, the annular collar could be provided with a single further protrusion extending radially inwards towards the rotational axis of the backing pad and the annular groove could be provided with one or more grooves extending radially inwards towards the rotational axis of the polishing pad. The polishing pad can be attached to the backing pad in one or more discrete rotational positions in respect to the axes, in which the further protrusion is received by one of the further recesses.

[0012] Instead of a groove in the top surface of the polishing pad, it is also possible to provide an outer annular recess on the top surface of the polishing pad. The

annular protrusion of the backing pad can enter into this annular recess. In this case, starting from the outer circumference of the polishing pad, the polishing pad has an annular section with a smaller thickness and, going further towards the rotational axis, the polishing pad has a circular section with a larger thickness. The annular protrusion enters into the annular section and encompasses the circular section, thereby positioning the polishing pad on the bottom surface of the backing pad. To this end it is suggested that the at least one recess comprises an annular recess located along a circumference of the top surface of the polishing pad in an equidistant manner in respect to a rotational axis of the polishing pad.

[0013] Furthermore, it is suggested that the at least one recess comprises a plurality of separate recesses located in the top surface of the polishing pad in an equidistant manner in respect to a rotational axis of the polishing pad. Similarly, the at least one protrusion comprises a plurality of separate protrusions each protruding from the bottom surface of the backing pad and located there in an equidistant manner in respect to a rotational axis of the backing pad. The positions of the separate recesses in the top surface of the polishing pad correspond to the positions of the separate protrusions on the bottom surface of the backing pad, in order to allow the protrusions to enter into the corresponding recesses when attaching the polishing pad to the backing pad. This allows a precise positioning of the polishing pad in the plane of extension of the bottom surface of the backing pad as well as an attachment of the polishing pad to the backing pad in a precise rotational alignment in respect to the rotational axis of the backing pad.

[0014] Alternatively, it is suggested that the at least one recess comprises a plurality of separate recesses located in the top surface of the polishing pad with different distances in respect to a rotational axis of the polishing pad. Similarly, the at least one protrusion comprises a plurality of separate protrusions each protruding from the bottom surface of the backing pad and located there with different distances in respect to a rotational axis of the backing pad. Again, the positions of the separate recesses in the top surface of the polishing pad correspond to the positions of the separate protrusions on the bottom surface of the backing pad, in order to allow the protrusions to enter into the corresponding recesses when attaching the polishing pad to the backing pad.

[0015] Alternatively or additionally it is suggested that the separate recesses are located in the top surface of the polishing pad with different circumferential distances in respect to one another. Similarly, the separate protrusions are located on the bottom surface of the backing pad with different circumferential distances in respect to one another.

[0016] The polishing pads can be made of an open-cell foamed material. They are available in different rigidities for different intended uses of the pad. The different rigidities of the foam material are a result either of different materials used (e.g. Polyamide (PA), Polyester,

Polyurethane, etc.), different cell structures (closed-cell or open-cell structure) and different sizes of the cells.

[0017] Furthermore, the polishing pads may have a bottom working surface comprising wool or a microfiber material. The wool or microfibers are usually fixed to a supporting surface of the pad, which is releasably attached to the bottom surface of the plate-like backing pad. The supporting surface can be made of rigid plastic or a foam-like material. Wool or microfiber pads are available in different rigidities for different intended uses of the pad. The rigidities of the wool or microfiber material can be varied by different densities of the wool or microfiber strands or threads, by different diameters of each of the wool or microfiber strands or threads, or by using different materials.

[0018] Further characteristics and advantages of the present invention will be described hereinafter in more detail making reference to the accompanying figures. The figures show:

- Fig. 1 a hand-held power tool comprising a backing pad and a polishing pad according to the present invention;
- Fig. 2 a detail of a polishing pad according to a preferred embodiment of the invention in a sectional view;
- Fig. 3 a combination of a plate-like backing pad and a polishing pad according to the embodiment of Fig. 2 in a sectional view;
- Fig. 4 the combination of the plate-like backing pad and the polishing pad according to the embodiment of Fig. 3 in a perspective view;
- Fig. 5 a detail of a polishing pad according to another preferred embodiment of the invention in a sectional view;
- Fig. 6 a combination of a plate-like backing pad and a polishing pad according to the embodiment of Fig. 5 in a perspective view;
- Fig. 7 a detail of a polishing pad according to another preferred embodiment of the invention in a sectional view;
- Fig. 8 a combination of a plate-like backing pad and a polishing pad according to the embodiment of Fig. 7 in a sectional view;
- Fig. 9 the combination of the plate-like backing pad and the polishing pad according to the embodiment of Fig. 8 in a perspective view;
- Fig. 10 a detail of a polishing pad according to another preferred embodiment of the invention in a

sectional view;

- Fig. 11 a combination of a plate-like backing pad and a polishing pad according to the embodiment of Fig. 10 in a perspective view;
- Fig. 12 a combination of a plate-like backing pad and a polishing pad according to another preferred embodiment of the invention in a perspective view;
- Fig. 13 a combination of a plate-like backing pad and a polishing pad according to another preferred embodiment of the invention in a perspective view; and
- Fig. 14 the combination of the plate-like backing pad attached the polishing pad according to the embodiment of Fig. 3 in a perspective view.

[0019] With reference now to the drawings, Fig. 1 shows a hand-held power tool 1 according to the present invention adapted to be used with a backing pad and a polishing pad attached to a bottom surface of the backing pad according to the present invention. In Fig. 1 a hand-held power tool 1 in the form of a random orbital polishing tool (or polisher) 1 is shown. The polisher 1 has a housing 2, essentially made of a plastic material. The polisher 1 is provided with a handle 3 at its rear end and a grip 4 at its front end. An electric power supply line 5 with an electric plug at its distal end exits the housing 2 at the rear end of the handle 3, in order to provide an electric motor and an electronic control unit both located inside the housing 2 with electric energy. At the bottom side of the handle 3 a switch 6 is provided for activating and deactivating the electric motor of the power tool 1. The switch 6 can be continuously held in its activated position by means of a push button 7. The power tool 1 can be provided with a rotary adjustment means (not shown) for adjusting the rotational speed of the tool's motor. The housing 2 can be provided with cooling openings 8 for allowing heat from the electronic control unit and/or the electric motor to dissipate into the environment.

[0020] The power tool 1 shown in Fig. 1 has an electric motor. Of course, the machine tool according to the present invention could also be equipped with a pneumatic motor, which is especially advantageous in explosive environments, where sparks from an electric motor could provoke an explosion of an explosive mixture (e.g. oxygen and very fine dust) contained in the environment. Furthermore, instead of the connection of the machine tool 1 to a mains power supply by means of the electric cable 5, the machine tool 1 could alternatively be equipped with a rechargeable battery (not shown) located inside the housing 2. In that case the electric energy for driving the electric motor would be provided by the battery. Nonetheless, an electric cable 5 could be provided in order to recharge the battery.

[0021] The power tool 1 has a plate-like backing pad 9 rotatable about a rotational axis 10 and having a connection element (not shown) extending along the backing pad's rotational axis 10. The connection element is adapted for connecting the backing pad 9 to a backing pad holder (not shown) of the power tool 1. A bottom surface 9a of the backing pad 9 is provided with means for releasably attaching a polishing pad 11 according to the present invention. The attachment means can comprise a first layer of a hook-and-loop fastener (or Velcro®), wherein the top surface 11a of the polishing pad 11 is provided with the second layer of the hook-and-loop fastener. The two layers of the hook-and-loop fastener interact with one another in order to releasably but safely fix the polishing pad 11 to the bottom surface 9a of the backing pad 9.

[0022] The plate-like backing pad 9 is made of a semi-rigid material, preferably a plastic material possibly with a metal insert 17 (see Figs. 3 and 8) for stability reasons. The metal insert 17 may comprise a central hollow shaft with an internal thread for connection of the backing pad 9 to a motor shaft of a power tool 1. The metal insert 17 is form-fit or positive-fit, respectively, into the plastics material during manufacturing of the backing pad 9, e.g. by means of an injection molding process. Of course, differently to what is shown in Figs. 3 and 8, for stability reasons part of the metal insert 17 could also extend into at least part of the horizontally extending plate-like plastics material providing for the bottom surface 9a of the backing pad 9. The plastic material may be, for example, PA66 (polyamide) reinforced with up to 30% of glass fiber. Any other plastics material can be used, which on the one hand is rigid enough to carry and support the polishing pad 11 during the intended use of the power tool 1 and to apply a force to the polishing pad 11 in a direction essentially downwards and parallel to the backing pad's rotational axis 10 and which on the other hand is flexible enough to avoid damage or scratching of the surface to be worked by the polishing pad 11. It is even possible that the entire backing pad is made of metal, for example aluminum.

