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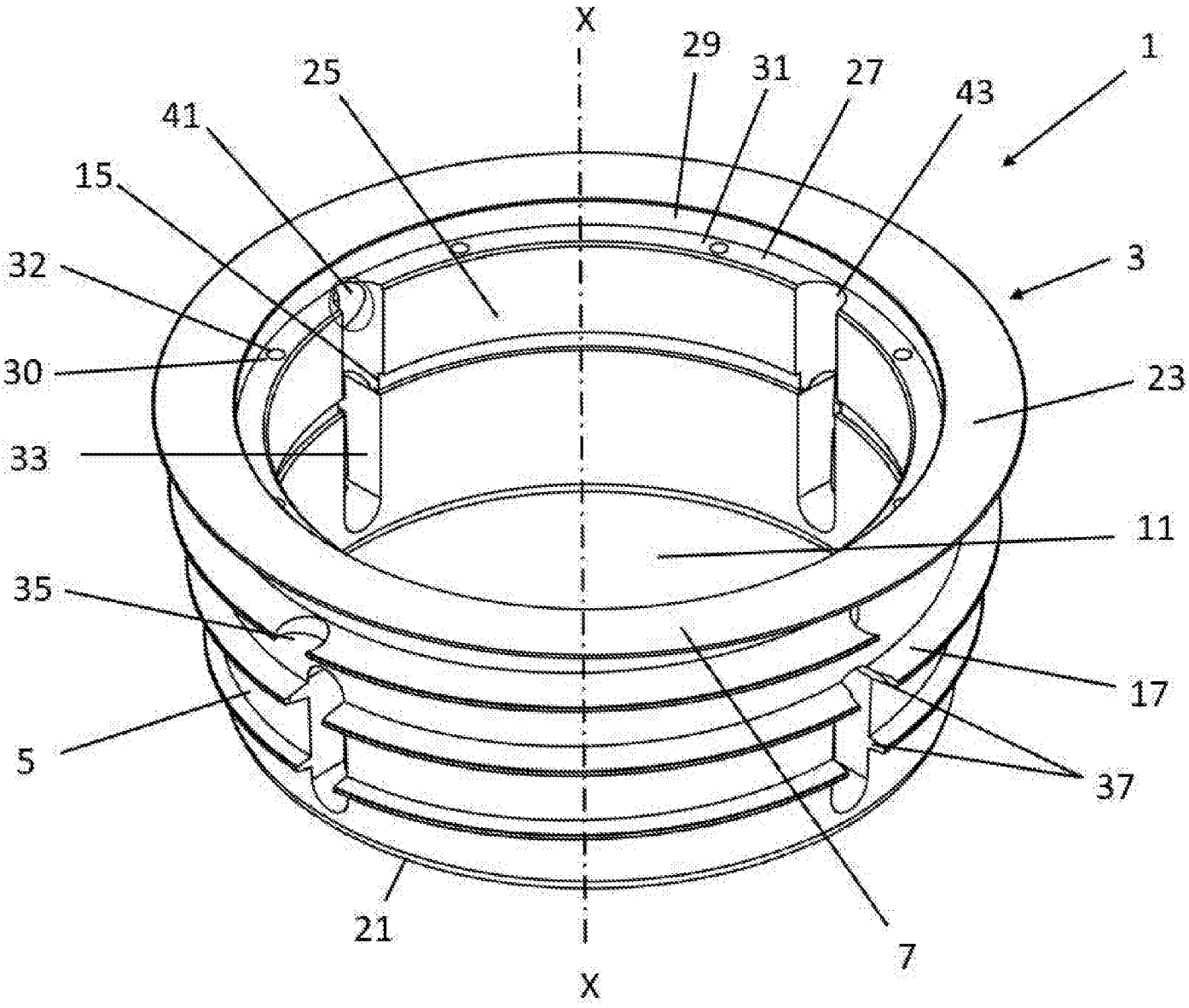
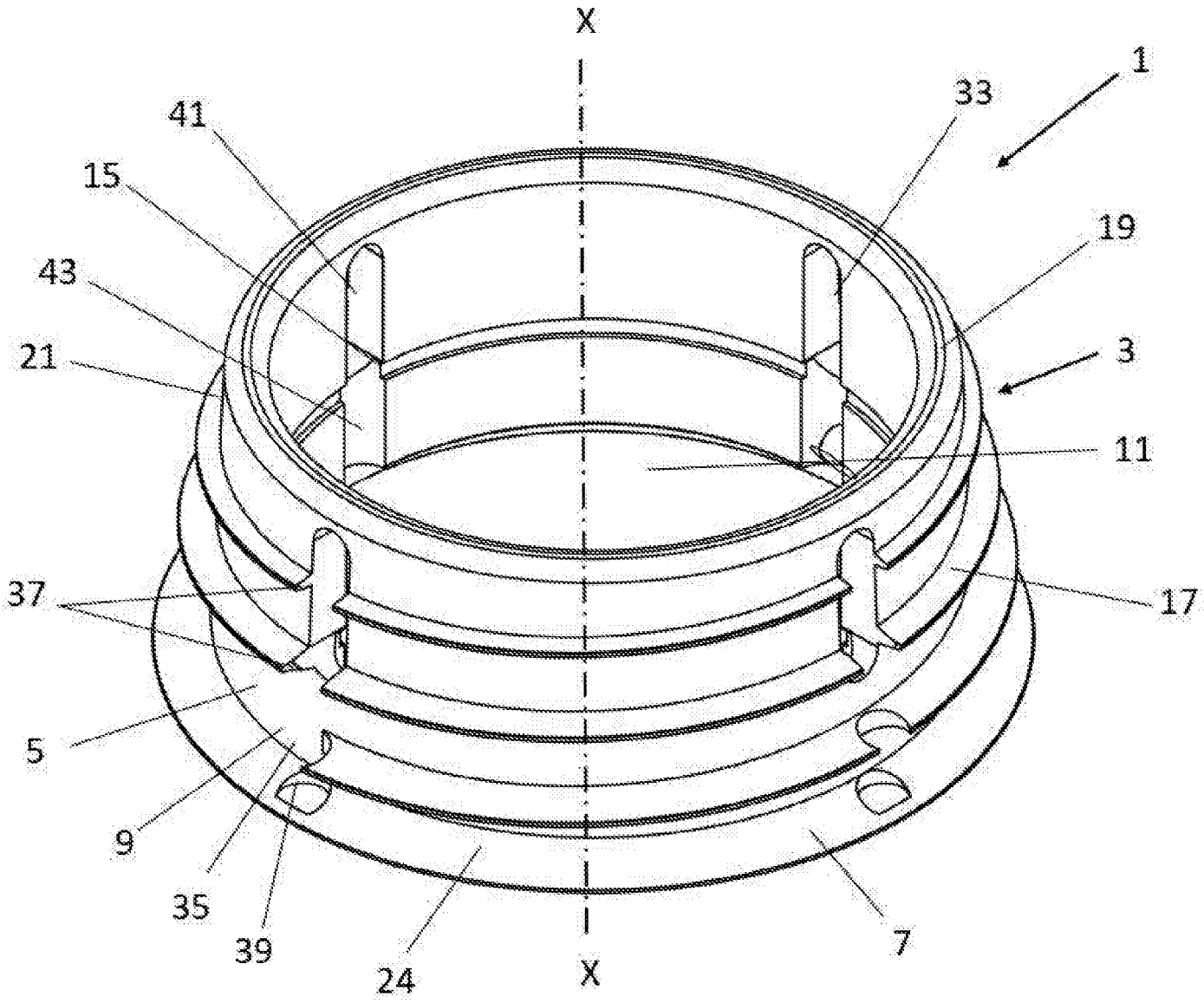


Figure 1



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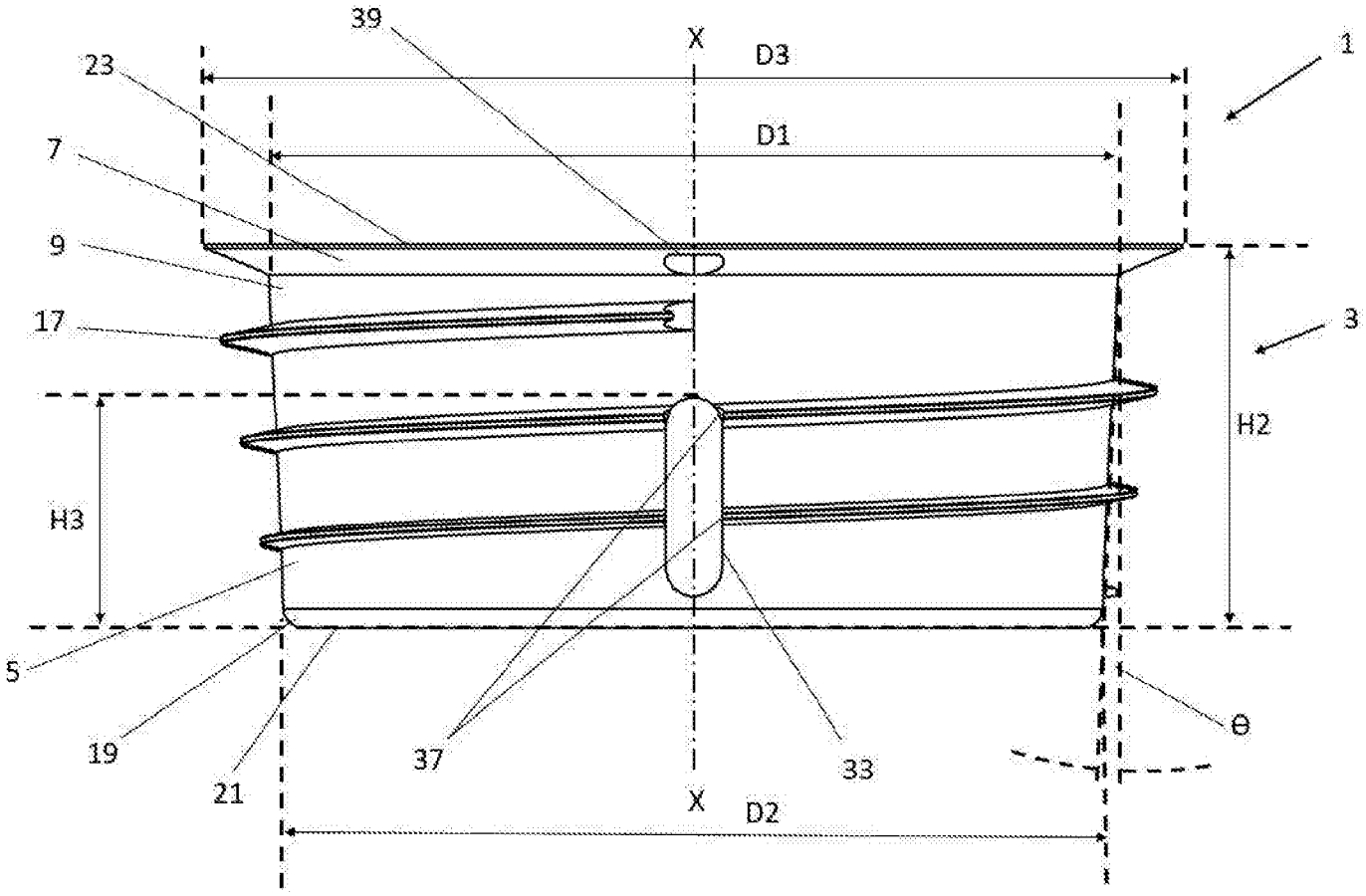

