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(71) Applicant: NGI A/S [DK/DK]; Virkelyst 5-7, DK-9400 Nørresundby (DK).

(72) Inventor: OLSEN, Tomas Hecht; Virkelyst 5-7, DK-9400 Nørresundby (DK).

(74) Agent: PATENT NORD APS; Julius Posselts Vej 12,3th, 9400 Nørresundby (DK).

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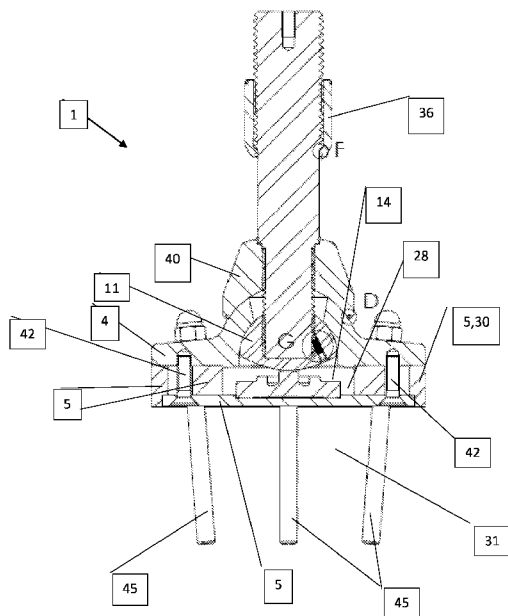


FIG. 13

(57) Abstract: Levelling device (1), which includes a top part (3) for fastening in a machine and a lower part (2) for contact against a base (31). The lower part (2) includes a housing (4) and a sealing item (5), which is placed in the lower part (2). The lower part (2) includes a weighing cell (6) with an activation surface (7) and an opposite placed surface (8). The weighing cell (6) is placed in the housing (4) and in the sealing item (5) in the lower part (2). A power transmission device (11) includes a lower end surface (12) and an opposite placed upper surface (13). The lower end surface (12) is placed in an area between a spindle's (9) lower surface facing towards the lower part (9) and the activation surface (7). The end surface (12) forms contact with the weighing cell's (6) activation surface (7) or the weighing cell's (6) lower surface (8). Hereby, registration of the weight can be established.



Levelling device with weighing cell and use thereof

5 The invention relates to a levelling device, which includes a top part for fastening in a device such as a machine, and a lower part for contact against a base such as a floor, and where the lower part includes a housing and a weighing cell with an activation surface and an opposite placed surface and that there is found a power transmission device with a lower end surface and an opposite placed upper surface.

10 From US patent number 5881533 is known a machine foot including a weighing cell. The machine foot in the mentioned document is however unfit to be used in areas where high hygiene requirements exist for instance as a result of the complicated construction with many visible and exposed components, and it is not suited to be used in an earthquake area. The
15 machine foot is however also specially designed to become mounted on packing machines for cigarettes.

It is thus the object of the present invention to provide a levelling device, which does not have the stated drawbacks or which at least provides a
20 useful alternative to the known technique.

This is achieved with a levelling device of the in the introduction stated and where there is also placed a sealing item in the lower part and that the weighing cell is placed in the lower part and is at least partially enclosed by
25 the sealing item, and that the top part includes a spindle and that the lower end surface is placed in an area between the spindle's lower surface facing towards the lower part and the activation surface, which lower end surface is designed to form contact with the weighing cell's activation surface or the weighing cell's lower surface, by which the activation surface is designed
30 for being able to become activated.

When the, on the levelling device mounted machine, is applied a weight, the pressure will become transferred to the levelling device and the spindle will become pressed downwards. This pressure is transferred via the power transmission device to the weighing cell. The force will either affect the
5 activation surface directly, which occurs when this surface faces towards the device or indirectly when it is the weighing cell's opposite surface, which has contact against the power transmission device. In this case, the weighing cell's activation surface will face towards the base and have contact against this and by force influence, the activation surface will thus
10 press against the base and cause a result on a, for the weighing cell belonging, registration unit.

The invention can also be used for a pressure equalisation of differently loaded levelling devices, since each individual levelling device in a complex has mounted a weighing cell as stated. The force from each levelling device
15 is registered and compared in a registration unit, and if there are unacceptable differences, a pressure equalisation will occur such that each levelling device carries the same weight.

The weighing cell can be a weighing cell, which is connected to a registration unit via wire, or it can be a wireless unit.
20 By activation surface is understood the surface on a weighing cell, which by a force impact of the surface gives rise to an electrical signal, which can later be converted to a power value. The activation surface is placed in the lower part. The weighing cell is enclosed in a sealing item, preferably manufactured in a polymeric material such as a rubber mass. The power
25 transmission device's lower end surface itself is also placed in or with contact against the lower part while the opposite placed surface is placed outside or in the lower part and either with contact against the spindle's lower surface or with a decided thread piece, which goes up in the spindle itself and is screwed into this by mesh with an inner thread in the spindle.
30 An additional possibility is that the upper surface is placed in a recess in the power transmission device, which recess encloses an end part of the

spindle.

Levelling device in this context includes an adjustable construction element, including an adjustable machine foot for supporting machines.

5 Levelling device can also include an adjustable leg, which supports a machine.

The adjustment of the device entails that the, on the device resting, machine can be set level or in a desired angle depending on the conditions.