[0023] The polishing pad 11 is in particular used for polishing a workpiece in the form of a vehicle or car body or the hull or any other part of a boat or ship. The workpiece is preferably made of wood, metal, plastic or a composite material (e.g. glass fiber reinforced, GFR, or carbon fiber reinforced, CFR, material) and may be provided with or without some kind of base coat, primer, paint and/or varnish. Some kind of polishing paste or polishing liquid may be applied to the working surface in order to enhance the polishing effect of the polishing pad 11 during its intended use. For example, the polishing pad can be made of a sponge-like material, in particular a plastics material like polyurethane with an open-cell structure. Furthermore, the polishing pad can comprise a support structure consisting of a plate-like element made of a plastics material, like polyurethane with a closed-cell structure, with microfibers attached to the bottom surface

of the support structure. The microfibers are made of polyester and/or polyamide. Finally, the polishing pad can comprise a support structure consisting of a sponge-like element made of a plastics material, like polyurethane with an open-cell structure, with natural or synthetic wool attached to the bottom surface of the support structure. In the following embodiments the polishing pad 11 is made of sponge-like material but of course, the invention could be perfectly well also realized for other types of polishing pads 11.

[0024] The polishing pad 11 comprises a bottom working surface 11b with which the surface of the workpiece can be polished. The polishing pad 11 is preferably made of foamed plastics material having an open-cell structure (e.g. Polyamide (PA), Polyester, Polyurethane, etc.). The polishing pads 11 are available in different rigidities for different intended uses of the pad 11 (e.g. a more intense cutting polishing action of a workpiece or a softer finishing polishing action). The different rigidities of the foamed material are a result either of different materials used, different thicknesses of the pad 11, different cell structures (closed-cell or open-cell structure) and different sizes of the cells. The bottom working surface 11b is preferably made of the foamed plastic material of the pad 11. Alternatively, polishing pad 11 may comprise wool or microfiber material on its bottom surface 11b. Further, the polishing pad 11 preferably has the form of a truncated cone resulting in the top surface 11a having a smaller diameter than the bottom working surface 11b and in a slanting circumferential side wall 11c between the top surface 11a and the bottom surface 11b. Of course, the polishing pad 11 may also have the form of a cylinder with top and bottom surfaces 11a, 11b of the same diameter and an upright circumferential side wall 11c, running perpendicular in respect to the top and bottom surfaces 11a, 11b. The bottom working surface 11b of the polishing pad 11 may comprise any type of three-dimensional structure, if desired, for example a waffle structure having depressions and hills located displaced in respect to one another (not shown).

[0025] The present invention suggests a polishing pad 11 and a plate-like backing pad 9, which are both adapted for providing for a fast and efficient attachment of the polishing pad 11 to the backing pad 9 in a predefined position in the plane of extension of the bottom surface 9a of the backing pad 9 and possibly also in a predefined rotational position in respect to a rotational axis 10 of the backing pad 9. In particular, by means of the present invention the polishing pad 11 can be easily centered in respect to the backing pad 9. If the polishing pad 11 is properly attached to the backing pad 9 a rotational axis 14 of the polishing pad 11 runs congruent in respect to the rotational axis 10 of the backing pad 9.

[0026] According to a first embodiment of the invention shown in Figs. 2 to 4 a top surface 11a of the polishing pad 11 comprises at least one recess 12a adapted for receiving at least one corresponding protrusion 13a located at and protruding from the bottom surface 9a of

the plate-like backing pad 9. In this embodiment the protrusion 13a comprises an annular collar extending along the entire outer circumference of the bottom surface 9a of the backing pad 9 in an equidistant manner in respect to the rotational axis 10 of the backing pad 9. Of course, it would also be possible that there is a plurality of protrusions 13a each of which extending along a certain section of the outer circumference of the bottom surface 9a of the backing pad 9. Correspondingly, in the embodiment of Figs. 2 to 4 the at least one recess 12a comprises an annular groove extending along the entire circumference in the top surface 11a of the polishing pad 11 in an equidistant manner in respect to the rotational axis 14 of the polishing pad 11. Of course, it would also be possible that there is a plurality of recesses 12a each of which extending along a certain section of the circumference of the top surface 11a of the polishing pad 11. The advantage of this embodiment is that the backing pad 9 can be easily made out of a plastics material, for example PA66 reinforced with glass fibers, by means of an injection molding process.

[0027] The top surface 11a of the polishing pad 11 and the bottom surface 9a of the backing pad 9 are at least partly provided with attachment means, preferably a hook-and-loop fastener (Velcro®) for attaching the polishing pad 11 to the backing pad 9 in the aligned position. In this embodiment, preferably only center part 15 of the top surface 11a of the polishing pad 11 within the annular groove 12a is provided with the attachment means. Hence, the outer annular part 16 of the top surface 11a of the polishing pad 11 extending outside of the annular groove 12a has no attachment means. In that case the entire bottom surface 9a of the backing pad 9 inside the annular collar 13a would be provided with corresponding attachment means.

[0028] The co-operation of the at least one recess 12a on the top surface 11a of the polishing pad 11 with the at least one corresponding protrusion 13a on the bottom surface 9a of the backing pad 9 allows an exact and fast positioning and attachment of the polishing pad 11 in respect to the backing pad 9. The positioning can be effected in a translational direction (e.g. providing for an easy centering of the polishing pad 11 in respect to the bottom surface 9a of the backing pad 9) as well as in a desired rotational (angular) direction (e.g. providing for an easy alignment of dust suction holes in the backing pad 9 with respective openings in the polishing pad 11).

[0029] The described embodiment allows exact positioning of the polishing pad 11 in respect to the backing pad 9 in a predefined translational position within the plane of extension of the bottom surface 9a of the backing pad 9. This may be sufficient in many cases. However, it is noted that with the annular groove 12a and the annular collar 13a only, the polishing pad 11 can be attached to the bottom surface 9a of the backing pad 9 in any angular position (0°...360°) in respect to the rotational axes 10, 14. In this embodiment no alignment of the polishing pad 11 in respect to the backing pad 9 in a desired

rotational (angular) position is possible. In order to achieve this object one or more further protrusions and corresponding recesses may be realized on the bottom surface 9a of the backing pad 9 or in the top surface 11a of the polishing pad 11, respectively, both not extending circumferentially (e.g. at least partly in a radial direction in respect to the rotational axes 10, 14). An example for such an embodiment is shown in Fig. 12, where the additional protrusions are indicated with reference sign 13b and the additional corresponding recesses are indicated with reference sign 12b. The additional protrusions 13b are designed as even plain-like elements having an essentially radial extension. The additional recesses 12b are designed as corresponding linear grooves having an essentially radial extension. Of course, the polishing pad 11 could be provided with the additional recesses 12b only, without the annular groove 12a. Correspondingly, the backing pad 9 could be provided with the additional protrusions 13b only, without the annular collar 13a. Furthermore, the number, form, translational and angular position of the additional protrusions 13b and the corresponding additional recesses 12b could vary from what is shown in Fig. 12.

[0030] Another embodiment, which allows a fast and precise centering of the polishing pad 11 in respect to the backing pad 9 as well as a fast and precise angular positioning of the polishing pad 11 in respect to the backing pad 9 in a desired rotational position about the axes 10, 14, is shown in Fig. 13. There, the additional protrusions are indicated with reference sign 13c and the additional corresponding recesses are indicated with reference sign 12c. The one or more additional protrusions 13c and the corresponding additional recesses 12c do also not extend circumferentially but are rather located at discrete rotational positions about the axes 10, 14. The additional protrusions 13c have the form of cylinders but of course may have any other form, too. The distances between the further protrusions 13c and the rotational axis 10 may be identical or different. Similarly, the distances between the corresponding further recesses 12c and the rotational axis 14 may be identical or different. Of course, the backing pad 9 could be provided with the additional protrusions 13c only, without the annular collar 13a. In that case the polishing pad 11 could be provided with the additional recesses 12c only, without the annular groove 12a. Furthermore, the number, form, translational and angular position of the additional protrusions 13c and the corresponding additional recesses 12c could vary from what is shown in Fig. 13.

[0031] A further embodiment of the present invention is shown in Figs. 5 and 6. In contrast to the embodiment of Figs. 2 to 4, in this further embodiment an annular collar 13d is not provided at the outer edge of the backing pad 9 but rather in a distance to the outer edge leaving a space 18 between the outer edge of the polishing pad 11 and the outer edge of the backing pad 9. During intended use of the power tool 1 and the backing and polishing pads 9, 11 according to this embodiment the outer

edge portion of the polishing pad 11 may be pressed upwards into the space 18. The upward movement of the outer edge portion of the polishing pad 11 is limited by the outer edge portion of the backing pad 9 providing for some kind of stopper for the outer edge portion of the polishing pad 11. In this embodiment, the at least one recess 12d in the top surface 11a of the polishing pad 11 comprises the space 18 and extends right to the outer edge of the polishing pad 11.