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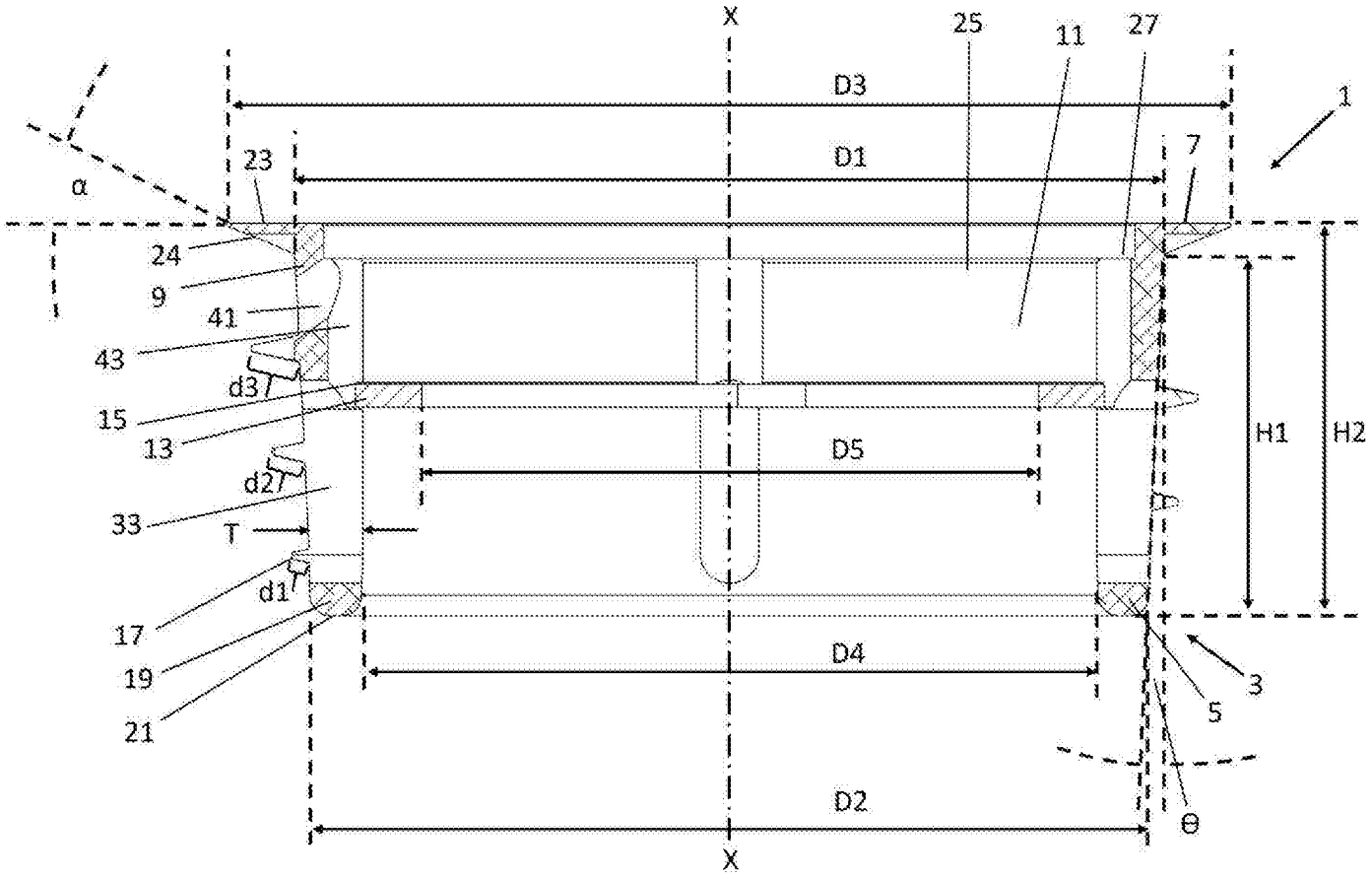
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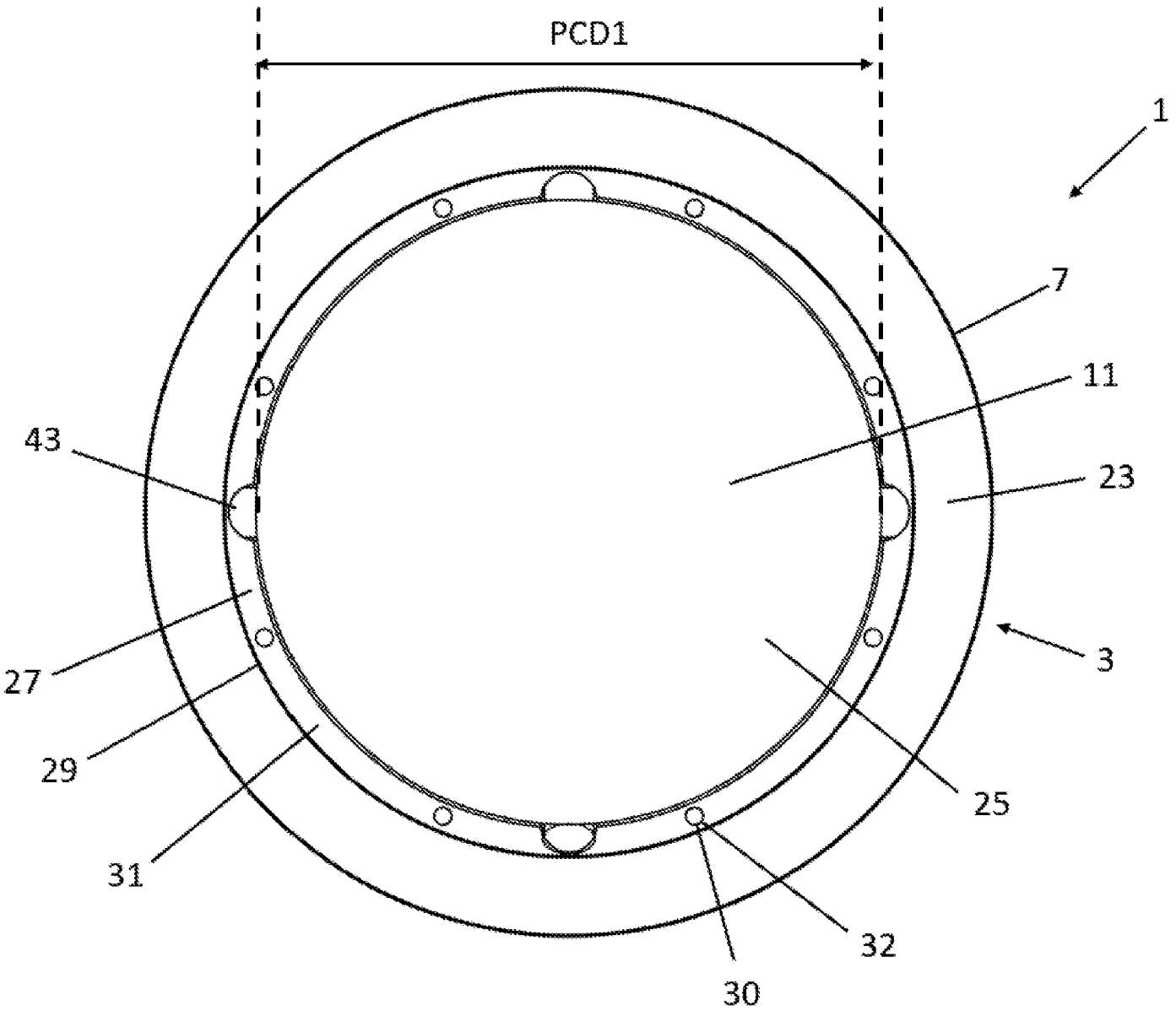
Figure 4



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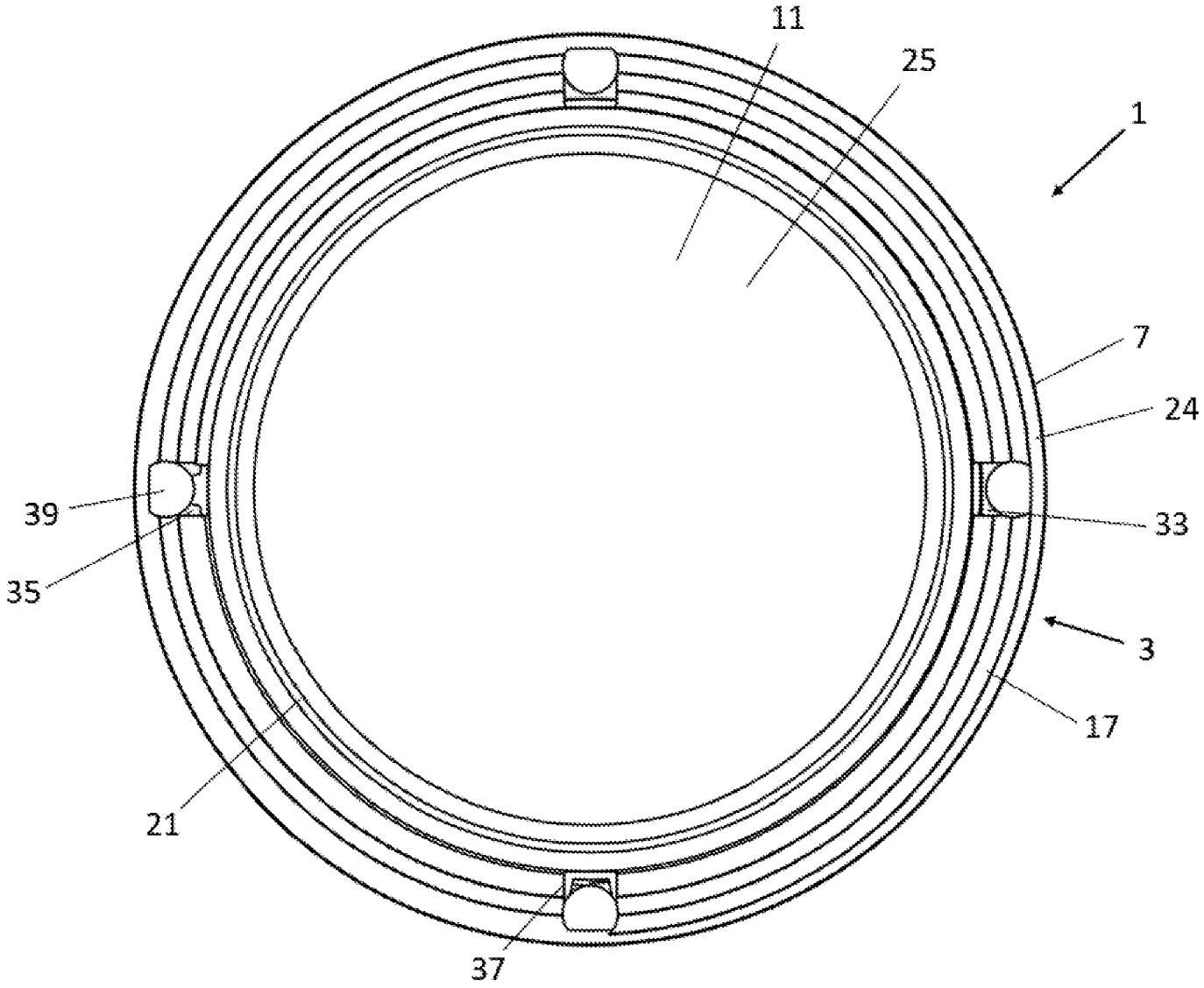

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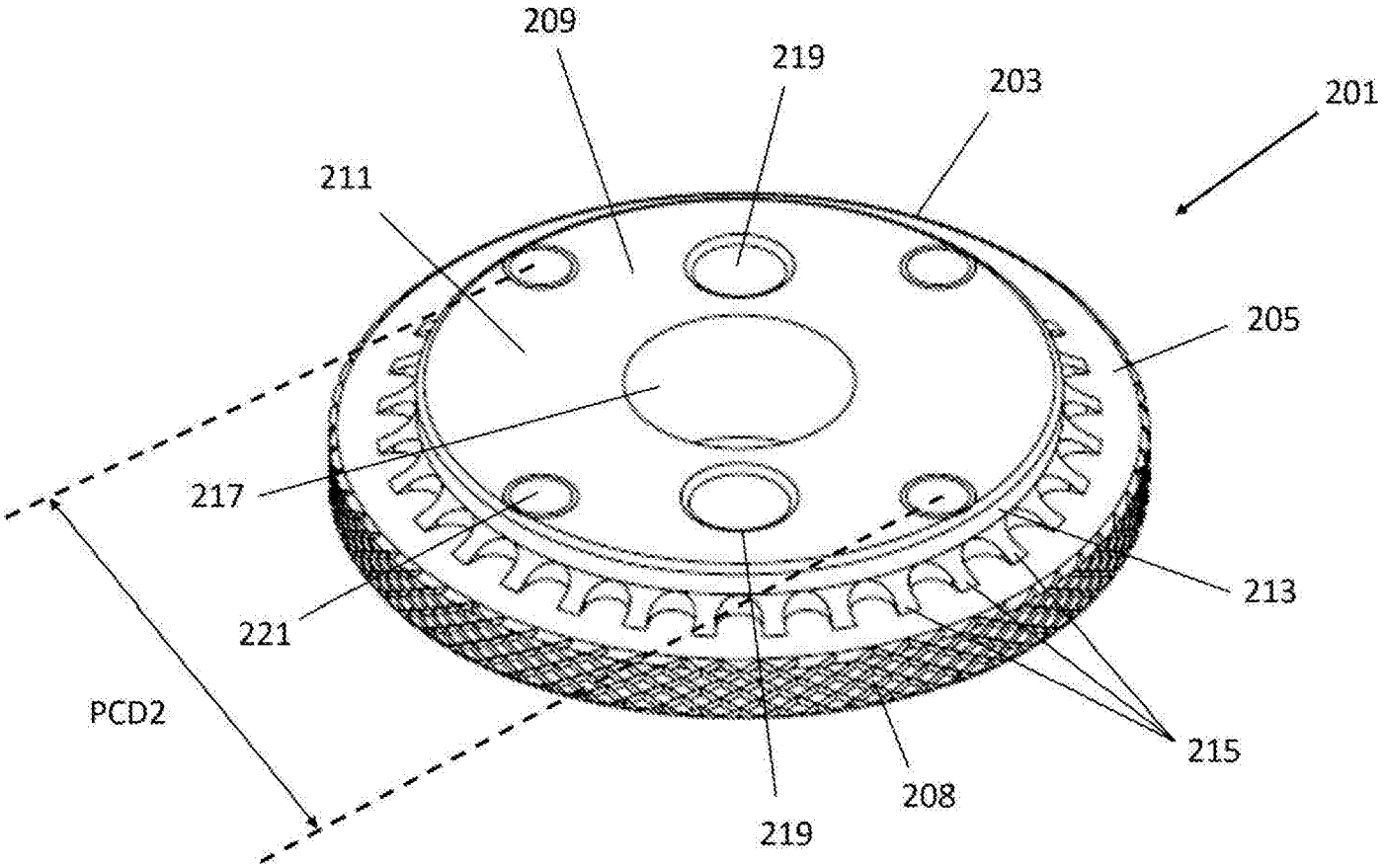