10 In an additionally preferred embodiment according to claim 2, at least one of the surfaces, including the lower end surface of the power transmission device or the surface which the power transmission device forms contact against, are mostly plane or convex against the opposite surface.

15 It hereby contributes to getting a well defined pressure area for the pressure transfer, simultaneously with an inclining of the levelling device being made possible without it damaging the accuracy of the measured weight. Typically, the weighing cell's surface is with contact against the power transmission device's lower surface mostly plane or slightly convex in direction towards the power transmission device.

20

In an additionally preferred embodiment, according to claim 3, there is in the area between the sealing item and the contact between the power transmission device and the weighing cell a first cavity, which cavity encloses at least the contact area, which is between the weighing cell and

25 the power transmission device.

25

A free space is hereby achieved, which enables a movement between the weighing cell's surface and the pressure transmission device's contact to the weighing cell, without the grouting mass / the sealing item counteracting the movement and in this way could cause a false weight result. The cavity

30 is preferably ring shaped, since the weighing cell is most often manufactured cylindrically. The cavity can, however, take other shapes

30

such as quadratic et cetera.

In an additionally preferred embodiment, according to claim 4, the lower end surface of the power transmission device is convex or concave in direction towards the contact surface against the weighing cell.

By this geometry, it is ensured that the surface can tip towards the weighing cell's surface such that when the levelling device stands slanted, there still occurs a correct pressure transmission to the weighing cell.

In an additionally preferred embodiment, according to claim 5, the power transmission device's upper surface is in connection with a part of the spindle.

By connection is understood that the upper surface is either in direct touch contact with the spindle or that the upper surface is at least embedded in the spindle, which is the case when the power transmission device includes a rod shaped thread piece, which is screwed up in a, with thread provided, cavity in the spindle.

There is achieved a close connection between the two separate units, whereby the force is transferred directly.

In an additionally preferred embodiment, the power transmission device includes a bolt head, which bolt head includes a protruding part opposite placed the lower end surface, which protruding part is in connection with the spindle and that the bolt head is placed in the lower part.

A connection is hereby achieved between upper part and lower part and an unambiguous power transmission can occur to the weighing cell.

In an additionally preferred embodiment, the power transmission device is a bolt head with a protruding part, such as a tap, or the power transmission device is a bolt including a bolt head and a, from the bolt head protruding part with an outer thread, which goes in mesh with an inner thread in the

spindle.

In the case where the power transmission device only includes a bolt head with a smaller protruding part, this protruding part will have a surface, which is mostly congruent with the spindle's end surface, since this tap is not enclosed by the spindle, such which it is the case when the protruding part includes a thread. The tap takes part in ensuring a good contact between the lower part and the top part without the two parts being fixed connected to each other. At the same time, there is also achieved a good power transmission to the weighing cell. In the case where the protruding part includes a thread, is achieved a fixed connection between top part and lower part.

In an additionally preferred embodiment, according to claim 6, the power transmission device includes a recess such as a thread hole, which recess' / thread hole's bottom surface includes the power transmission device's upper surface.

Good stability is hereby achieved by sideways displacement and a good connection between the power transmission device and the spindle.

In an additionally preferred embodiment, according to claim 7, the recess includes a thread on the radial and vertical limiting sides, which thread is in mesh with an outer thread on the spindle's lower part.

The connection is hereby optimised between the two parts.

In an additionally preferred embodiment, according to claim 8, there is between the recess' vertical sides and the spindle's lower part placed a tailstock screw.

Hereby, the connection between the two parts is fixed and an unintended loosening of the connection, for example during transport, is prevented.

In an additionally preferred embodiment, according to claim 9, the levelling

device includes a nut, which nut encloses an outer thread on the lower part of the spindle and that the nut's lower surface has contact against a part of the housing's outer limiting surface.

5 The two abutting surfaces are congruent and the nut's lower surface is concave in direction towards the base, while the housing has a convex part, which is enclosed by the convex part. This nut construction takes part in ensuring the stability of the construction in sideways direction, which is significant, partly during transport and also in areas where there are risk of earthquake.

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In an additionally preferred embodiment, according to claim 10, there is between the locking nut and the housing's surface placed a sealing item such as an O-ring and / or there is between the housing and the spindle placed a sealing item such as an O-ring, which last-mentioned O-ring
15 encloses a part of the power transmission device's outer circumference placed outside the housing.

There is achieved a sealed connection between top part and lower part, which is important in areas with a high hygiene standard.

20

In an additionally preferred embodiment, according to claim 11, there is between the sealing item and the housing's inner surface at least another cavity and in its periphery, the sealing item includes a ring going lip / sealing ring for sealing against the base.

The other cavity is placed in the area lateral of the weighing cell's periphery
25 in the bottom of the lower part. By ensuring that there is not grouting mass in this area, it is achieved that the force registration is not hindered. If there had been a polymeric material with high resistance against pressure, such as the grouting mass, which additionally encloses the weighing cell, it would cause that the weighing cell did not become affected, corresponding to the
30 pressure, which is on the levelling device and the weighing result would thereby become erroneous. Alternatively, the other cavity can be filled with

a soft polymer, which does not exercise resistance against a pressure. The ring going lip / sealing ring ensures that there can not diffuse filth into the construction and that the amount of bacteria is reduced.

5 In an additionally preferred embodiment, according to claim 12, the weighing cell's radially facing surfaces are shape complementary with internal surfaces of the sealing item, and that at least a part of the weighing cell's outer radially facing surfaces are in direct contact with the sealing item. It is hereby ensured that the weighing cell sits fixed in the lower part
10 by friction between its walls and the sealing item.