[0032] The top surface 11a of the polishing pad 11 and the bottom surface 9a of the backing pad 9 are at least partly provided with attachment means, preferably a hook-and-loop fastener (Velcro®) for attaching the polishing pad 11 to the backing pad 9 in the aligned position. In this embodiment, preferably only center part 15 of the top surface 11a of the polishing pad 11 within the annular recess 12d is provided with the attachment means. Hence, the outer annular part 16 (forming the bottom surface of the recess 12d) of the polishing pad 11 has no attachment means. Similarly, preferably only center part 19 of the bottom surface 9a of the backing pad 9 within the annular protrusion 13d is provided with the attachment means. Hence, an outer annular part 20 of the backing pad 9 outside of the annular collar 13d has no attachment means. In this embodiment the protrusion 13d comprises an annular collar extending along the entire circumference of the bottom surface 9a of the backing pad 9 in an equidistant manner in respect to the rotational axis 10 of the backing pad 9 and in respect to the outer circumferential edge of the backing pad 9. Of course, it would also be possible that there is a plurality of protrusions 13d each of which extending along a certain section of the outer circumference of the bottom surface 9a of the backing pad 9. It would also be possible that there is a plurality of recesses 12d each of which extending along a certain section of the circumference of the outer edge portion of the top surface 11a of the polishing pad 11.

[0033] Furthermore, it is also possible in the embodiment of Figs. 5 and 6 that there are additional protrusions, like the protrusions 13b and 13c of Figs. 12 and 13, protruding from the bottom surface 9a of the backing pad 9. Correspondingly, the top surface 11a of the polishing pad 11 may also be provided with additional recesses, like the recesses 12b, 12c of Figs. 12 and 13.

[0034] Yet another embodiment is shown in Figs. 7 to 9. In that embodiment, the annular circumferential protrusion 13a of Figs. 2 to 4 is combined with the annular circumferential recess 12d of Figs. 5 and 6.

[0035] The top surface 11a of the polishing pad 11 and the bottom surface 9a of the backing pad 9 are at least partly provided with attachment means, preferably a hook-and-loop fastener (Velcro®) for attaching the polishing pad 11 to the backing pad 9 in the aligned position. In this embodiment, preferably only center part 15 of the top surface 11a of the polishing pad 11 within the annular recess 12d is provided with the attachment means. Hence, the outer annular part 16 (forming the bottom surface of the recess 12d) of the polishing pad 11 has

no attachment means. In that case the entire bottom surface 9a of the backing pad 9 inside the annular collar 13a would be provided with corresponding attachment means.

[0036] In this embodiment the protrusion 13a comprises an annular collar extending along the entire outer circumference of the bottom surface 9a of the backing pad 9 in an equidistant manner in respect to the rotational axis 10 of the backing pad 9. Of course, it would also be possible that there is a plurality of protrusions 13a each of which extending along a certain section of the outer circumference of the bottom surface 9a of the backing pad 9. It would also be possible that there is a plurality of recesses 12d each of which extending along a certain section of the circumference of the outer edge portion of the top surface 11a of the polishing pad 11.

[0037] Furthermore, it is also possible in the embodiment of Figs. 7 to 9 that there are additional protrusions, like the protrusions 13b and 13c of Figs. 12 and 13, protruding from the bottom surface 9a of the backing pad 9. Correspondingly, the top surface 11a of the polishing pad 11 may also be provided with additional recesses, like the recesses 12b, 12c of Figs. 12 and 13.

[0038] Yet another embodiment is shown in Figs. 10 and 11. In that embodiment, the annular protrusion 13d of Figs. 5 and 6 is combined with the annular circumferential groove 12a of Figs. 2 to 4.

[0039] The top surface 11a of the polishing pad 11 and the bottom surface 9a of the backing pad 9 are at least partly provided with attachment means, preferably a hook-and-loop fastener (Velcro®) for attaching the polishing pad 11 to the backing pad 9 in the aligned position. In this embodiment, to provide the entire bottom surface 9a (comprising partial surfaces 19 and 20) of the backing pad 9 and the entire top surface 11a (comprising partial surfaces 15 and 16) of the polishing pad 11 with corresponding attachment means.

[0040] In this embodiment the protrusion 13d comprises an annular collar extending along the entire circumference of the bottom surface 9a of the backing pad 9 in an equidistant manner in respect to the rotational axis 10 and to the outer circumferential edge of the backing pad 9. Of course, it would also be possible that there is a plurality of protrusions 13d each of which extending along a certain section of the circumference of the bottom surface 9a of the backing pad 9. It would also be possible that there is a plurality of grooves 12a each of which extending in the top surface 11a along a certain section of the circumference of the polishing pad 11.

[0041] Furthermore, it is also possible in the embodiment of Figs. 10 and 11 that there are additional protrusions, like the protrusions 13b and 13c of Figs. 12 and 13, protruding from the bottom surface 9a of the backing pad 9. Correspondingly, the top surface 11a of the polishing pad 11 may also be provided with additional recesses, like the recesses 12b, 12c of Figs. 12 and 13.

[0042] Finally, Fig. 14 shows a perspective view of the polishing pad 11 releasably attached to the backing pad

9 according to the embodiment of Figs. 2 to 4.

[0043] It is an aspect of the present invention to provide for a plug-and-socket-type of releasable connection between the top surface 11a of a polishing pad 11 and the bottom surface 9a of a backing pad 9. To this end at least one protrusion 13a; 13b; 13c; 13d and at least one corresponding recess 12a; 12b; 12c; 12d for receiving the protrusions 13a; 13b; 13c; 13d are provided on the bottom surface 9a of the backing pad 9 and in the top surface 11a of the polishing pad 11, respectively. Preferably but not necessarily the number of protrusions 13a; 13b; 13c; 13d and recesses 12a; 12b; 12c; 12d is the same. This allows a fast attachment of a polishing pad 11 to a backing pad 9 in a desired translational position thereby permitting an easy centering of the polishing pad 11 in respect to the backing pad 9. Furthermore, by positioning and designing the at least one protrusion 13a; 13b; 13c; 13d and the at least one corresponding recess 12a; 12b; 12c; 12d accordingly, the polishing pad 11 can even be positioned in a desired rotational (or angular) position (about the rotational axes 10, 14) in respect to the backing pad 9 thereby permitting alignment of suction holes provided in the backing pad 9 with corresponding openings in the polishing pad 11.

Claims

1. Polishing pad (11) comprising a top surface (11a) adapted for releasable attachment of the polishing pad (11) to a bottom surface (9a) of a plate-like backing pad (9) of a hand-held power tool (1) and a bottom surface (11b) adapted for polishing a surface of a workpiece, the backing pad (9) being actuated by an electric or pneumatic motor of the hand-held power tool (1) in order to make the backing pad (9) together with the polishing pad (11) attached thereto perform a purely rotating, a random orbital or a roto-orbital working movement, **characterized in that** the top surface (11a) of the polishing pad (11) comprises at least one recess (12a; 12b; 12c; 12d) adapted for receiving at least one corresponding protrusion (13a; 13b; 13c; 13d) located at and protruding from the bottom surface (9a) of the plate-like backing pad (9) when the polishing pad (11) is attached to the backing pad (9).
2. Polishing pad (11) according to claim 1, wherein the at least one recess comprises an annular groove (12a) extending in the top surface (11a) of the polishing pad (11) in an equidistant manner in respect to a rotational axis (14) of the polishing pad (11).
3. Polishing pad (11) according to claim 1, wherein the at least one recess comprises an annular recess (12d) located along an outer circumference of the top surface (11a) of the polishing pad (11) in an equidistant manner in respect to a rotational axis (14) of

the polishing pad (11).