Figure 7

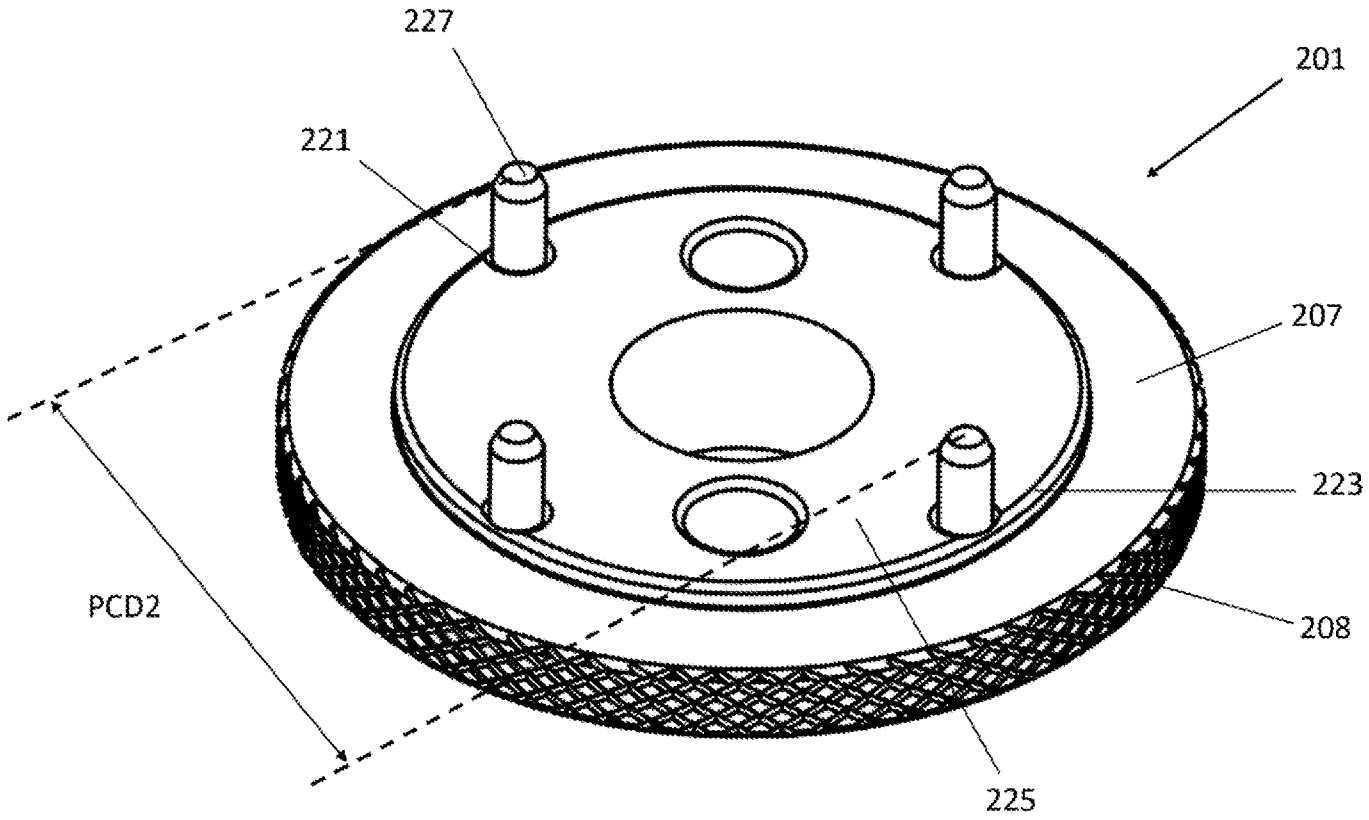

Figure 8

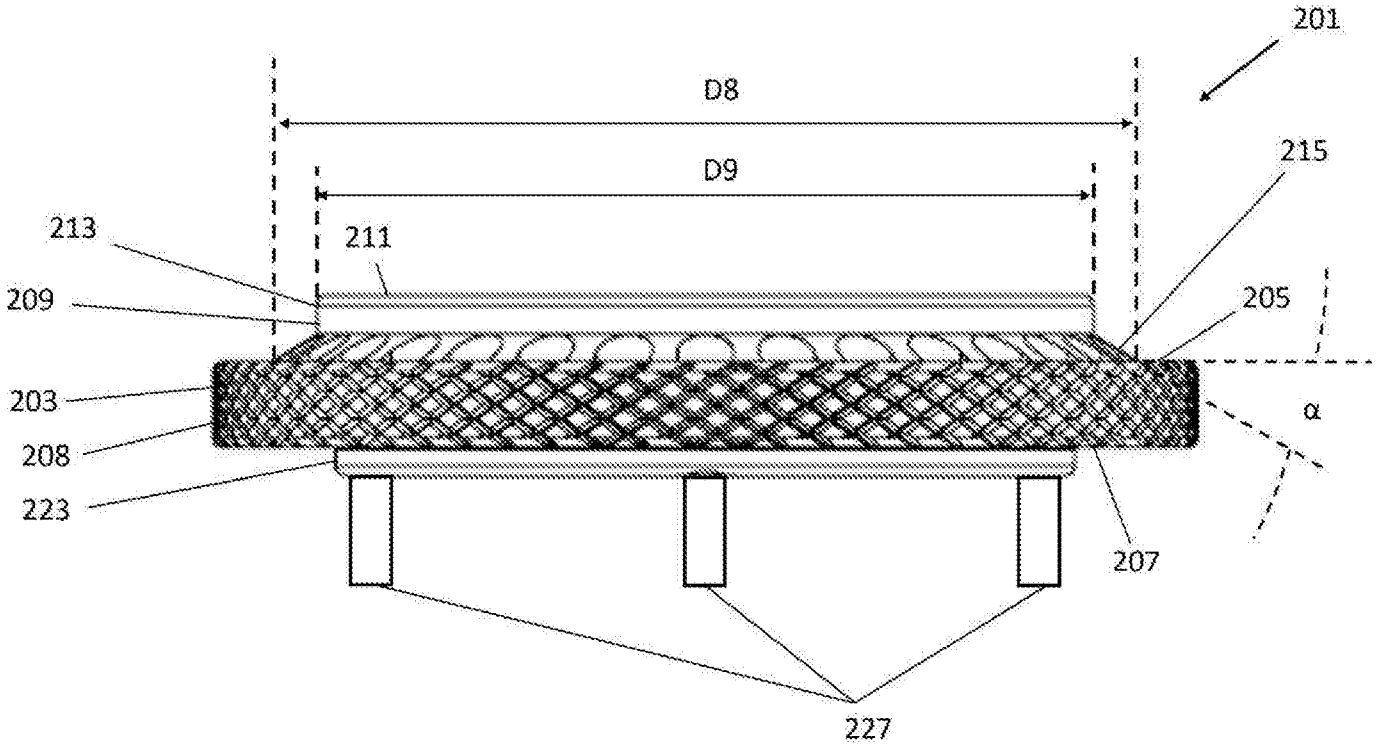

Figure 9

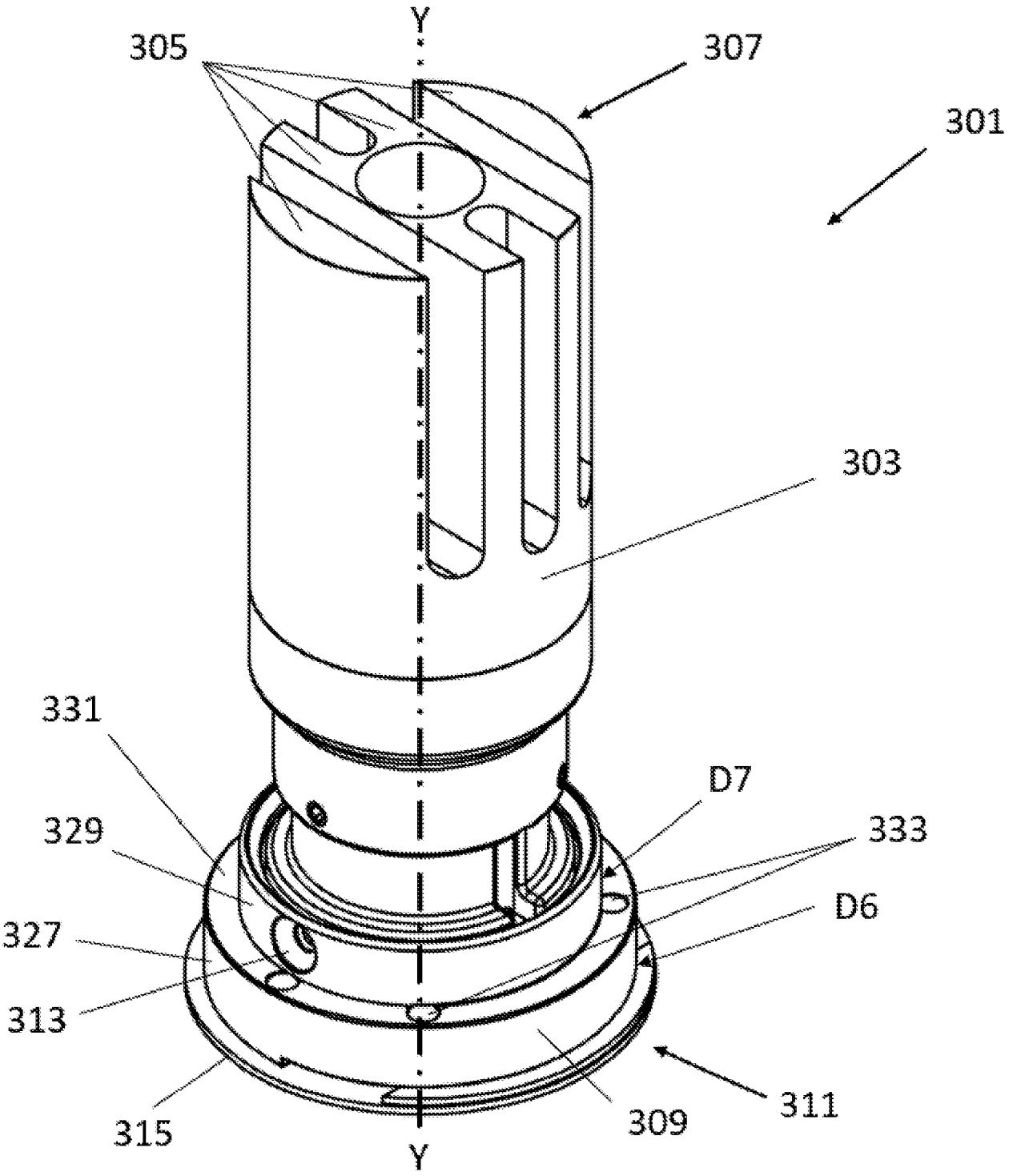

Figure 10