In an additionally preferred embodiment, according to claim 13, the sealing item includes several parts, including a bottom part, which bottom part fully or partially consists the lower part's lower surface for contact against the
15 base and which bottom part covers the weighing cell's lower surface. Hereby, the weighing cell becomes hermetically wrapped in a closed part consisting of the housing and by the sealing item. The bottom part is a disc shaped circular part.

20 In an additionally preferred embodiment, according to claim 14, the bottom part is fixed to the housing by fastening devices such as bolts.

In an additionally preferred embodiment, according to claim 15, the levelling device is fixed to the base by bolts, which bolts drill through the housing
25 and other parts of the lower part and is designed to be screwed fixed in the base.

Hereby, it is ensured that the machine mounted to the levelling device does not move from its position on the base.

30 In an additionally preferred embodiment, the weighing cell is designed with a protruding central part placed on the activation surface, which central part

has contact against a central area of the lower surface on the power transmission device or the base.

5 By an additional aspect of the invention, the levelling device includes that all sealing rings in the levelling device consist of FDA approved NBR rubber material.

10 By an additional aspect of the invention, the levelling device includes that the sealing item is a polymeric material such as a rubber fastened to the housing by vulcanization.

It is hereby achieved that the attachment of the polymeric material to the housing is optimum and the attachment reduces the entry of filth and bacteria in the levelling device via the bottom of it.

15 By an additional aspect of the invention, the levelling device includes that all metal items have direct metallic contact under pressure.

It is hereby achieved that there is the same electrical potential in all metal items, which removes the risk of sparks.

20 By an additional aspect of the invention, the levelling device includes that there between the housing and the spindle is placed an anti-friction disc.

It is hereby achieved that the spindle can be moved in relation to the housing without risk of the metal, in contact between the two items, being ripped.

25

The invention also relates to the use of the above mentioned levelling device in locations with high requirements for hygiene such as locations for processing of foodstuffs or manufacturing of medicine.

30 Furthermore, the invention also relates to the use of the levelling device for support of a machine placed in areas with risk of earthquake.

The invention will now be explained more fully with reference to the drawing, where

5 Fig. 1 A shows a sectional view of a first embodiment of a levelling device, according to the invention, including a top part and a lower part.

Fig 1 B shows a sectional view of the in figure 1 shown levelling device, resting on an inclined base.

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Fig. 2 A shows a sectional view of another embodiment of a levelling device, according to the invention, including a top part and a lower part.

15 Fig. 3 A shows a sectional view of a third embodiment of a levelling device, according to the invention, including a top part and a lower part.

Fig. 3 B shows a sectional view of the in figure 1 shown levelling device resting on an inclined base.

20 Fig. 4 shows three identical weighing cells in different perspective for use in a levelling device according to the invention.

Fig. 5 A shows a first embodiment of a power transmission device for use in a levelling device according to the invention.

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Fig. 5 B shows the in fig. 5A shown power transmission device seen in its full length.

30 Fig. 6 shows another embodiment of a power transmission device for use in a levelling device according to the invention.

Fig. 7 shows a levelling device, seen from the bottom, and before a weighing cell is placed in the foot.

5 Fig. 8 shows the in figure 7 shown levelling device, seen from the bottom, and where the weighing cell is placed.

Fig. 9 shows a completely assembled levelling device, according to the invention, seen in perspective.

10 Fig. 10 shows a fourth embodiment of a levelling device according to the invention

Fig. 11 shows the in fig. 10 shown embodiment example of a levelling device seen in sectional view.

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Fig. 12 shows a fifth embodiment example of a levelling device according to the invention.

20 Fig. 13 shows the in fig. 12 shown embodiment example of a levelling device seen in sectional view.

Fig. 14 shows a magnified section of a sealing area and marked with F in fig. 11 and fig. 13

25 Fig. 15 shows a magnified section of a sealing area and marked with D in fig. 11 and fig. 13

30 Fig. 16 shows a magnified section of an area marked with G between lower part of the spindle and power transmission device including a tailstock screw for locking of spindle to the power transmission device

With reference to the figures 1A, B; 2 and 3A, B the levelling device 1 will, according to the invention and in the subsequent be mentioned as a machine foot 1, become gone through, since the principle difference between the three embodiment examples is the design of a power transmission device 11 and of this derived construction changes for the machine foot 1.

The figures show the machine foot 1 including a top part 3 for fastening in a device such as a machine and a lower part 2 for contact against a base 31 such as a floor and where the lower part 2 includes a housing 4, and a preferably ring shaped sealing item 5, which is enclosed in the housing 4. The sealing item 5 partially encloses a weighing cell 6. The top part 3 includes a spindle 9. Between top part 3 and lower part 2, the power transmission device 11 is enclosed. This is in figure 1 shaped as a bolt 23 including a bolt head 22, which is the actual part of the power transfer against the weighing cell 6, since the bolt head's lower surface's 12 top point 25 and central part are what have contact against a surface on the weighing cell 6. This surface is in this case the weighing cell's upper surface: an activation surface 7, which means the surface, which is pressed down by a force impact of the weighing cell 6. The surface which the bolt head's 12 lower surface 12 has contact against could also be the weighing cell's 6 opposite placed surface and here lower surface 8 meaning that the weighing cell 6 should be turned 180 degrees. The pressure registration will then occur by the activation surface 7 pressing against the base 31 by a force impact of the machine foot 1 and hereby give rise to a measuring of a weight, which loads the, on the foot mounted, machine.