4. Polishing pad (11) according to claim 1, wherein the at least one recess comprises a plurality of separate recesses (12a; 12b; 12c; 12d) located in the top surface (11a) of the polishing pad (11) in an equidistant manner to a rotational axis (14) of the polishing pad (11).
5. Polishing pad (11) according to claim 1, wherein the at least one recess comprises a plurality of separate recesses (12a; 12b; 12c; 12d) located in the top surface (11a) of the polishing pad (11) with different distances to a rotational axis (14) of the polishing pad (11).
6. Polishing pad (11) according to claim 4 or 5, wherein the separate recesses (12a; 12b; 12c; 12d) are located in the top surface (11a) of the polishing pad (11) with different circumferential distances in respect to one another.
7. Plate-like backing pad (9) of a hand-held power tool (1), the backing pad (9) comprising a bottom surface (9a) adapted for releasably attaching a top surface (11a) of a polishing pad (11), the backing pad (9) being actuated by an electric or pneumatic motor of the hand-held power tool (1) in order to make the backing pad (9) together with the polishing pad (11) attached thereto perform a purely rotating, a random orbital or a roto-orbital working movement, **characterized in that** the bottom surface (9a) of the plate-like backing pad (9) comprises at least one protrusion (13a; 13b; 13c; 13d) protruding from the bottom surface (9a) of the backing pad (9) and adapted for entering into a corresponding recess (12a; 12b; 12c; 12d) located in the top surface (8a) of the polishing pad (11) when the polishing pad (11) is attached to the backing pad (9).
8. Backing pad (9) according to claim 7, wherein the at least one protrusion comprises an annular collar (13a; 13d) protruding from the bottom surface (9a) of the backing pad (9) and extending in an equidistant manner in respect to a rotational axis (10) of the backing pad (9).
9. Backing pad (9) according to claim 8, wherein the annular collar (13a; 13d) extends along the outer circumference of the backing pad (9).
10. Backing pad (9) according to claim 8, wherein the annular collar (13a; 13d) extends in an equidistant manner in respect to the outer circumference of the backing pad (9).
11. Backing pad (9) according to one of the claims 7 to 10, wherein the at least one protrusion comprises a

plurality of separate protrusions (13a; 13b; 13c; 13d) each protruding from the bottom surface (9a) of the backing pad (9) and located there in an equidistant manner to a rotational axis (10) of the backing pad (9).

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12. Backing pad (9) according to one of the claims 7 to 10, wherein the at least one protrusion (14) comprises a plurality of separate protrusions (13a; 13b; 13c; 13d) each protruding from the bottom surface (9a) of the backing pad (9) and located there with different distances to a rotational axis (10) of the backing pad (9).
13. Backing pad (9) according to claim 11 or 12, wherein the separate protrusions (13a; 13b; 13c; 13d) are located on the bottom surface (7a) of the backing pad (7) with different circumferential distances in respect to one another.
14. Hand-held power tool (1) comprising a plate-like backing pad (9) with a bottom surface (9a) and a polishing pad (11) with a top surface (11a), the bottom surface (9a) and the top surface (11a) adapted for releasable attachment of the polishing pad (11) to the backing pad (9), and further comprising an electric or pneumatic motor adapted for actuating the backing pad (9), in order to make the backing pad (9) together with the polishing pad (11) attached thereto perform a purely rotating, a random orbital or a roto-orbital working movement, **characterized in that** the bottom surface (9a) of the plate-like backing pad (9) comprises at least one protrusion (13a; 13b; 13c; 13d) protruding from the bottom surface (9a) of the backing pad (9) and the top surface (11a) of the polishing pad (11) comprises at least one corresponding recess (12a; 12b; 12c; 12d), wherein the at least one protrusion (13a; 13b; 13c; 13d) is received by the at least one recess (12a; 12b; 12c; 12d) when the polishing pad (11) is attached to the plate-like backing pad (9).
15. Power tool (1) according to claim 14, wherein the plate-like backing pad (9) is designed according to one of the claims 7 to 13.
16. Power tool (1) according to claim 14 or 15, wherein the polishing pad (11) is designed according to one of the claims 2 to 6.

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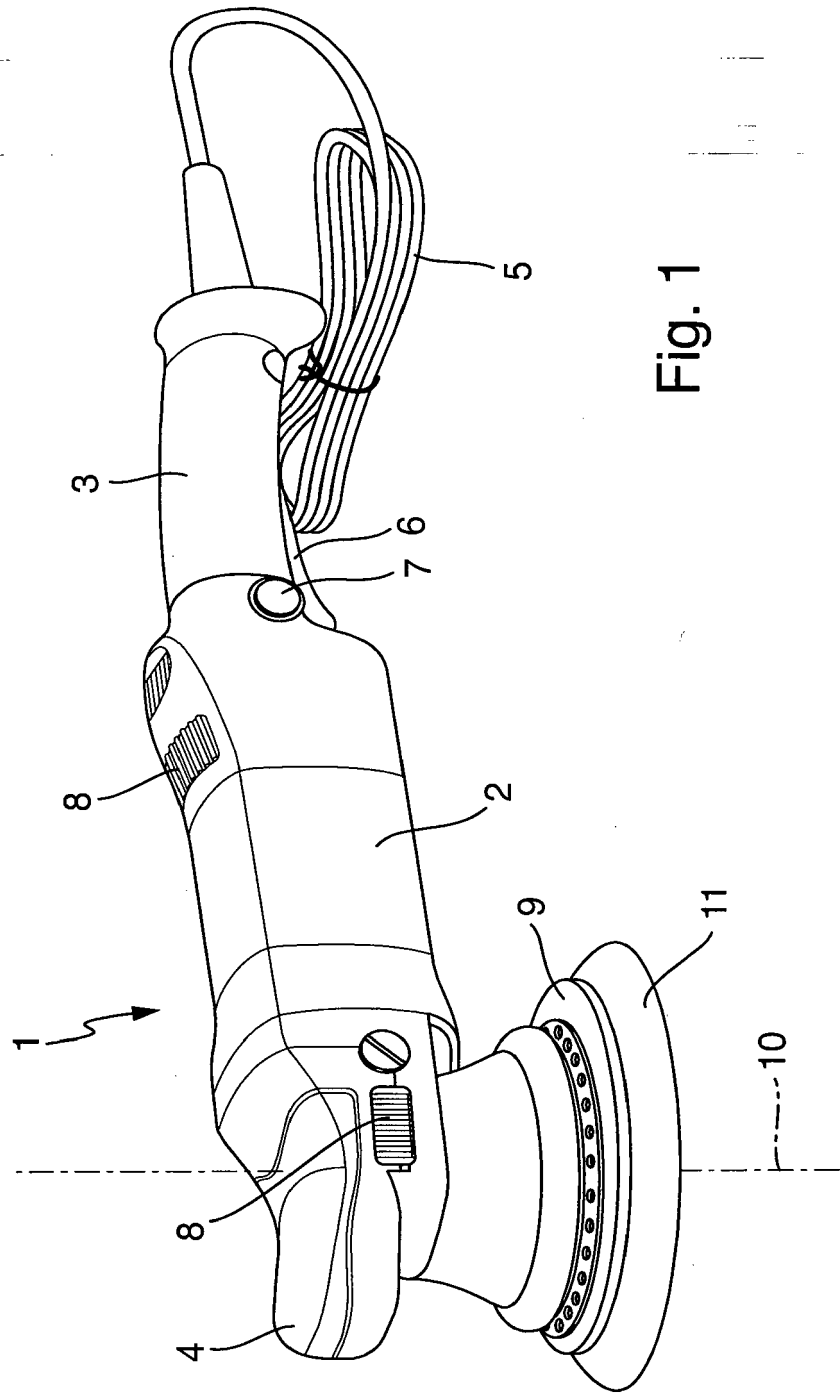