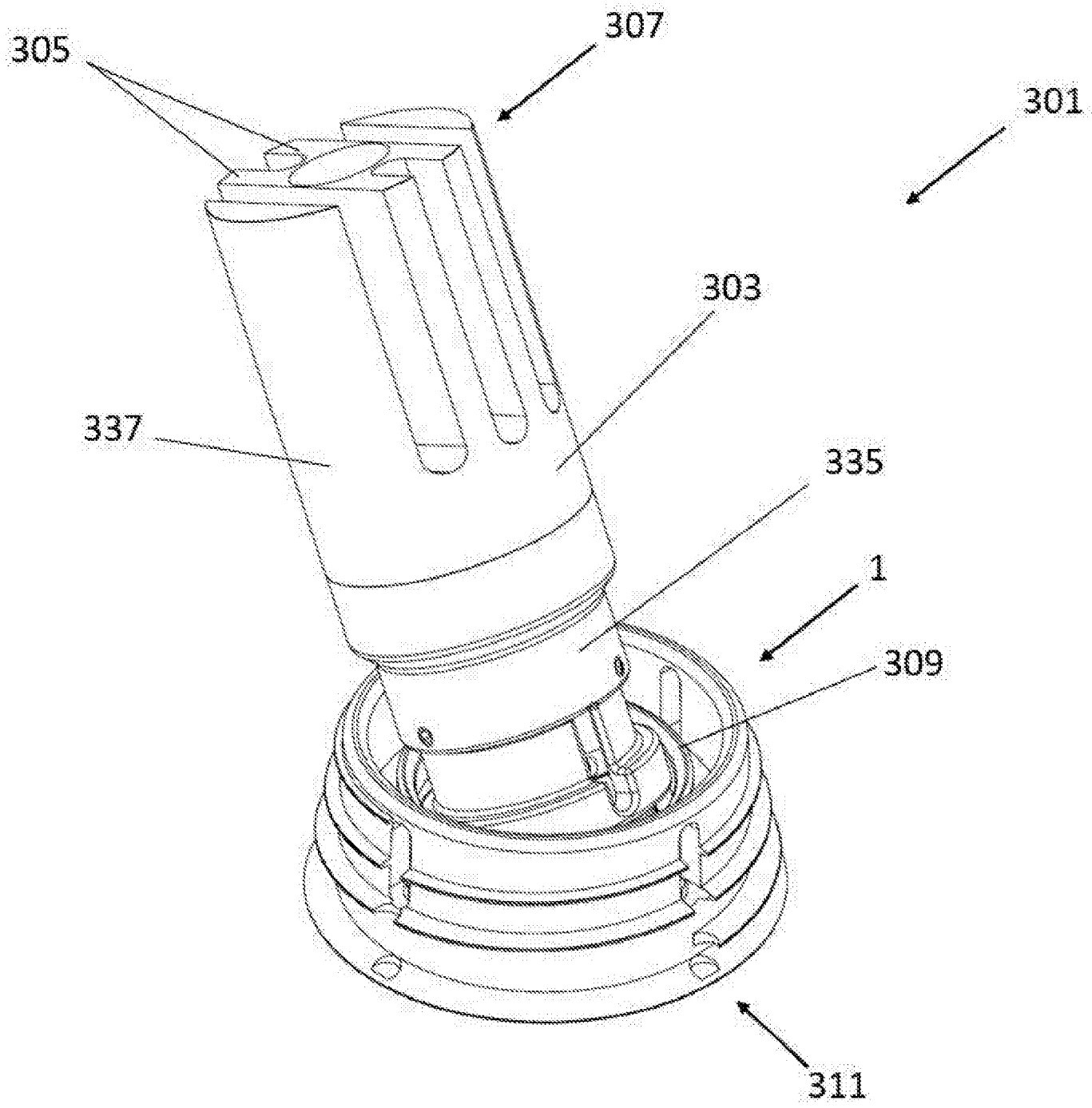

Figure 11

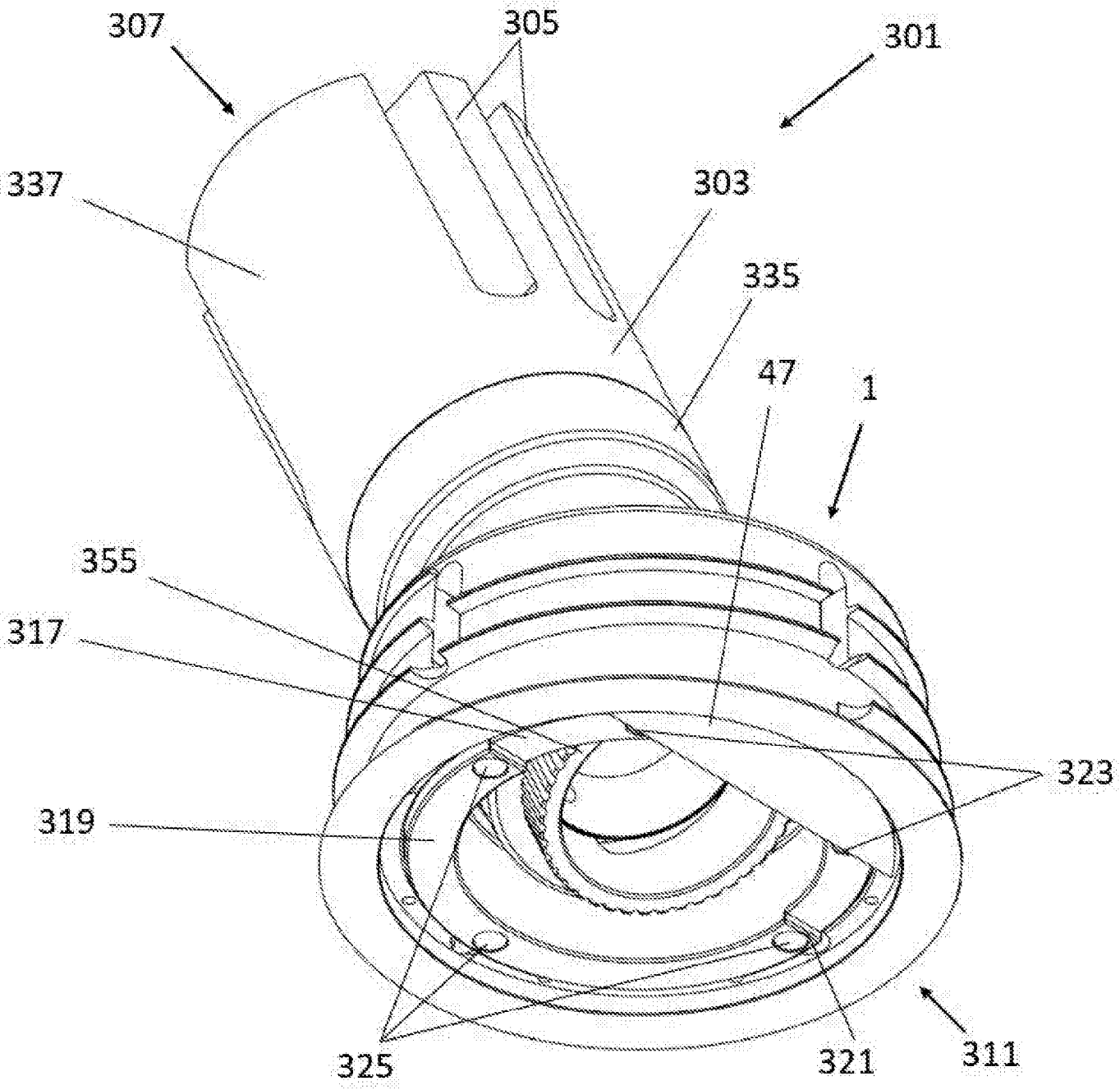

Figure 12

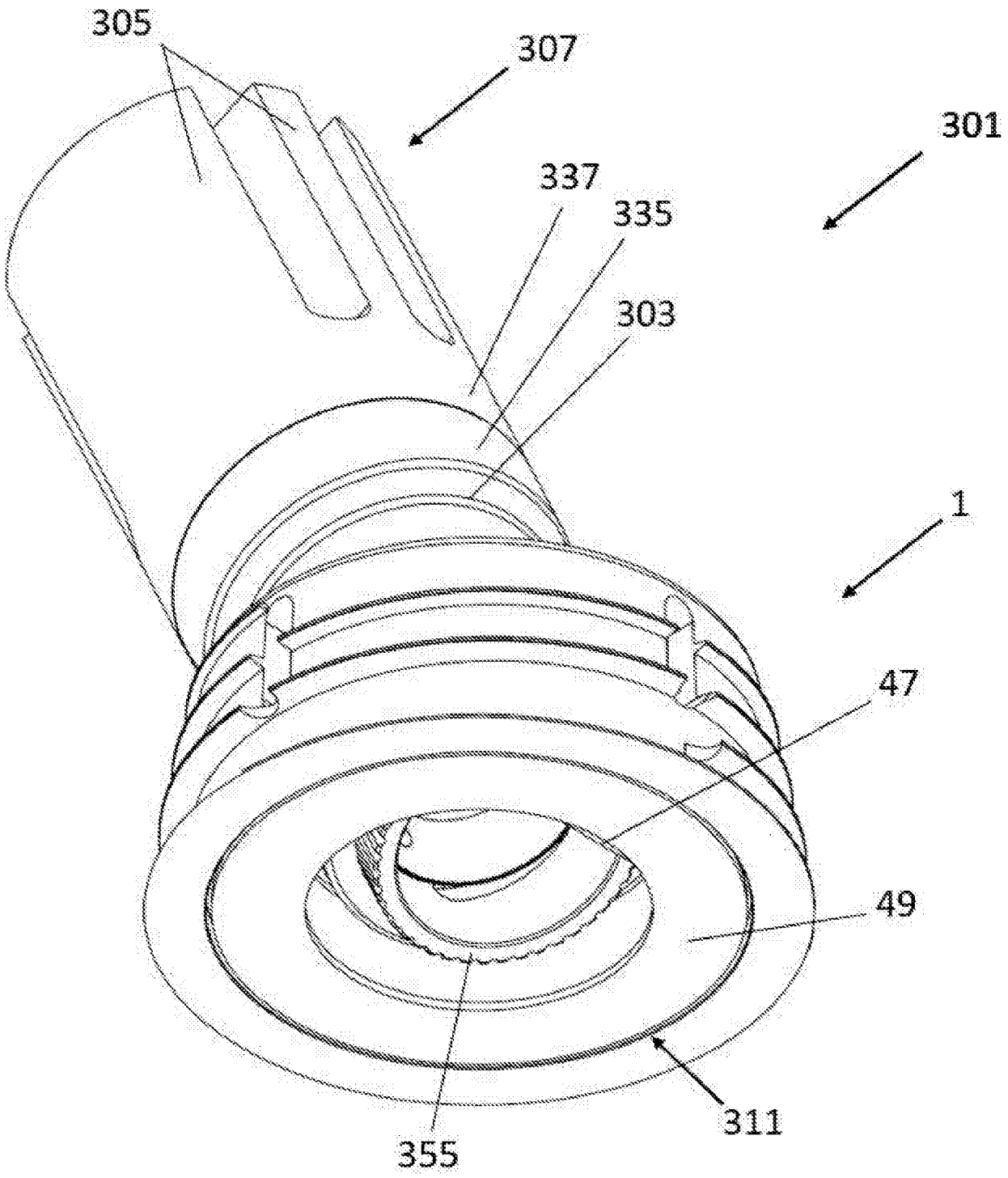

Figure 13