In figure 1 A, B the power transmission device 11 is as mentioned designed as a bolt 23 including the bolt head 12 and a protruding tap 38 consisting of a thread part 24 with an outer thread 18, which is screwed up in the lower part of the spindle 15 including a cavity 16 with an inner thread 19 such that the power transmission device's 11 upper surface 13 is placed in the spindle's 9 inner thread 19. Figure 5 A,B shows the power transmission

device 11 used in the in figure 1 A,B shown machine foot 1 and reference numbers present the same technical details as stated above.

5 In figure 2, the power transmission device 11 is designed solely as a bolt head 22 with a protruding tap 38 and has an upper surface 13, which is placed mostly shape complementary against the spindle's lower surface in the lower part 15. Figure 6 shows the power transmission device 11 used in the in figure 2 shown machine foot 1, where the bolt head's 22 contact surface 12 against the activation surface 7 is convexly shaped and the
10 contact against the weighing cell's 6 activation surface 7 is therefore mostly point formed, and as it is seen in figure 2, the two surfaces will easily be able to be moved in relation to each other by a tipping movement of the machine foot 1. This is relevant when the base 31 is inclined and / or it is exposed to vibrations. The power transmission device 11 is typically
15 manufactured in a stainless steel material.

In figure 3, the power transmission device is designed with a bolt head 22 and a tap 38, where the bolt head 22 is concave shaped against the weighing cell's 6 activation surface 7, which is slightly convex. The two
20 surfaces are mostly shape complementary. Also here, the two surfaces will be able to take different positions, moved, in relation to each other, which is demonstrated by figure 3 B, where the machine foot 1 is inclined due to a slanted base 31. This results in that the two contacting surfaces are tipped in relation to each other, and the encircling first cavity 14 ensures that the
25 movement is not prevented by the sealing item 5.

The power transmission device 11 is thus placed between the spindle's 9 lower surface facing against the lower part 2 and the activation surface 7. The power transmission device 11 includes the protruding part / tap 38 opposite the lower end surface 12, which protruding part 38 is in connection
30 with the spindle 9, while the bolt head 22 itself is placed in the lower part 2. In all the embodiment examples, the bolt head 22 is placed in the lower part

2.

The weighing cell 6, which is used, can for example be from the brand "Sartorius". The weighing cell 6 is as mentioned partially enclosed by the sealing item 5, which is a suited rubber mass, such that parts of the weighing cell's 6 periphery are shape complementary enclosed by the sealing item 5. Between sealing item 5 and weighing cell 6, there are at least two cavities, namely a first cavity 14 and another cavity 28, both preferably ring shaped. The cavities can take on other geometries depending on the weighing cell's outer surfaces. The cavity can thus be a quadratic or rectangular cavity. These cavities 14, 28 exist such that the weighing cell's 6 movements are not obstructed by the rubber mass such that a correct registration of weight can occur simultaneously with that the rubber mass ensures a sealed barrier out towards the surrounding space.

The first cavity 14 is placed in the area between the sealing mass 5 and the contact surface between the bolt head 22 and the weighing cell's 6 activation surface 7, while the other cavity 28 is at least placed in basis of the housing 4 such that at least a part of basis of the weighing cell 6 forms the contact with the base 31 without the rubber material preventing the force registration. The sealing item 5 however includes, in its periphery 29, a ring shaped sealing lip 30, which seals the housing 4 against the base 31. The lip 30 is however so flexible that it does not counteract the weighing cell's 6 movement and has thereby no influence on the weighing result.

In the shown constructions in figure 1A, B; 2; 3A, B there is a need for additional cavities 35, namely above a horizontally placed surface 34 vertically displaced in relation to the activation surface 7.

The weighing cell 6 is in the shown examples via a wire 37 connected to a registration unit, but could also function wirelessly. In the cases where the weighing cell 6 is connected to the registration unit via wire 37, this wire 37 will be wrapped up in an airtight hose. Hereby, it is protected against damage.

An O-ring 20 is placed between the spindle's 9 lower surface 15 and the housing 4 and enclosing the bolt head 22.

5 Fig. 4 shows three identical weighing cells 6 in different perspective for use in a machine foot 1 according to the invention. The weighing cell 6 is a cylindrical unit with a protruding part 26, where the activation surface 7 is placed. The weighing cell 6 can weigh up to 5 tons and registers weight changes down to 5 grams. The weighing cell 6 is therefore suited for being incorporated in machine feet 1 according to the invention. The machine foot
10 1 can thus with high success be used in process units where weighing of a product is significant either during the process itself or as registration of the final product's weight.

The weighing cell 6 is also suited for being used in machine feet 1 where the machine foot 1 is used for levelling a machine mounted on the machine
15 feet 1, since a weight difference between the carrying feet on the machine will become registered and a subsequent correction of the mutual position of the machine feet 1 can be established, until the weighing cells 6 on the measured machine feet show the same weight distribution.