Fig. 1

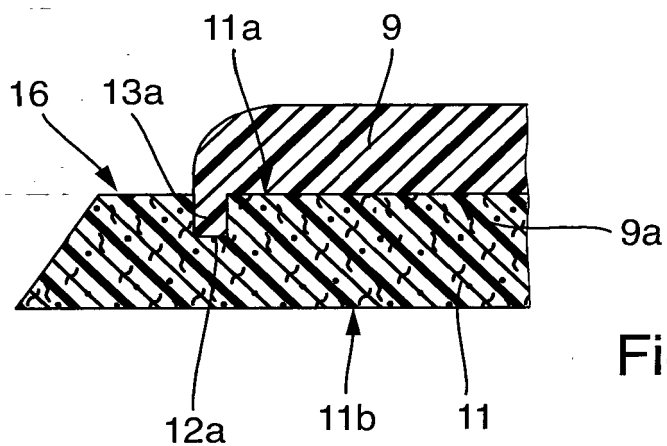


Fig. 2

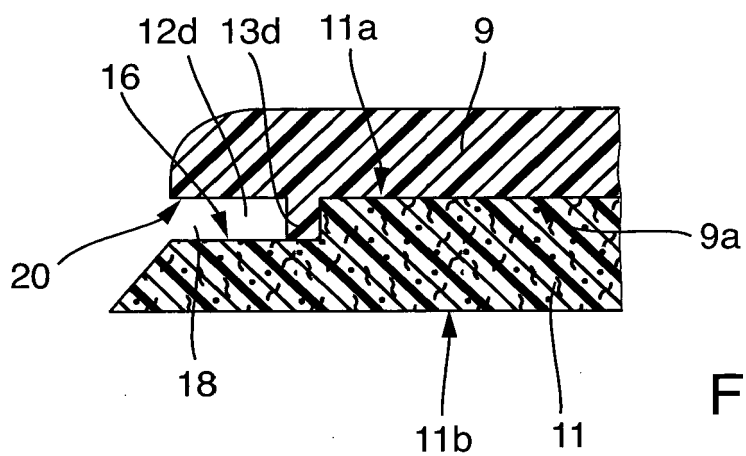


Fig. 5

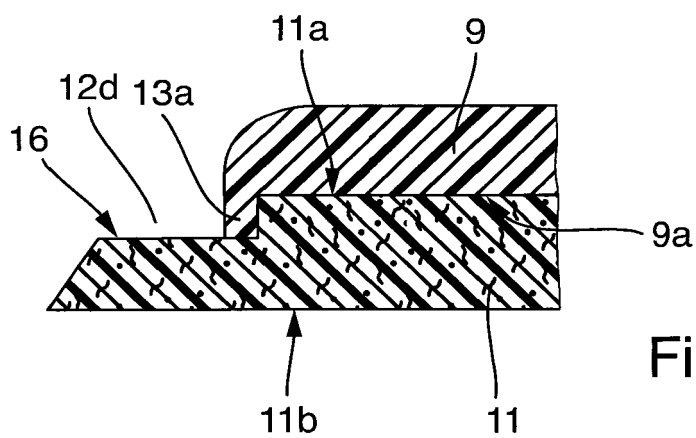


Fig. 7