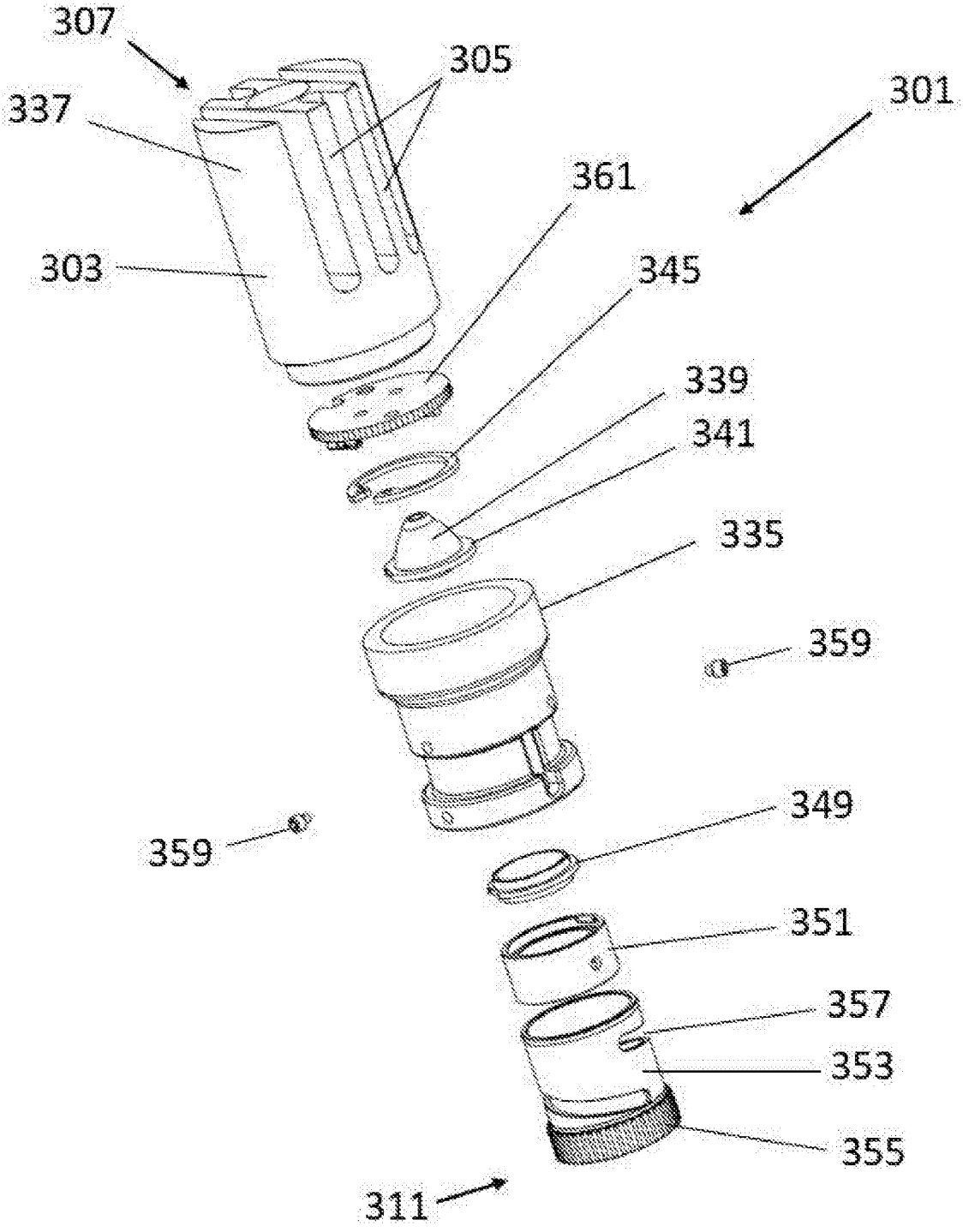
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Figure 14

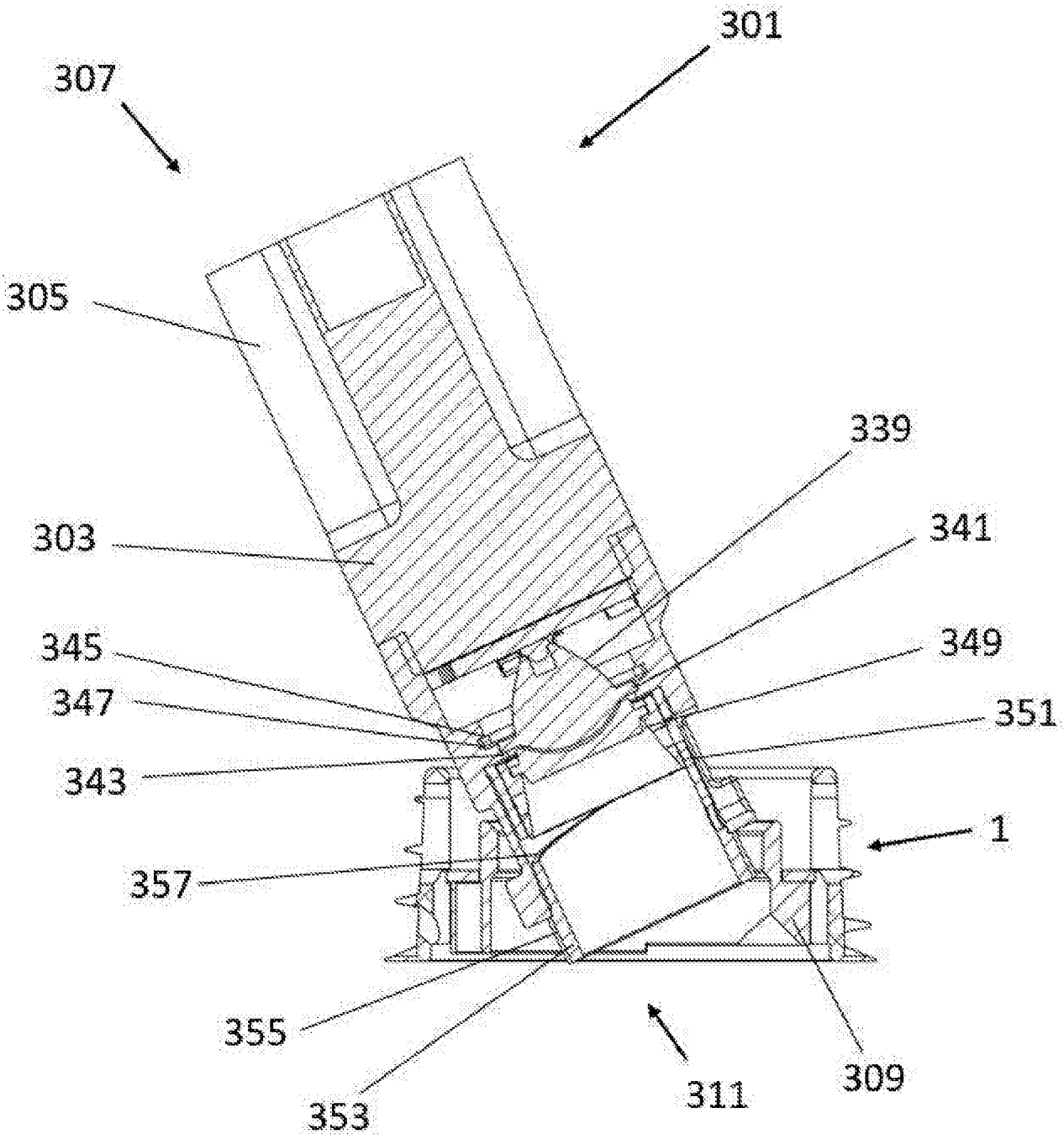
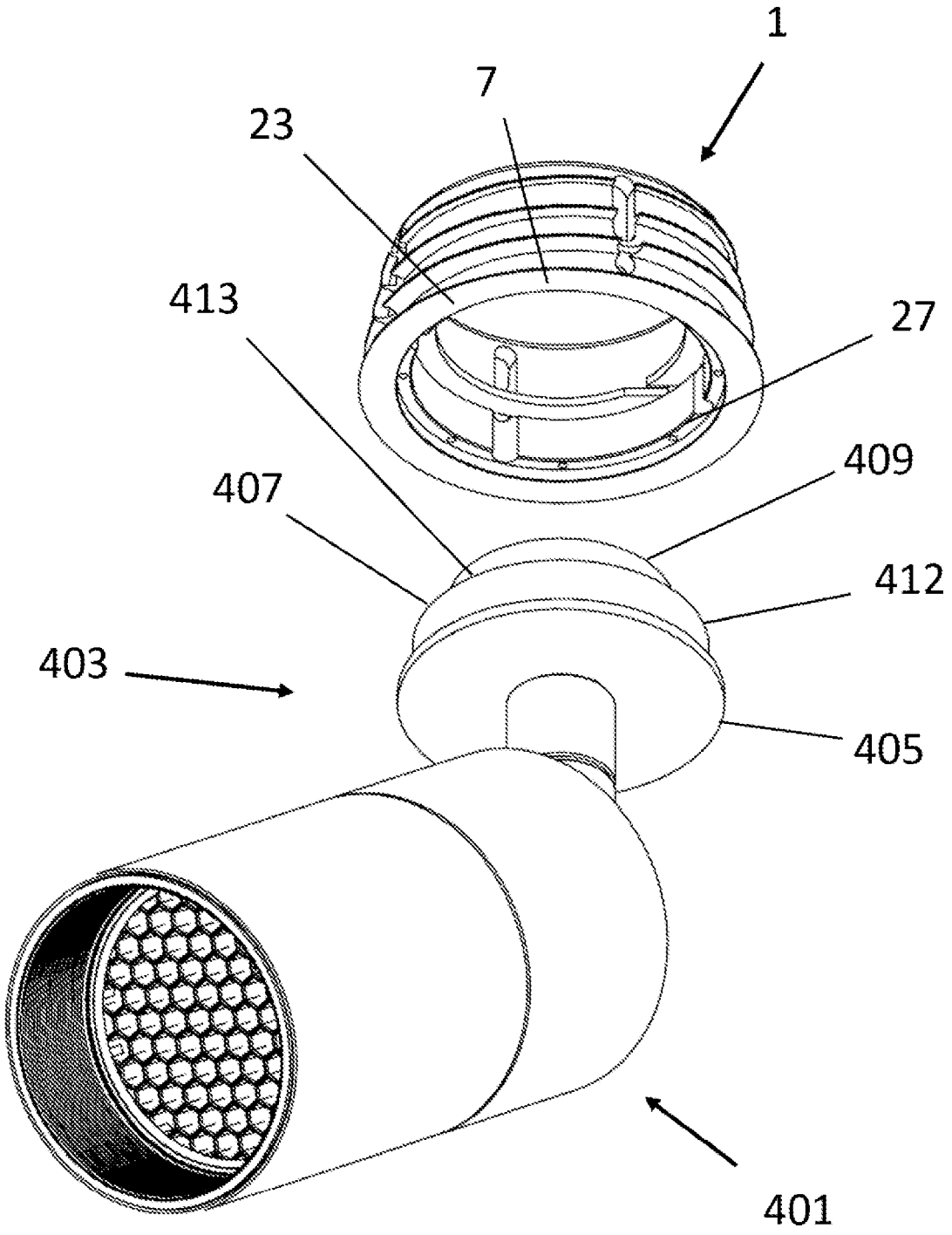