20 Fig. 7 shows a machine foot 1 seen from the bottom and before a weighing cell 6 is placed in the foot 2 and shows a cavity in the sealing item 5, which is placed in the housing 4. The cavity is shaped such that there is room for the weighing cell 6, such that it can be placed in the cavity and fits by a press fitting, whereby the friction fixes the weighing cell 6 in the housing 4.
25 The previously mentioned first 14 and other 28 cavities are provided in the sealing item 5. But since these cavities are laid by and / or parallel to the weighing cell's 6 horizontal surfaces, it does not influence the friction between weighing cell 6 and sealing item 5, since the grouting mass' vertical walls are shape complementary with the weighing cell's 6 vertical
30 walls. The open bottom can be covered with a bottom part as described below.

Figure 8 shows a machine foot 1, seen in perspective from the bottom, and where the weighing cell 6 is placed in the sealing item 5 and a wire 37 emanates from the weighing cell 6.

5

Fig. 9 shows a completely assembled machine foot 1, according to the invention, seen in perspective and including a spindle 9 provided with a thread shielding 36 and the lower part 2 with a weighing cell 6 incorporated.

10

Fig. 10 shows a fourth embodiment example of a levelling device 1 according to the invention, and fig. 11 shows the in fig. 10 shown embodiment example of a levelling device 1 seen in sectional view. The shown embodiment example includes a nut 40, which encloses a lower and outer thread 43 on the spindle 9 and which is screwed towards the housing's 4 upper outer surface. The housing's 4 outer and upper surface is convex upwards and the nut's 40 surface facing towards the housing 4 is concave downwards such that the surfaces, which are pressed against each other, at the nut's 40 screwing in, are congruent. The nut's 40 lower surface 49 has thus contact against a part of the housing's 4 outer limiting surface. In the periphery, marked D, is laid a sealing ring 41, see figure 15, which ensures sealing against the surroundings. This is seen clearly in figure 15. The power transmission device 11 itself includes a thread hole 47 with a thread 48, in which the spindle's 9 lower part is screwed down since the spindle 9 includes the outer thread 43 on this lower part. The spindle 9 is screwed in until it bumps against the upper surface 13.

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In order to lock the two components against each other, there is screwed in a tailstock screw 46 in the area marked G and as shown in fig. 16. The tailstock screw is screwed in such that it with a part bumps against the outer thread 43 on the spindle 9 and against the inner thread 48 on the power transmission device 11.

The weighing cell 6 itself is enclosed in a sealing item 5, which includes several separate units. A sealing item, a bottom part 50, is placed in the bottom of the device 1 and is by bolts 42, which proceed from the bottom surface of the sealing item 50 up towards a sealing item 5 inside the housing 4 and up to the housing's 4 inner surface where it is screwed in, fixed to the lower part 2. This sealing plate 50 will together with the nut 40 ensure that the weighing cell is hermetically closed inside the levelling device 1 and thus that bacteria do not have a chance of contaminating the inside of the device. Furthermore, the nut 40 helps to stabilize against sideways forces. The bottom part 50 is a circle shaped disc manufactured in the same material as the rest of the sealing item 5.

It is additionally noted that there with F is marked an area, which is shown magnified in fig. 14, and which shows a sealing item 41 between the spindle 9 and the thread shielding 36 in the area, which faces towards the lower part 2.

Fig. 12 shows a fifth embodiment example of a levelling device 1 according to the invention, and fig. 13 shows the in fig. 12 shown embodiment example of a levelling device 1 seen in sectional view.

The difference between this embodiment example and the in fig. 10 and 11 shown is that the in fig. 12 and 13 shown includes bolts 45, which lock in place the levelling device 1 to the base. The bolts 45 perforate the housing 4 and other parts of the lower part 2 and are screwed into the base 31 in, for that purpose designed, holes.

The fourth and fifth embodiment example on a levelling device 1 also includes the previously mentioned cavities: first cavity 14 and other cavity 28.

All sealing rings in the machine foot appropriately consist of FDA approved NBR rubber material.

All metal items in the machine foot are appropriately in electrical contact since they are either screwed together or have direct metallic contact under pressure and thereby have the same potential whereby it is prevented that
5 there can occur potential differences and subsequent possibility of sparks.

Reference numbers

- 1 Levelling device
- 2 lower part
- 5 3 top part
- 4 housing
- 5 sealing item
- 6 weighing cell
- 7 activation surface
- 10 8 opposite placed surface
- 9 spindle
- 10
- 11 power transmission device
- 12 11's lower end surface
- 15 13 11's upper surface
- 14 a first cavity.
- 15 part of the spindle (including the lower surface and / or a cavity in the spindle)
- 16 cavity spindle
- 20 17
- 18 outer thread
- 19 inner thread placed in the spindle's lower part
- 20 sealing object such as an O-ring
- 21
- 25 22 bolt head
- 23 bolt
- 24 thread piece,
- 25 the bolt head's top point
- 26 protruding part placed on the weighing cell
- 30 Central area of the lower surface on the power transmission device
- 28 another cavity

- 29 the sealing item's periphery
- 30 ring going lip
- 31 the base
- 32 the weighing cell's external surfaces
- 5 33 internal surfaces of the sealing item
- 34 horizontal surface
- 35 additional cavity
- 36 thread shielding
- 37 wire
- 10 38 tap

- 40 locking nut
- 41 sealing ring
- 42 bolts for sealing item
- 15 43 spindle's lower and outer thread
- 44 locking nut inner thread
- 45 bolts for sealing item for base
- 46 tailstock screw
- 47 thread hole
- 20 48 47's inner thread
- 49 locking nut's lower surface
- 50 The sealing item's bottom surface