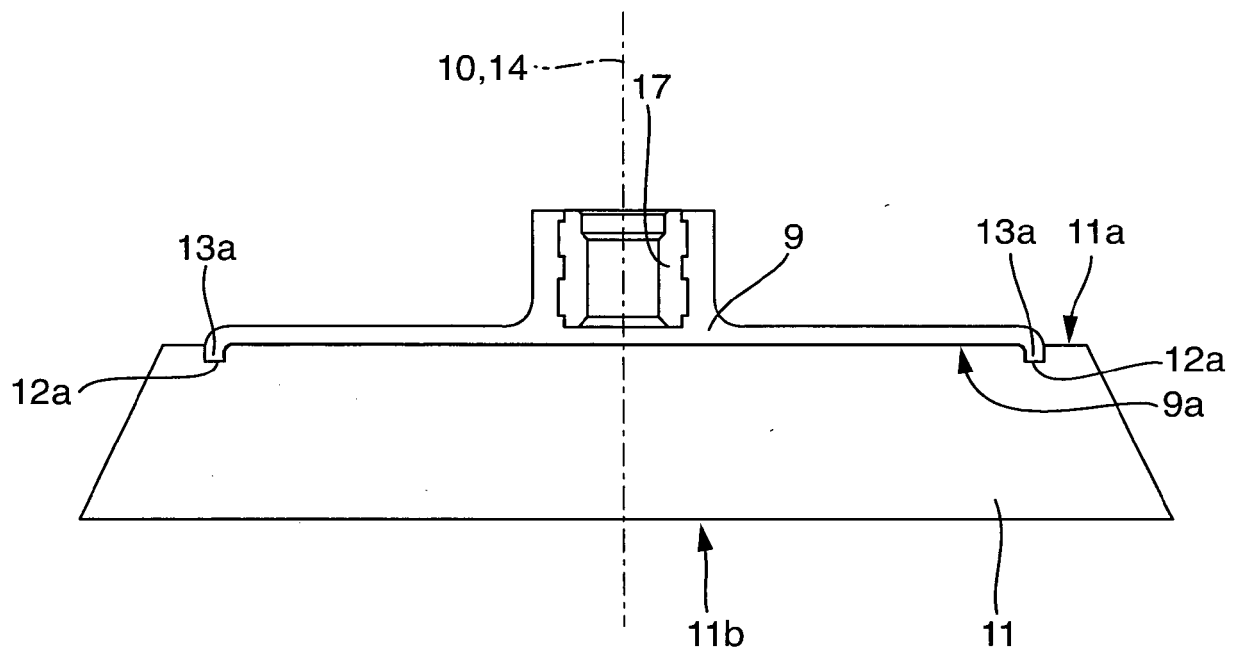


Fig. 3

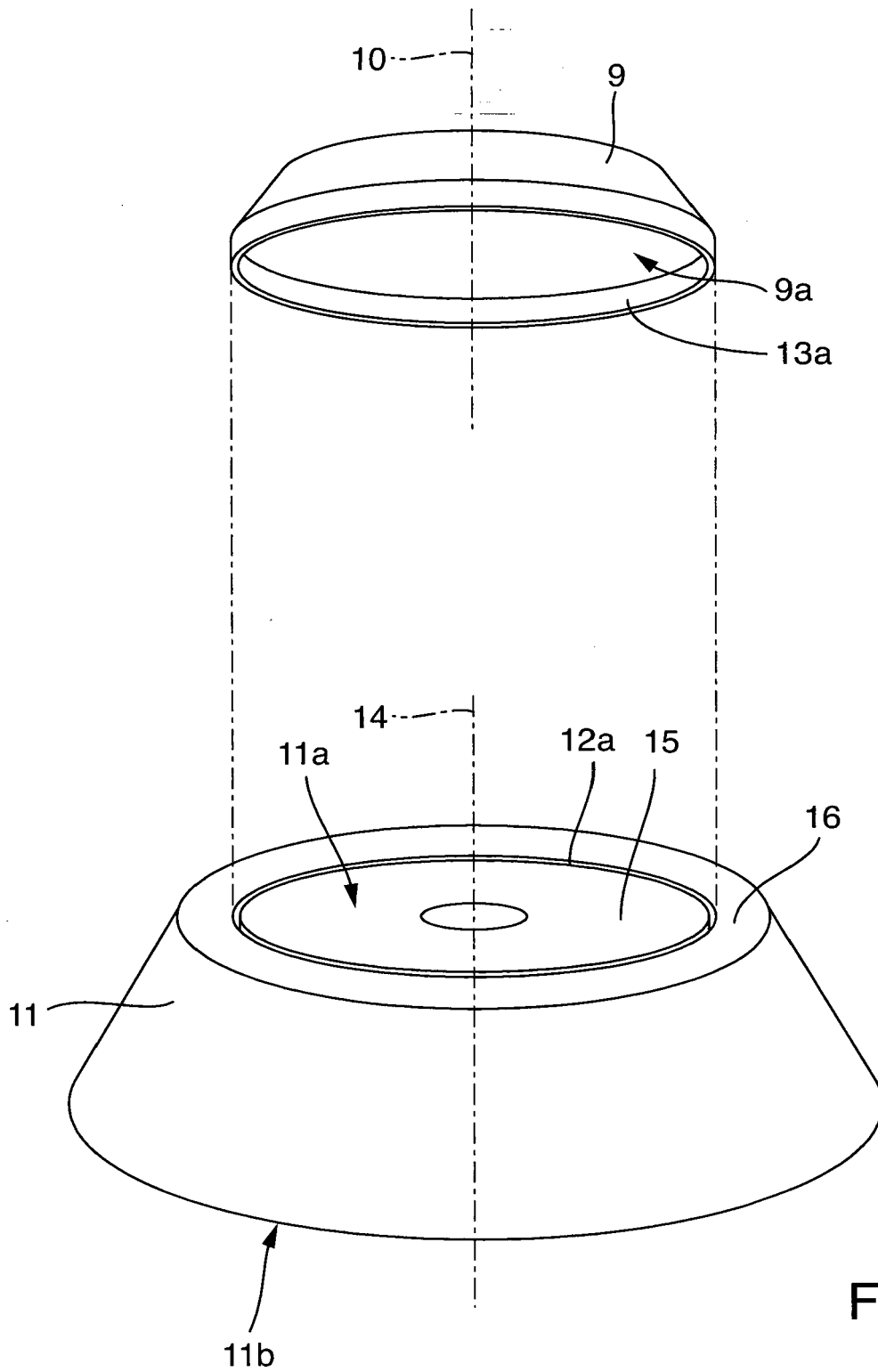


Fig. 4

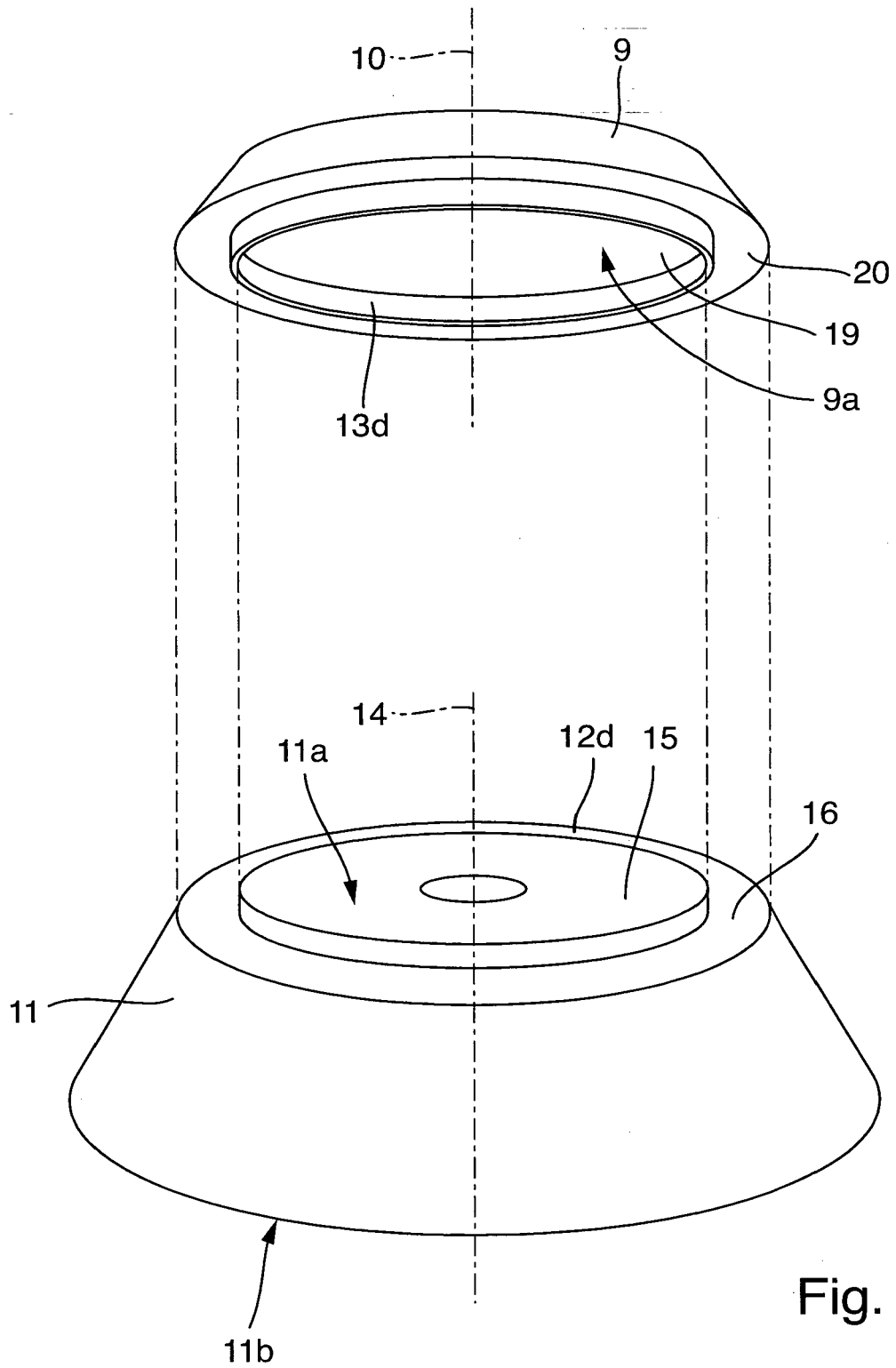


Fig. 6