Figure 15



25 05 23

Figure 16

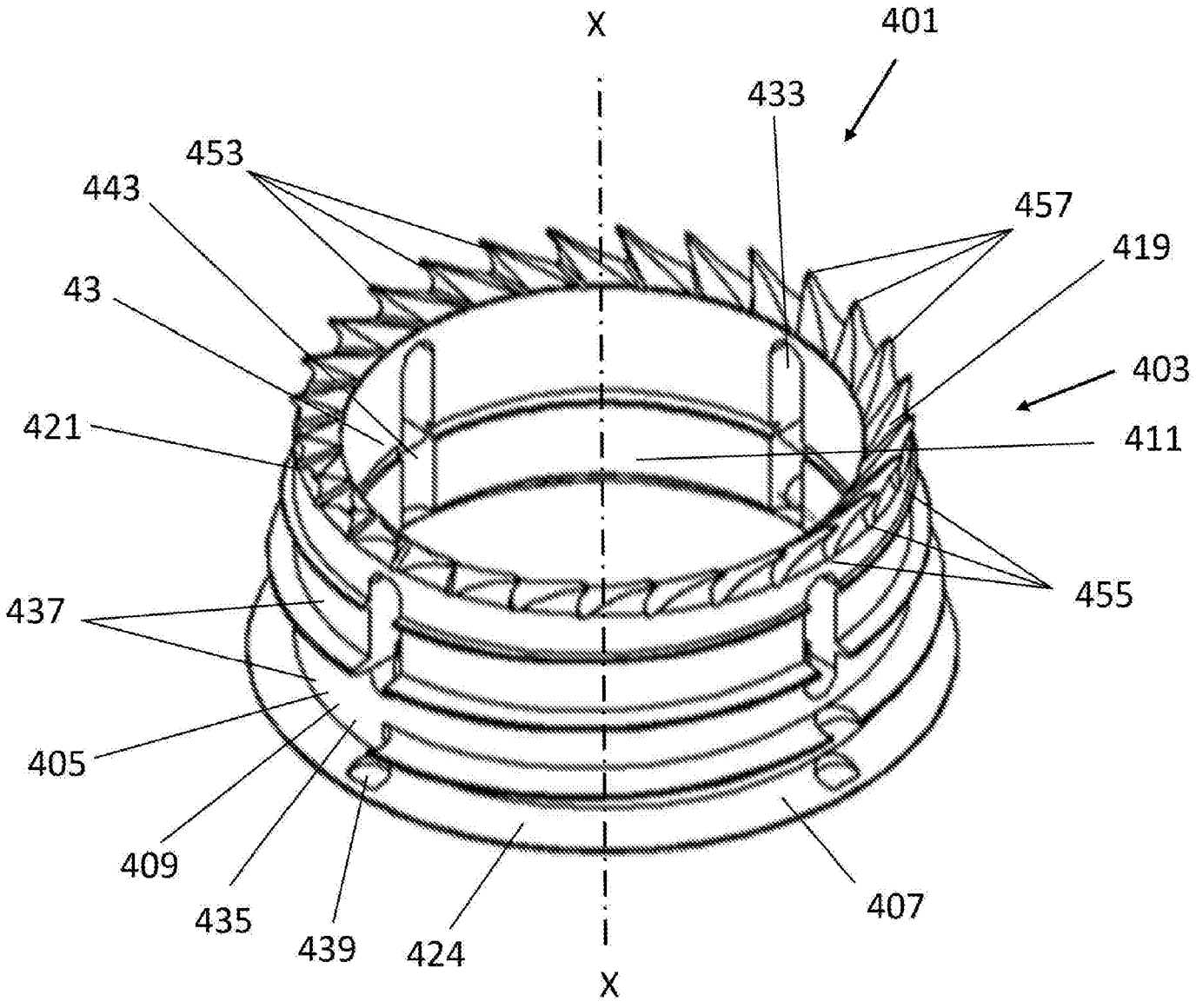

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Figure 17

A FLUSH-MOUNT

The present invention relates to a flush-mount that provides a housing in a surface within which a device can be fitted. In particular, the housing of the flush-mount can be fitted into a plasterboard ceiling and can accommodate a downlight. It is envisaged that other electrical devices can be accommodated, for example other lighting equipment, smoke detectors and cameras, or indeed non-electrical devices. Multiple flush-mounts can be provided in an array, such that all of, or just some of, the flush-mounts can be provided with a device. If a flush-mount is not provided with a device then a blanking plug can be fitted into the housing to reduce the visual impact of the flush-mount.

Ceiling fitted downlights are well known in the lighting industry. They fall into a number of types including surface mounted and plaster-in types.

Surface mounted types typically have an annular bezel, with the lamp of the downlight being located within the bezel's opening. The bezels can be provided in many different materials and finishes, but the feature that is common to them all is that they are located on top of the surface and therefore the bezel stands proud of the surface. It may not always be desirable to have a bezel that projects above the surface, particularly in locations such as art galleries, where a surface with the minimal amount of visible features is desirable.

Plaster-in type downlights overcome that downside of surface mounted bezels, because they can be fitted so that they do not project above the surface. However, whereas a surface mounted downlight can be fitted very simply, i.e. by cutting a hole in the surface and pushing the downlight into that hole, the fitting process for a plaster-in downlight is more involved. Plaster-in type downlights are time-consuming to fit, particularly when they are being installed retrospectively into an already plastered ceiling. The normal process is that a hole needs to be drilled through the plasterboard of the ceiling and then the plaster around that hole is removed to accommodate a mesh. The downlight is placed into the hole and screw fixings attach the downlight to the plasterboard. A plasterer is then required to make good the ceiling by plastering over the mesh to replace the removed plaster and blend the downlight into the ceiling. Removal of the original plaster takes time and creates a great deal of mess and a plasterer needs to be employed to apply the new plaster. These processes create additional expense which increases the cost of the installation.

There is therefore a need for a flush-mount that can be installed very simply and quickly into a surface and that, once installed, is flush with the surface. It is only necessary for a final

surface finish to be applied in a redecorating step, for example the surface is filled, painted and/or wall papered, in order to obtain an installation of very high quality.

Accordingly, the present invention provides a flush-mount for receiving a device, the flush-mount having a body, a device receiving socket located within the body, a device retention element, a non-displaceable gripper extending outwardly from an external surface of the body and a flange extending around an opening of the device receiving socket, wherein the non-displaceable gripper comprises at least one protrusion, wherein the at least one protrusion extends around substantially the whole of the external perimeter of the body, the body has a circular cross-section and the at least one protrusion is a male helical screw thread, the flange is a circular annular flange extending around the body and a proximal face of the flange extends perpendicularly to the rotational axis (X-X) of the male helical screw thread, and wherein a distally oriented face of the flange extends at an angle to the proximal face, and wherein the root of the flange is adjacent to the body and has a depth that is greater than the depth of the flange at its outer periphery and wherein the distally oriented face extends from the external perimeter of the body, wherein he distally oriented face of the flange is provided with a cutter. It is advantageous to have a non-displaceable gripper because this facilitates a close engagement between the flush-mount and the aperture in the installation surface into which the flush-mount is installed. Such a close engagement is needed so that the proximal face of the flange of the flush-mount is flush with the installation surface. The engagement provided by displaceable grippers, such as flexible fins, sprung elements and the like, may relax over time resulting in the flush-mount standing proud of the installation surface and thus becoming visible, which is counter to the desire to have a flush-mount that provides a very small visual impact. The at least one protrusion may be a ridge or any suitable element that extends above the external surface of the body, such as a bump or a hemispherical dome. If more than one protrusion is provided, then those protrusions can be arranged in an array around the external surface of the body. The protrusions interact with the material of the installation surface to provide the above-mentioned engagement. It is advantageous to have a male helical screw thread because it facilitates installation of the flush-mount using a rotary motion. Extension of the proximal face of the flange perpendicularly to the rotational axis of the male helical screw thread is advantageous because it facilitates installation of the flush-mount using a rotary motion. The cutter on the flange helps to ensure a very close engagement between the flush-mount and the installation surface by honing the countersink in the installation surface so that it closely matches the profile of the flange.

Preferably, the male helical screw thread has a constant pitch and a varying amplitude such that the height of its tip above the external surface of the body is greatest nearest to the flange

and smallest nearest to the distal end face of the body. This arrangement is advantageous because it facilitates easy installation of the flush-mount into the installation surface. The first thread to engage the walls of the aperture in the installation surface has the lowest amplitude and it is therefore relatively easy to start the female thread. The amplitude of the male thread can gradually increase so that the depth of the female thread gradually increases and that full depth can be cut more easily once the threaded engagement has started.

Preferably, the cross-sectional profile of the flange tapers to a point at its outer periphery. This arrangement enables the flush-mount to be fitted neatly into the installation surface, by virtue of the countersunk arrangement, meaning that the amount of redecoration that is required can be kept to a minimum.

Preferably, both ends of the device receiving socket are open. This is advantageous because it allows a wide range of devices to be fitted, including devices that have a depth greater than that of the flush-mount.

Preferably, the device retention element is located at least partially within the device receiving socket and provides a device abutment surface. The device abutment surface may be an annular shoulder or a recess, for example a recess for a ball of a ball lock pin.

Preferably, the device retention element is made from a magnetic or a ferromagnetic material. The device retention element may be an internal circlip made from spring steel.

Preferably, the at least one protrusion comprises a cutting surface. This is advantageous because it allows the material of the installation to be cut away during the installation process. Alternatively, the protrusion can be provided without a cutting surface and during the installation process the material of the installation surface is compressed to accommodate the flush-mount.

Preferably, the male helical screw thread is provided in at least two discrete parts and a cutting surface is provided at one end of at least one of the at least two discrete parts. This arrangement is advantageous because it provides an additional cutting surface (the tip of the thread is itself a cutting surface). In addition, a gap may be provided between the two discrete parts and that gap assists with the transport of cutting debris away from the cutting surfaces. This helps to prevent the flush-mount from binding in the aperture of the installation surface.

Preferably, the body is provided with a relief aperture that passes between the external surface of the body and the device receiving socket. The relief aperture assists with the transport of cutting debris away from the cutting surfaces.

Preferably, the body is in the form of a frustoconical annulus that is widest at its end that is adjacent to the flange, such that the external surface of the body is angled relative to the longitudinal axis of the flush-mount. The provision of a draft angle further assists with installation of the flush-mount into the installation surface by providing an initial clearance between the body and the aperture, so that the non-displaceable gripper can be brought into engagement with the installation surface.

Preferably, the body is provided with a fixing pin aperture that passes between the external surface of the body and the device receiving socket. The fixing pin aperture may be a threaded bore that accommodates a grub screw. However, any suitable means of mechanically restraining the flush-mount to the installation surface can be used.

Preferably, the flush-mount has installation tool apertures.

Preferably, the flush-mount has a face plate recess that is located adjacent to the flange and around the device receiving socket.

In an alternative embodiment, the flush-mount further comprises a cutter provided on the distal end of the body.

In the alternative embodiment, preferably the cutter has a plurality of saw teeth arranged in a circle around the distal end of the body and the diameter of the cutter at the tip of the teeth is the same as, or greater than, the external diameter of the distal end of the body and the diameter of the cutter at the root of the teeth is the same as the diameter of the socket.

Alternatively, the cutter can comprise a sharp knife edge, an abrasive surface or any other cutting tool suitable for use on an installation surface.

According to a second aspect of the present invention, there is provided an installation tool for installing a flush-mount that comprises a plate that is provided with a lower face and an upper face, wherein the upper face is provided with an annular cutter with a cutting surface that has a profile that is complementary to the profile of the flange of the flush-mount and wherein the lower face is provided with at least two drive pegs that each extend outwardly from the upper face and which have a spacing that is complementary to the spacing of the installation tool apertures of the flush-mount.

Preferably, the plate is provided with a central bore and two pin bores, wherein the pin bores are located diametrically opposite each other and on either side of the central bore and wherein the central bore and the pin bores holes are arranged to accommodate a standard hole saw arbor.

Preferably, the cutting surface slopes relative to the longitudinal axis of the plate from a first diameter that is adjacent to the upper face of the plate to a second diameter that is spaced away from the upper face, wherein the first diameter is complementary to the external diameter of the flange of the flush-mount and wherein the angle of the sloping cutting surface is complementary to the angle of the distally oriented face of the flange.

Preferably, the plate is a circular disc, the plate is provided on its upper face with a cylindrical cutting boss that is coaxially aligned with the plate, wherein the cutting surface of the annular cutter is provided around the external surface of the cutting boss, wherein the central bore is coaxial with the plate and wherein the drive pegs are located such that the mid-point of their separation is also coaxial with the plate.

Preferably, the sides of the plate have a knurled surface.

The present invention will be described here with reference to the following figures:

Figure 1 is a top perspective view of a flush-mount according to a first aspect of the present invention;

Figure 2 is a bottom perspective view of the flush-mount of Figure 1;

Figure 3 is a side view of the flush-mount of Figure 1;

Figure 4 is a cross-sectional view of the flush-mount of Figure 1, provided with a circlip;

Figure 5 is a top plan view of the flush-mount of Figure 1;

Figure 6 is a bottom plan view of the flush-mount of Figure 1;

Figure 7 is a perspective view of the cutting face of an installation tool according to a second aspect of the present invention;

Figure 8 is a perspective view of the driving face of the installation tool of Figure 7;

Figure 9 is a side view of the installation tool of Figure 7;

Figure 10 is a perspective view of a downlight for fitment to the flush-mount of the present invention;

Figure 11 is a bottom perspective view of the downlight of Figure 10 when fitted to the flush-mount of Figure 1 and tilted relative to the flush-mount;

Figure 12 is a top perspective view of the downlight of Figure 10 when fitted to the flush-mount of Figure 1, tilted relative to the flush-mount and fitted with a louvre;

Figure 13 is a bottom perspective view of the downlight of Figure 10 when fitted to the flush-mount of Figure 1, having a louvre and a face plate, and when tilted relative to the flush-mount;

Figure 14 is a perspective exploded view of the downlight of Figure 10;

Figure 15 is a cross-sectional view of the downlight of Figure 10 when fitted to the flush-mount of Figure 1, tilted relative to the flush-mount and fitted with a louvre and a face plate;

Figure 16 is a top perspective view of the flush-mount of Figure 1 and an adapter for fitting a spotlight to the flush-mount; and

Figure 17 is a bottom perspective view of a flush mount according to a further embodiment of the present invention.