PATENT CLAIMS

- 5
1. Levelling device (1), which includes a top part (3) for fastening in a device such as a machine, and a lower part (2) for contact against a base (31) such as a floor, and where the lower part (2) includes a housing (4) and a weighing cell (6) with an activation surface (7) and an opposite placed surface (8) and that there is found a power transmission device (11) with a lower end surface (12) and an opposite placed upper surface (13), **characterized** in that there in the lower part (2) is placed a sealing item (5) and that the weighing cell is placed in the lower part (2) and at least partially enclosed by the sealing item (5), and that the top part (3) includes a spindle (9) and that the lower end surface (12) is placed in an area between the spindle's (9) lower surface facing towards the lower part (2) and the activation surface (7), which lower end surface (12) is designed to form contact with the weighing cell's (6) activation surface (7) or the weighing cell's (6) lower surface (8), by which the activation surface (7) is designed for being activated by a force impact of the weighing cell (6).
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2. Levelling device (1) according to claim 1 **characterized** in that at least one of the surfaces: the lower end surface (11) of the power transmission device or the surface (7,8), which the power transmission device (7) forms contact against, is mostly shaped plane or convex against the opposite surface.
3. Levelling device (1) according to claim 1 or 2 **characterized** in that there in the area between the sealing item (5) and the contact between the power transmission device (11) and the weighing cell

(6) is a first cavity (14.), which cavity (14) encloses at least the contact area, which is between the weighing cell (6) and the power transmission device (11).

- 5 4. Levelling device (1) according to any of the previous claims **characterized** in that the lower end surface (12) of the power transmission device (11) is convex or concave in direction towards the contact surface against the weighing cell (6).
- 10 5. Levelling device (1) according to any of the previous claims **characterized** in that the power transmission device's (11) upper surface (13) is in connection with a part of the spindle (15).
- 15 6. Levelling device (1) according to any of the previous claims **characterized** in that the power transmission device (11) includes a recess such as a thread hole (47), which recess' / thread hole's (47) bottom surface includes the power transmission device's upper surface (13).
- 20 7. Levelling device (1) according to claim 6 **characterized** in that the recess (47) includes a thread (48) on the radial and vertical limiting walls, which thread (48) is in mesh with an outer thread (43) on the spindle's (9) lower part.
- 25 8. Levelling device (1) according to claim 7 **characterized** in that there between the recess' (47) vertical walls (48) and the spindle's (9) lower part is placed a tailstock screw (46)
- 30 9. Levelling device (1) according to any of the previous claims **characterized** in that the levelling device includes a nut (40), which nut (40) encloses an outer thread (43) on the lower part of the spindle (9) and that the nut's (40) lower surface (49) has contact against a part of the housing's (4) outer limiting surface.

- 5 10. Levelling device (1) according to claim 9 **characterized** in that there between the nut (40) and the housing's (4) surface is placed a sealing item such as an O-ring (41) and / or that there between the housing (4) and the spindle (9) is placed a sealing items such as an O-ring (20), which O-ring (20) encloses a part of the power transmission device's (11) outer circumference placed outside the housing (4).
- 10 11. Levelling device (1) according to any of the previous claims **characterized** in that there between the sealing item (5) and the housing's (4) inner surface is at least another cavity (28) and that the sealing item (5) in its periphery includes a ring going lip / sealing ring (30) for sealing against the base (31).
- 15 12. Levelling device (1) according to any of the previous claims **characterized** in that the weighing cell's (6) radially facing surfaces are shape complementary with internal surfaces of the sealing item (5), and that at least a part of the weighing cell's (6) outer radially facing surfaces are in direct contact with the sealing item (5).
- 20 13. Levelling device (1) according to any of the previous claims **characterized** in that the sealing item (5) includes several parts, including a bottom part (50), which bottom part consists fully or partially the lower part's (2) lower surface for contact against the base (31) and that the bottom part (50) covers the weighing cell's (6) lower surface (8).
- 25 14. Levelling device (1) according to claim 13 **characterized** in that the bottom part (50) is fixed to the housing (4) by fastening devices such as bolts (41).
- 30 15. Levelling device (1) according to any of the previous claims

characterized in that the levelling device (1) is fixed to the base by bolts (45), which bolts (45) penetrate the housing (4) and other parts of the lower part (2) and is designed for becoming screwed fixed into the base (31).

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16. Use of a levelling device (1) according to any of the previous claims in locations with high requirements for hygiene such as locations for processing of foodstuffs or manufacturing of medicine.

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17. Use of a levelling device (1) according to any of the previous claims for support of a machine placed in areas with risk of earthquake.