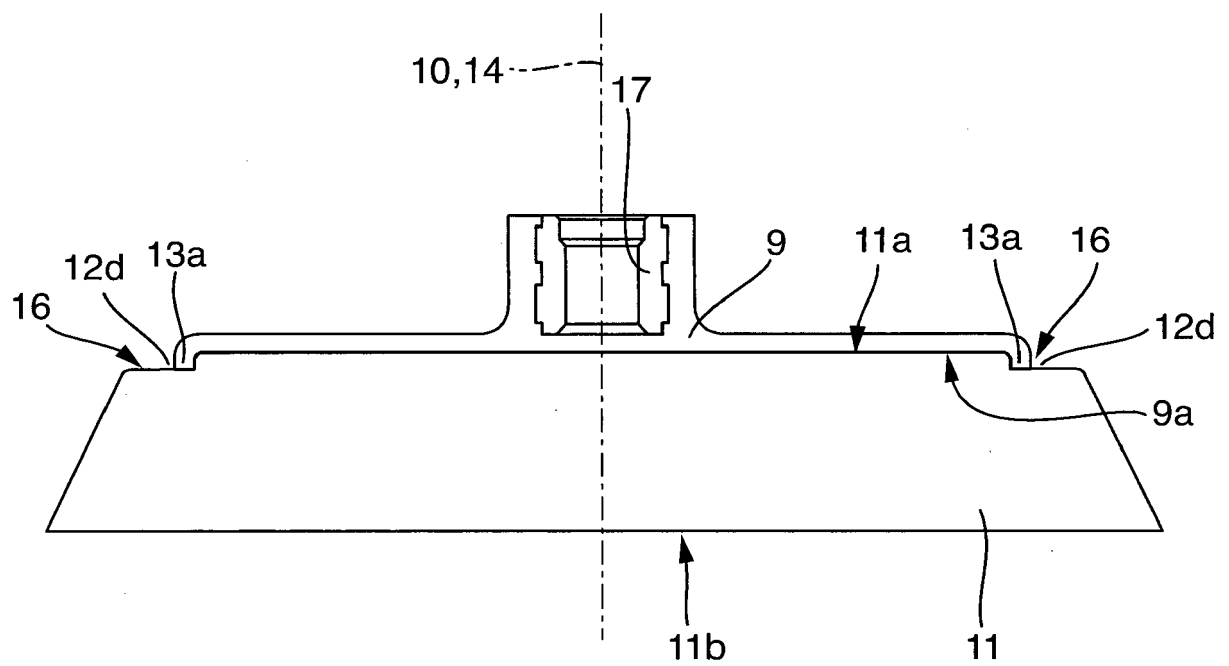


Fig. 8

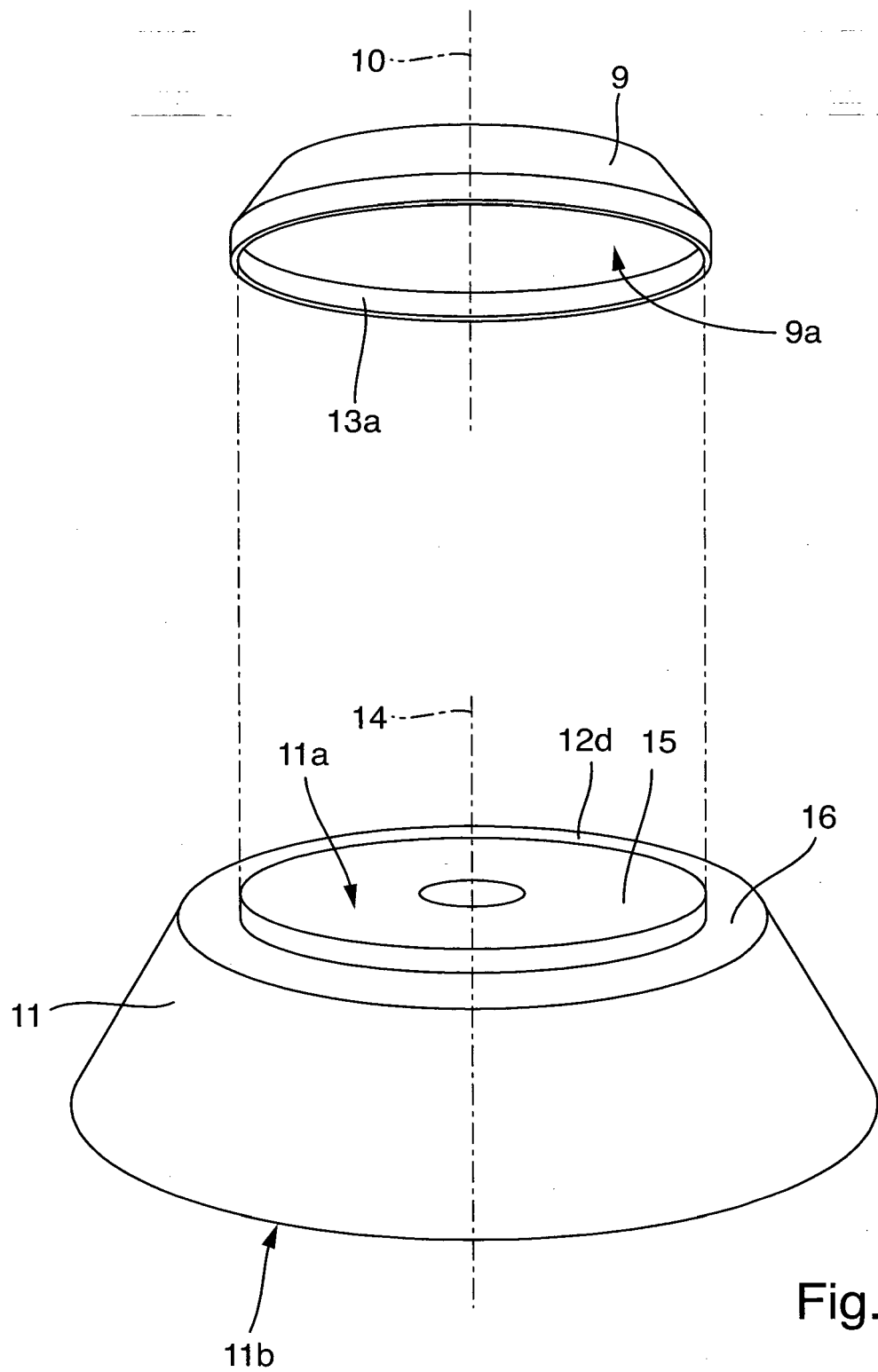


Fig. 9

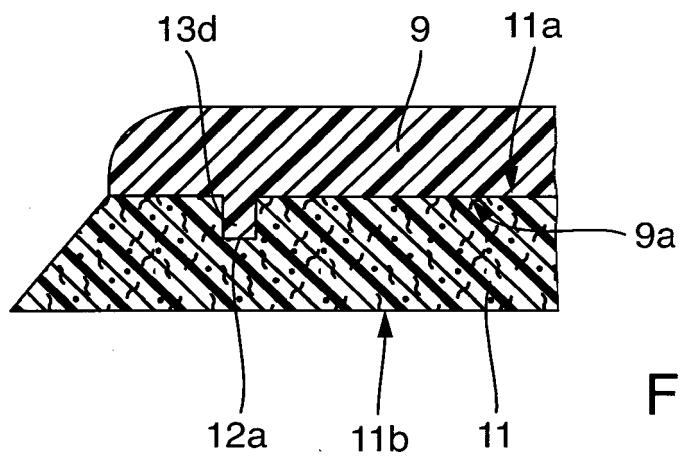
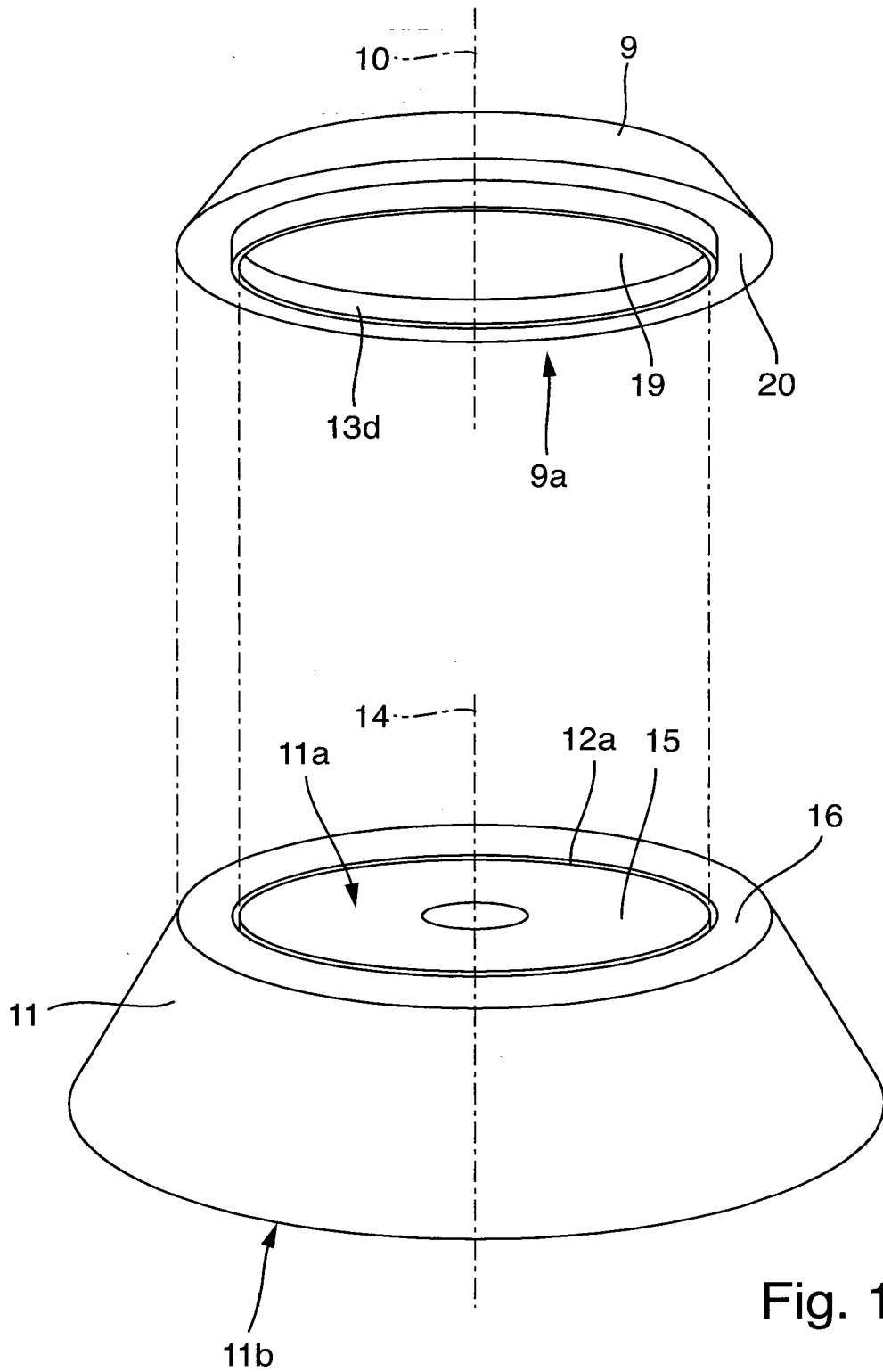