An embodiment of a flush-mount 1 according to the present invention is shown in Figure 1 and Figure 2. The flush-mount 1 has a circular annular body 3, comprising a wall 5 and an annular flange 7. The wall 5 and the flange 7 are formed integrally and the flange 7 extends from a proximal end 9 of the wall 5. The flush-mount 1 has a longitudinal axis X-X and the flange 7 extends perpendicularly to the longitudinal axis X-X in an outwards direction. The centre of the annulus of the body 3 forms a tubular device receiving socket 11. A spring steel internal circlip 13 is located in an annular circlip groove 15 provided on the inside surface of the wall 5, it has an internal diameter D5. A helical male thread 17 is provided on the outside surface of the wall 5. The height of the wall 5 is H1 (for example, 17.5mm) and the height of the body 3, i.e. the wall 5 and flange 7 combined, is H2 (for example, 19mm), as shown in Figure 3.

The wall 5 has a draft angle Θ (for example, Θ is 2 degrees) on its external circumferential surface. The external diameter D1 (for example, 42mm) of the wall 5 is largest at the proximal end 9, that is its end adjacent to the flange 7. The external diameter D2 of the wall 5 is smallest at its distal end 19 (D1>D2). The dimension of diameter D2 is greater than the height H2 of the body 3. The flange 7 has an external diameter D3 (for example, 48.4mm), which is greater than diameter D2. The tubular socket 11 has a constant internal diameter D4 (for example, 35.6mm) (with the exception of the annular circlip groove 15) and thus the wall 5 has a thickness T, as shown in Figure 4, that decreases linearly along the height H1 of the wall 5 from the proximal end 9 to the distal end 19. The distal end 19 of the wall 5 has a distal end face 21 that is parallel to the flange 7.

The flange 7 has a flat proximal face 23 that is perpendicular to the longitudinal axis X-X and a flat distal face 24 that extends from the external circumference of the proximal end face 23 to the external circumference of the proximal end 9 of the wall 5 at an angle α to the proximal end face 23. The angle α is, for example, 22 degrees and thus the distal face 24 of the flange 7 has a shallow taper. The flange 7 is provided with a circular opening 25 that is coaxial with and that has the same diameter as the socket 11. A face plate recess 27 is provided around a circular opening 25 and has a side face 29 that is parallel to the wall of the socket 11 and extends part way through the depth of the flange 7 and a bottom face 31 that is parallel to the proximal face 23. The bottom face 31 is provided with eight blanking plug magnet recesses 30 that are spaced equidistantly around the perimeter of the flush-mount 1. A blanking plug magnet 32 is fixed into each of the blanking plate magnet recesses 30.

The male thread 17 has a right-hand thread of constant pitch (for example, a 5mm pitch) but varying depth. The depth increases from a minimum d1 nearest to the distal end 19 of the wall

5 to a depth d2 part way along the external surface of the wall and then to a depth d3 adjacent to the proximal end 9 of wall 5 (where d1<d2<d3).

Four relief slots 33 are provided in the wall 5 and pass through the wall 5 from its external surface to the socket 11. The relief slots 33 are provided in two pairs, within each pair the relief slots 33 are diametrically opposed and each of the two pairs are offset from each other by 90 degrees of rotation around the longitudinal axis X-X, so that the relief slots 33 are evenly spaced around the circumference of the wall 5. Each relief slot 33 is elongate with rounded ends and extends parallel to the longitudinal axis X-X from near to the distal end 19 to a height H3 (for example, 11.4mm) from the distal end face 21, where the height H3 is approximately half of the height H2 of the body 3.

Aligned with each relief slot 33 is a cut-out 35, which cuts through the threads of the male thread 17 and cuts partially into the distal face 24 of the flange 7. The male thread 17 is therefore not one continuous thread around the outside of the wall 5, but instead has breaks in it and the ends of the male thread 17 adjacent to the breaks form thread cutting faces 37. The partial cut-out in the distal end face 24 of the flange 7 form a counterbore cutting face 39.

A threaded grub screw hole 41 is provided through the wall 5 and is located above one of the relief slots 33 and below one of the counterbore cutting faces 39.

The body 3 is provided with four driving slots 43 that are cut into the wall 5 and the flange 7 and open out into the socket 11. Each driving slot 43 is aligned with a relief slot 33 and, so that the driving slots 43 are equally spaced around the edge of the socket 11, and are parallel to the longitudinal axis X-X. The driving slots 43 extend between the face plate recess 27 and the circlip groove 15 and have a part-circular cross-sectional profile.

Figures 7, 8 and 9 illustrate an installation tool 201 according to a second aspect of the present invention. The installation tool 201 has the general form of a circular disc 203, with an upper face 205 and a lower face 207 that are parallel to each other and with a knurled surface 208 provided on the side face. A generally circular disc shaped cutting boss 209 projects outwardly from the upper face 205 and is arranged coaxially with the disc 203. The cutting boss 209 has an upper face 211 that is parallel to upper face 205 and a circumferential perimeter surface 213 provided with sloping cutting teeth 215. A female threaded circular cross-section central bore 217 passes through the disc 203 and the cutting boss 209 and is co-axial with their longitudinal axes. Two straight-sided circular cross-section arbor pin bores 219 also pass through the disc 203 and the cutting boss 209 and are located on a diameter of the cutting

boss 209 and within its circumferential perimeter, with one arbor pin bore 219 on either side of the central bore 217. The central bore 217 and the arbor pin bores 219 have a size and an arrangement that matches with that of a standard hole saw arbor (not shown), so that the installation tool 201 can be utilised in combination with a standard hole saw arbor. Four drive peg bores 221 also pass through the disc 203 and the cutting boss 209 and are located within the circumferential perimeter of cutting boss 209 and regularly spaced at 90 degree intervals around its longitudinal axis. The pitch circle diameter PCD2 of the drive peg bores 221 is the same as that of the driving slots 43 of the flush-mount 1, i.e. PCD1 (for example, PCD1 is 35.6mm).

The lower face 207, as shown in Figure 8, is provided with a generally circular disc shaped driving boss 223 that projects outwardly from the lower face 207 and is arranged coaxially with the disc 203. The driving boss 209 has an upper face 225 that is parallel to lower face 207. A drive peg 227 is located in each of the four drive peg bores 221 and the four drive pegs 227 extend perpendicularly outwardly from the upper face 225, so that their PCD is also PCD2.

The cutting teeth 215 have a triangular cross-sectional profile, as shown, for example, in Figure 9. The angle of the slope is α, for example 22 degrees, i.e. the same angle as the slope of the flange 7 of the flush-mount 1. The large diameter D8 of the cutting teeth 215 is slightly smaller than the diameter D3 of the flange 7, so that when the flush-mount 1 is fitted to a surface the counterbore cutting face 39 undertakes a final shaping of the opening that ensures a close fit of the flush-mount 1 into the surface. The small diameter D9 of the cutting teeth 215, which is the same as the external diameter of the cutting boss 209, is the same as the diameter D1 of the proximal end of the body 3 of the flush-mount 1. The cutting teeth 215 are equally spaced around the entire external perimeter of the cutting boss 209 and extend part way up the height of the cutting boss 209.

Figure 10 shows an electrical downlight 301 for use with the flush-mount 1. The downlight 301 has a straight-sided aluminium alloy lamp casing 303 of constant cross-section and having integrally formed cooling fins 305 at its distal end 307. An attachment collar 309 is located around the proximal end 311 of the downlight 301 and is connected to the lamp casing 303 by a hinge 313. The downlight 301 and the attachment collar 309 each have a longitudinal axis Y-Y. The attachment collar 309 has a front face 315 with a louvre abutment surface 317 and a face plate abutment surface 319, as shown in Figure 12. The face plate abutment surface 319 is located at the proximal end 311 of the downlight 301 and the louvre abutment surface 317 is set back in a distal direction from the proximal end 311 of the downlight 301 so that a step 321 is formed between them. The step 321 splits the front face 319 into two halves, one

half for the louvre abutment surface 317 and the other half for the face plate abutment surface 319. Two louvre magnets 323 are located in recesses in the louvre abutment surface 317 and three face plate magnets 325 are located in recesses in the face plate abutment surface 319.

The attachment collar 309 has a larger proximal section 327 with an external diameter D6 and a smaller distal section 329 with an external diameter D7. The proximal section 327 and the distal section 329 are co-axial with the longitudinal axis Y-Y and an annular circlip abutment surface 331 is created on the proximal section 327. Downlight retention magnets 333 are located in recesses located in and spaced around the circlip abutment surface 331.The diameter D6 is slightly smaller than the diameter D4 of the socket 11 and the diameter D7 is slightly smaller than the diameter D5 of the circlip 13, so that the downlight 301 can fit within the flush-mount 1, as shown in Figures 11, 12 and 13.

Figure 14 is a perspective exploded view of the downlight 301. The lamp casing 303 comprises a hollow barrel 335, in the form of a thick-walled tube, and a solid heat sink 337 from which the cooling fins 305 are cut. An LED lamp 339 is located within the distal end of the barrel 335. A flange 341 on the lamp 339 abuts a shoulder 343 inside the barrel and is fixed relative to the barrel 335 by an internal circlip 345 located within a circlip groove 347, as shown in Figure 15. A beam focussing lens 349 is also placed within the barrel 335, between the lamp 339 and its proximal end. The lens 349 is fixed to a zoom collar 351, which is located within the barrel 335 and in turns sits within a zoom dial 353 which is also partially located within the barrel 335. The zoom dial 353 is tubular with a gripping surface 355 at its proximal end, that is located outside of the barrel 335, and a spiral track 357 cut through the wall 359 of the zoom dial 353. The zoom collar 351 has two cylindrical studs 359 screwed into and extending from its external surface, perpendicularly from its longitudinal axis, and located so that they are diametrically opposed. The diameter of the studs 359 is slightly less than the width of the track 357, so that the studs 359 can slide in the track 357. The zoom collar 351 can slide within the zoom dial 353. An electronic circuit board 361 is located within the barrel 335, distally of the lamp 339 and is held in place when the heat sink 337 is secured to the barrel 335.

Figure 15 is a cross-section through the downlight 301 and the flush-mount 1, when the downlight 301 is installed within the flush-mount 1.

In a typical use of the flush-mount 1, it is installed within a hole drilled in a plasterboard surface, for example a ceiling. The hole is drilled in the plasterboard surface in a first installation step, using an electric drill to which is fitted a conventional hole saw, i.e. a hole saw arbor provided

with a circular hole saw blade (not shown). The hole saw blade has a diameter that produces a hole slightly larger than diameter D1 of the wall 5.

The second installation step is to shape the lip of the hole. This is achieved by detaching the hole saw blade from the hole saw arbor and attaching the installation tool 201 to the hole saw arbor. The threaded central bore 217 is threaded onto the male threaded part of the hole saw arbor and each of the two pins on the arbor are engaged with one of the two arbor pin bores 219. The installation tool 201 is attached to the hole saw arbor such that the lower face 207 of the installation tool 201 is facing towards the hole saw arbor and the upper face 205 is facing away from the hole saw arbor. The installation tool 201 is then placed adjacent to the hole and is rotated using the electric drill such that the counterbore on the installation tool 201, which is formed from the cutting teeth 215, contacts the lip of the hole. The counterbore creates a chamfer around the lip of the hole which has a profile that matches the profile of the flange 7 of the flush-mount 1.

The third installation step is to screw the flush-mount 1 into the hole using the installation tool 201. The installation tool 201 is removed from the hole saw arbor and turned over so that the upper face 205 is facing towards the hole saw arbor and the lower face 207 is facing away from the hole saw arbor. The installation tool 201 has four drive pegs 227 and each one of those drive pegs 227 fits within a driving slot 43 of the flush-mount 1, so that the flush-mount 1 is engaged with the installation tool 201 and rotates with it. The blanking plug magnets 32 contact the installation tool 201 (which is made from a ferromagnetic material) and thus the installation tool 201 is held to the flush-mount 1. The flush-mount 1 is offered up to the hole in the plasterboard and the distal end face 21 is pushed into the hole until the male thread 17 engages the wall of the hole. The drill is then used to rotate the flush-mount 1 in a clockwise direction so that the male thread 17 and the thread cutting faces 37 provided on it cut a female thread into the plasterboard. The flush-mount 1 is then drawn into the plasterboard until the distal face 24 of the flange 7 contacts the chamfer around the edge of the hole. The counterbore cutting face 39 further shapes that chamfer so that the flange 7 fits within the chamfer such that its proximal face 23 is flush with the surface of the plasterboard. The flush-mount 1 can also be tightened into the hole by the user grasping the knurled surface 208 on the external surface of the installation tool 201 and rotating the installation tool 201.