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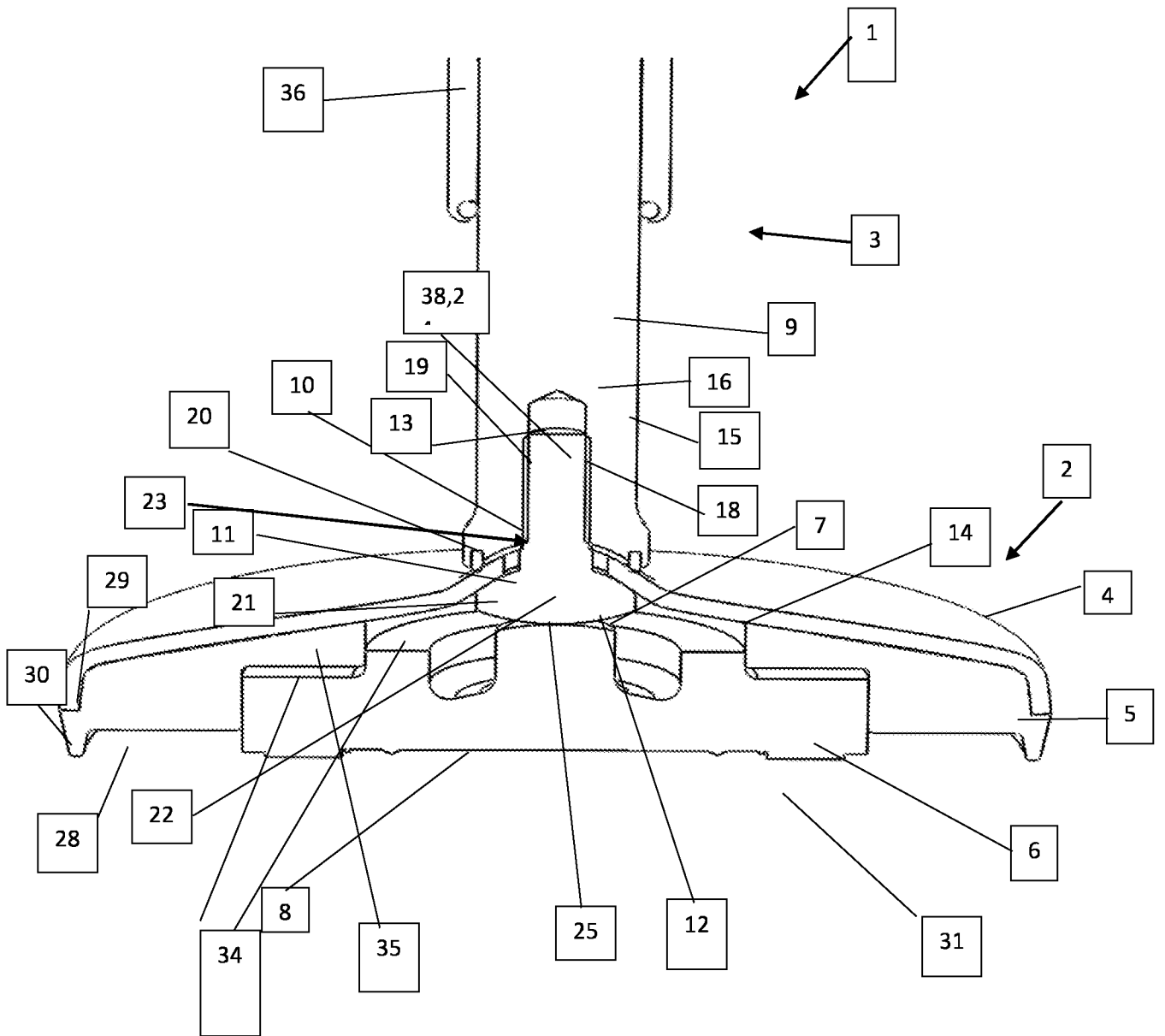
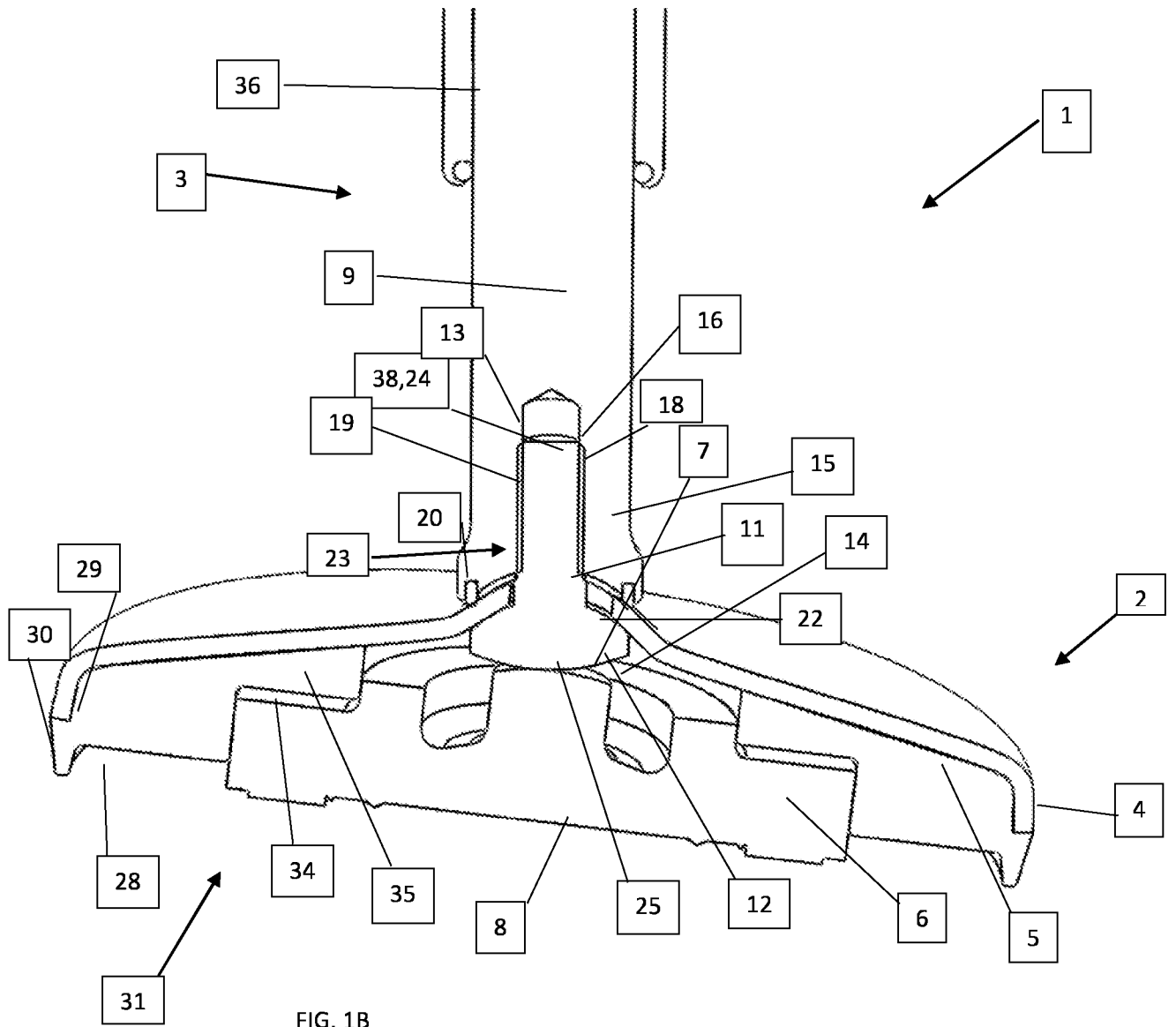