Fig. 10



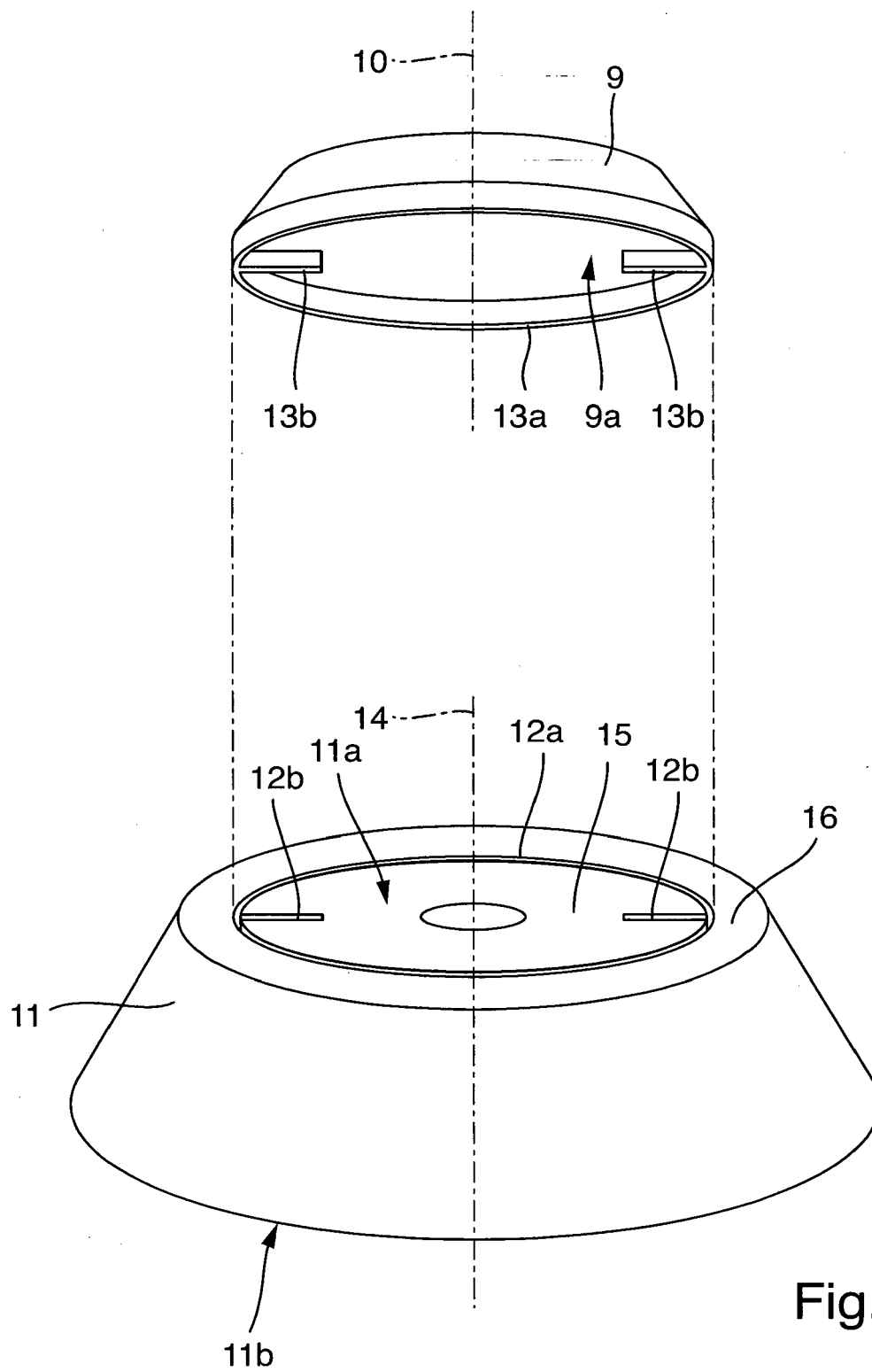


Fig. 12

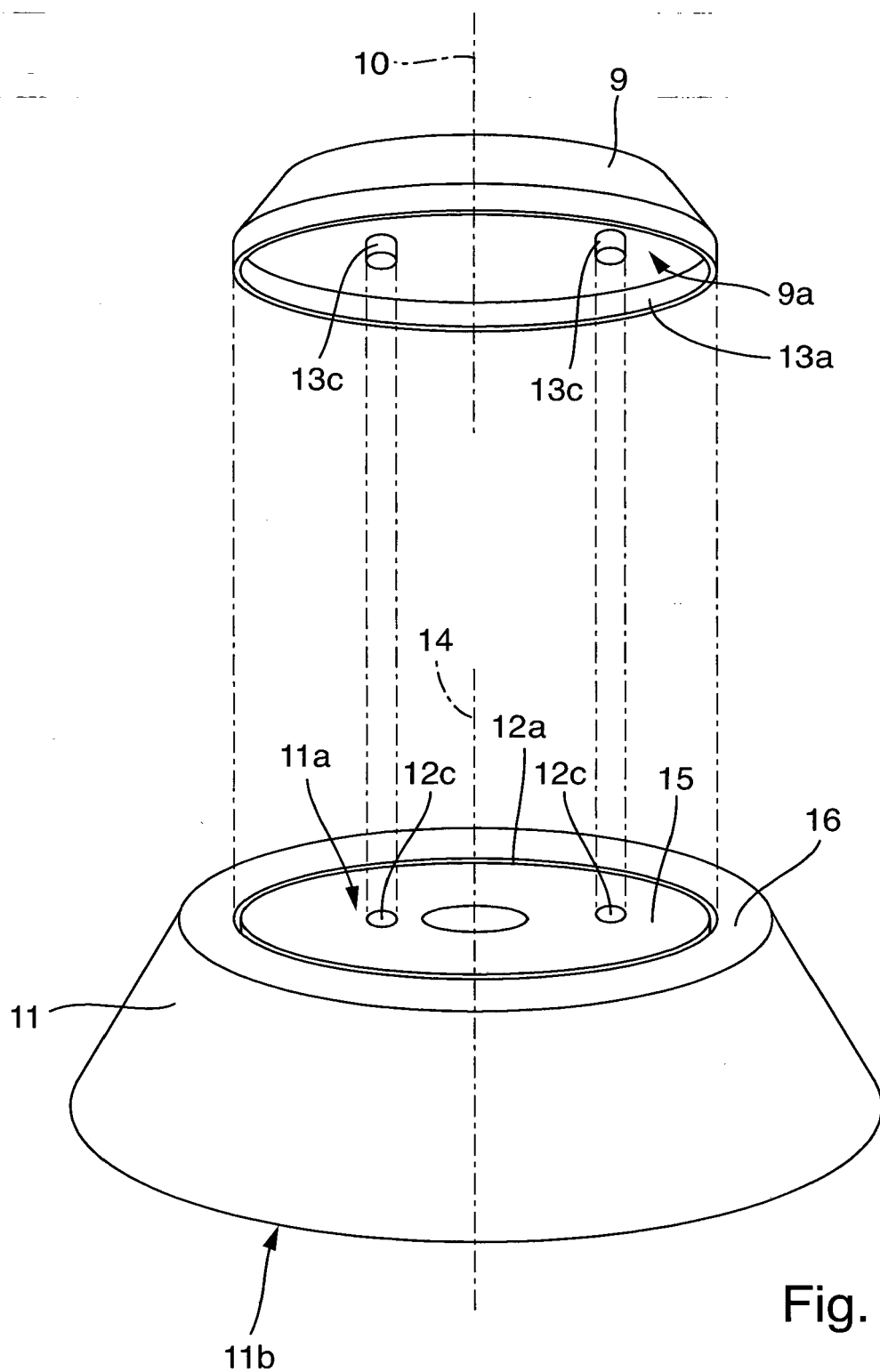


Fig. 13

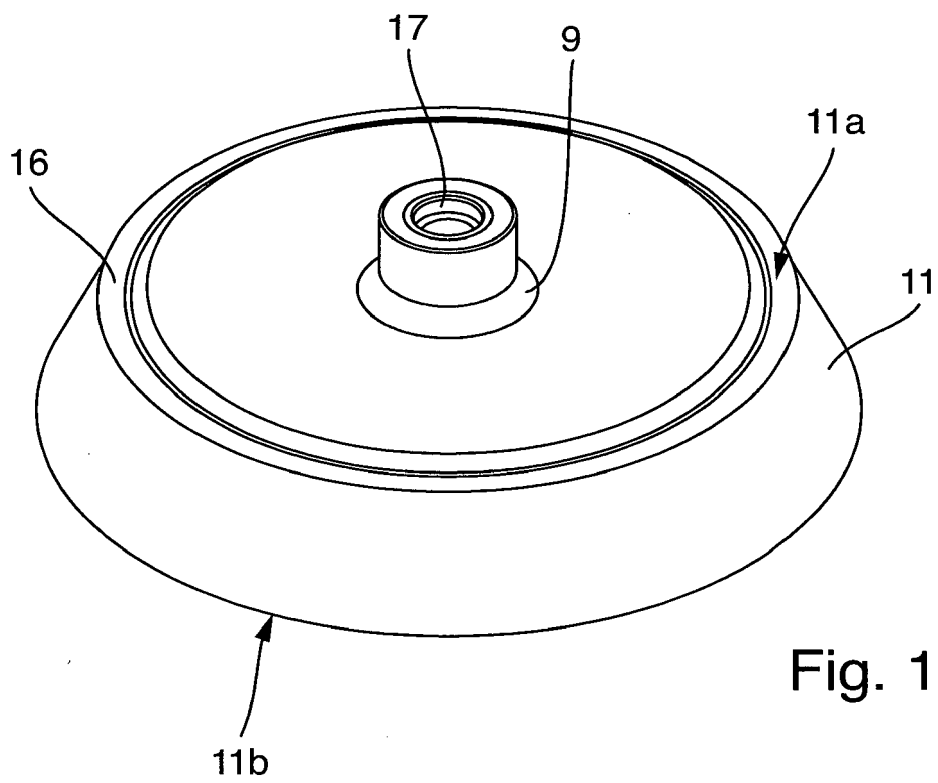


Fig. 14



EUROPEAN SEARCH REPORT

Application Number
EP 17 17 8839

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 6 105 197 A (UMBRELL RICHARD T [US]) 22 August 2000 (2000-08-22) * abstract; figures 1-7 *	1-3, 7-10, 14-16	INV. B24D13/14 B24D13/20 B24B23/02 B24B23/04
X	CN 102 049 739 B (UNIV NANJING AERONAUTICS) 25 July 2012 (2012-07-25) * paragraphs [0006] - [0014]; figures 1-3 *	1-16	
X	US 2012/276825 A1 (CHEN FENG [CN]) 1 November 2012 (2012-11-01) * abstract; figures 3A, 3B, 3C *	1,5-7, 12-16	
			TECHNICAL FIELDS SEARCHED (IPC)
			B24D B24B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 12 December 2017	Examiner Endres, Mirja
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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