Once the flush-mount 1 is satisfactorily installed in the hole, the installation tool 201 is pulled out of the flush-mount 1 and a locking grub screw (not shown) is screwed through threaded grub screw hole 41 to fix the flush-mount 1 into the plasterboard, by constraining it against rotation. The flush-mount 1 is ready to receive a downlight 301 in the socket 11.

If it is desired to leave the socket 11 temporarily empty then a blanking plug 51 (not shown) can be located within the socket 11, the surface of the blanking plug 51 being arranged so that it is flush with the proximal face 23. The blanking plug 51 is made from a ferromagnetic material and is held in place by the blanking plug magnets 32.

The flush-mount 1 can be removed from the ceiling, by unscrewing the locking grub screw from threaded grub screw hole 41 and then by re-engaging the installation tool 201 with the flush-mount 1 and driving the drill in an anti-clockwise direction so that the male thread 17 drives the flush-mount 1 out of the plasterboard (or by the user grasping the knurled surface 208 and rotating the installation tool 201 in an anti-clockwise direction).

It is typical that a final finish is applied to the mounting surface, e.g. the ceiling, in order to provide a high quality installation. The final finish might be a covering of filler, of paint or a covering of wallpaper. The proximal face 23 of the flange 7 is able to accept such a filled, painted or wallpapered finish in a manner that the finish remains adhered to the flange 7 for the life of the installation.

When the flush-mount 1 has been fitted into the plasterboard, the downlight 301 can be located within it. A wired electrical connection (not shown) is made between the downlight 301 and a power supply circuit (not shown). The downlight 301 is then inserted into the flush-mount 1 and the lamp casing 303 moves through the socket 11, past the circlip 13. The downlight 301 stops moving when the circlip abutment surface 331 abuts the circlip 13. The downlight 301 is held in place by the magnetic attraction force between the downlight retention magnets 333 and the spring steel circlip 13.

After location into the flush-mount 1 the downlight 301 can be adjusted to provide the desired lighting arrangement. The downlight 301 is rotatable within the flush-mount 1 through 360 degrees and it is tiltable relative to its Y-Y axis by, for example 30 degrees. Once the downlight 301 is pointing in the correct direction the spread of its light beam can be increased or decreased by rotating the zoom collar 351. Rotation of the zoom collar 351 causes the beam focussing lens 349 to move backwards or forwards, along the Y-Y axis, to create the desired beam width. Once the beam width has been set then the louvre 47 can be fitted to the downlight 301, using louvre magnets 323, if it is desired to crop the light beam (for example to prevent the light beam from extending past the bottom of a picture). Finally, the face plate 49 can be attached to the downlight 301, using face plate magnets 325. The face plate 49 is flush with the proximal face 23 of the flange 7 and is therefore flush with the surface into which the

flush-mount 1 is fitted. This creates a visible aperture in the surface that has a relatively low diameter and which therefore has a small visual impact.

A louvre 47 and a faceplate 49 are then attached to the downlight 30, in that order, and using louvre magnets 323 and face plate magnets 325 respectively.

Figure 16 shows the flush-mount 1 being used to support an adjustable spotlight 401. An adaptor 403 has a circular face plate 405 that fits within the face plate recess 27 of the flush-mount 1 and sits flush with the proximal face 23 of the flange 7. The adjustable spotlight 401 is attached to the face plate 405. A body 407 extends from the face plate 405 in a distal direction and comprises two cylinders that are coaxially arranged relative to each other and to the face plate 405, the distal cylinder 409 being smaller in diameter than the proximal cylinder 412 and therefore creating therebetween an annular circlip abutment surface 413. The circlip abutment surface 413 is provided with spotlight retention magnets 415 (not shown) which, in use, hold the spotlight 401 into the flush-mount 1.

25 05 23

Figure 17 shows a flush-mount 401 according to a further aspect of the present invention. The flush-mount 401 has all the features and dimensions of the flush-mount 1, as described previously and as illustrated in, for example, Figure 1, and has in addition cutting teeth 453 provided on the distal end of the wall 419. Those common features are shown in Figure 17, prefixed with the number four. The teeth 453 are triangular in shape and are slanted forwards in a clockwise direction when the flush-mount 401 is viewed from above. The external side of the root 455 of each tooth 453 is aligned with the external edge of the body 403 and the internal side of the root 455 of each tooth 453 is aligned with the internal edge of the body 403. Any disc cut out of a surface by the teeth 453 has a diameter that is no greater than the diameter of the socket 411 of the flush-mount 401 (i.e. diameter D4, as shown in Figure 4). The external sides of the tip 457 of each tooth 453 are positioned so that they cut out a hole with a diameter that is at least as large as diameter D2 of the flush-mount 401.

The flush-mount 401 is installed into a surface, such as a plasterboard ceiling, using the same installation tool 201 and hole saw arbor as employed to fit flush-mount 1. The installation tool 201 is fitted to the hole saw arbor with its upper face 205 facing towards the hole saw arbor and its lower face 207 facing away from the hole saw arbor, in the same manner as previously described. The flush-mount 401 is fitted on to the installation tool 201 by placing the drive pegs 227 into the driving slots 443 and the flush mount 401 is held to the installation tool 201 by the blanking plug magnets 32 (as described above in relation to the flush-mount 1). The flush-mount 401 is then placed against the surface into which it is to be fitted and, by rotating the

installation tool 201 clockwise using, for example, an electric drill, the cutting teeth 453 on the flush-mount 401 will cut a hole in the surface. The hole in the surface will have a diameter that is equal to, or slightly larger than, the diameter D2 of the wall 405.

In a first variant of the installation method, the hole saw arbor and the installation tool 201 are withdrawn from the surface as soon as the hole has been cut through the plasterboard. The flush-mount 401 is then removed from the installation tool 201 and the installation tool 201 is turned around and refitted to the hole saw arbor, so that its lower face 207 faces towards the hole saw arbor and its upper face 205 faces away from the hole saw arbor. The installation tool 201 is then used to produce a chamfer around the lip of the hole, as previously described in relation to installation of flush-mount 1. The installation tool 201 is then turned around, back to its original position and the flush-mount 401 is fully installed into the hole in the same manner as described above in relation to the installation of flush-mount 1.

In a second variant of the installation method, rotation of the hole saw arbor and the installation tool 201 is continued after the hole has been cut in the surface in order to install the flush-mount 401 into its final fitted position. The countersink cutting face 439 cuts the chamfer around the lip of the hole into which chamfer the flange 407 will seat, to make the flush-mount 401 sit flush with the surface. Upon the flush-mount 401 being seated flush with the surface the installation tool 201 can be removed from the flush-mount 1 and the grub screw (not shown) can be installed in the manner as described above in relation to installation of flush-mount 1. In both of these variants, once the installation tool 201 has been removed the flush-mount 401 is ready for receipt of a device, for example a downlight.

CLAIMS

1. A system for installing a flush-mount (1) for receiving a device, the system comprising a flush-mount (1) and an installation tool (201) for installing the flush-mount (1), the flush-mount (1) having a body (3), a device receiving socket (11) located within the body (3), the body (3) further comprising installation tool apertures (43), a device retention element (13), a non-displaceable gripper (17) extending outwardly from an external surface of the body (3) and a flange (7) extending around an opening of the device receiving socket (11), wherein the non-displaceable gripper (17) comprises at least one protrusion (17), wherein the at least one protrusion (17) extends around substantially the whole of the external perimeter of the body (3), the body (3) has a circular cross-section and the at least one protrusion (17) is a male helical screw thread (17), the flange (7) is a circular annular flange (7) extending around the body (3) and a proximal face (23) of the flange (7) extends perpendicularly to the rotational axis (X-X) of the male helical screw thread (17), and wherein a distally oriented face (24) of the flange (7) extends at an angle to the proximal face (23), and wherein the root of the flange (7) is adjacent to the body (3) and has a depth that is greater than the depth of the flange (7) at its outer periphery and wherein the distally oriented face (24) extends from the external perimeter of the body (3), wherein the distally oriented face (24) of the flange (7) is provided with a cutter (39), the installation tool (201) comprising a plate (203) that is provided with a lower face (207) and an upper face (205), wherein the upper face (205) is provided with an annular cutter (209) with a cutting surface (215) that has a profile that is complementary to the profile of the flange (7) of the flush-mount (1) and wherein the lower face (207) is provided with at least two drive pegs (227) that each extend outwardly from the lower face (207) and which have a spacing that is complementary to the spacing of the installation tool apertures (43) of the flush-mount (1) such that, in use, each of the at least two drive pegs fits (227) fits within a different one of the installation tool apertures (43).

2. A system for installing a flush-mount (1) as claimed in claim 1, wherein the male helical screw thread (17) has a constant pitch and a varying amplitude such that the height of its tip above the external surface of the body (3) is greatest nearest to the flange (7) and smallest nearest to the distal end face of the body (3).

3. A system for installing a flush-mount (1) as claimed in claim 1 or claim 2, wherein the cross-sectional profile of the flange (7) tapers to a point at its outer periphery.

4. A system for installing a flush-mount (1) as claimed in any one of the preceding claims, wherein both ends of the device receiving socket (11) are open.

5. A system for installing a flush-mount (1) as claimed in any one of the preceding claims, wherein the device retention element (13) is located at least partially within the device receiving socket (11) and provides a device abutment surface.

6. A system for installing a flush-mount (1) as claimed in any one of the preceding claims, wherein the device retention element (13) is made from a magnetic or a ferromagnetic material.

7. A system for installing a flush-mount (1) as claimed in any one of the preceding claims, wherein the at least one protrusion (17) comprises a cutting surface (37).

8. A system for installing a flush-mount (1) as claimed in any one of the preceding claims, wherein the male helical screw thread (17) is provided in at least two discrete parts and a cutting surface (37) is provided at one end of at least one of the at least two discrete parts.

9. A system for installing a flush-mount (1) as claimed in any one of the preceding claims, wherein the body (3) is provided with a relief aperture (33) that passes between the external surface of the body (3) and the device receiving socket (11).

10. A system for installing a flush-mount (1) as claimed in any one of the preceding claims, wherein the body (3) is in the form of a frustoconical annulus that is widest at its end that is adjacent to the flange (7), such that the external surface of the body (3) is angled relative to the longitudinal axis (Y-Y) of the flush-mount (1).

11. A system for installing a flush-mount (1) as claimed in any one of the preceding claims, wherein the body (3) is provided with a fixing pin aperture (41) that passes between the external surface of the body (3) and the device receiving socket (11).

12. A system for installing a flush-mount (1) as claimed in any one of the preceding claims, comprising a face plate recess (27) located adjacent to the flange (7) and around the device receiving socket (11).

13. A system for installing a flush-mount (401) as claimed in any one of the preceding claims wherein the flush-mount (401) further comprises a cutter provided on the distal end of the body (403).

14. A system for installing a flush-mount (401) as claimed in claim 13, wherein the cutter has a plurality of saw teeth (453) arranged in a circle around the distal end of the body (403) and wherein the diameter of the cutter at the tip of the teeth (453) is the same as, or greater than, the external diameter (D2) of the distal end of the body (403) and the diameter of the cutter at the root of the teeth (453) is the same as a diameter (D4) of the device receiving socket (411).

15. A system for installing a flush-mount (1) as claimed in any one of the preceding claims, wherein the plate (203) of the installation tool (201) is provided with a central bore (217) and two pin bores (219), wherein the pin bores (219) are located diametrically opposite each other and on either side of the central bore (217) and wherein the central bore (217) and the pin bores (219) holes are arranged to accommodate a standard hole saw arbor.

16. A system for installing a flush-mount (1) as claimed in any one of the preceding claims, wherein the cutting surface (215) of the installation tool (201) slopes relative to the longitudinal axis of the plate (203) from a first diameter (D8) that is adjacent to the upper face (205) of the plate (203) to a second diameter (D9) that is spaced away from the upper face (205), wherein the first diameter (D8) is complementary to the external diameter of the flange (7) of the flush-mount (1,401) and wherein the angle of the sloping cutting surface (215) is complementary to the angle of the distally oriented face (24) of the flange (7).

17. A system for installing a flush-mount (1) as claimed in any one of the preceding claims, wherein the plate (203) of the installation tool (201) is a circular disc, the plate (203) is provided on its upper face (205) with a cylindrical cutting boss (209) that is coaxially aligned with the plate (203), wherein the cutting surface (215) of the annular cutter (209) is provided around the external surface of the cutting boss (209), wherein the central bore (217) is coaxial with the plate (203) and wherein the drive pegs (217) are located such that the mid-point of their separation is also coaxial with the plate (203).

18. A system for installing a flush-mount (1) as claimed in any one of the preceding claims, wherein the sides of the plate (203) of the installation tool (201) have a knurled surface.