FIG.1A



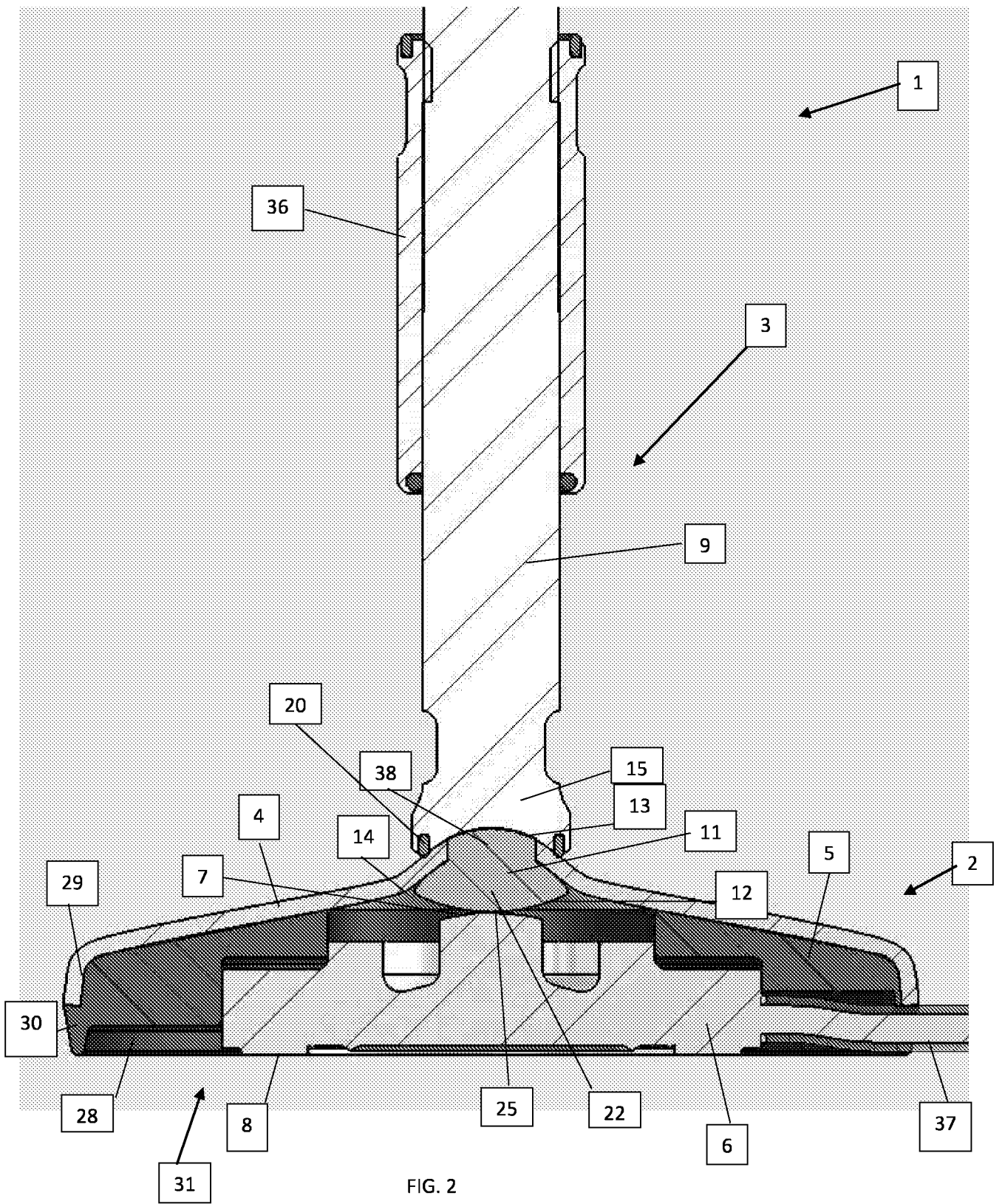
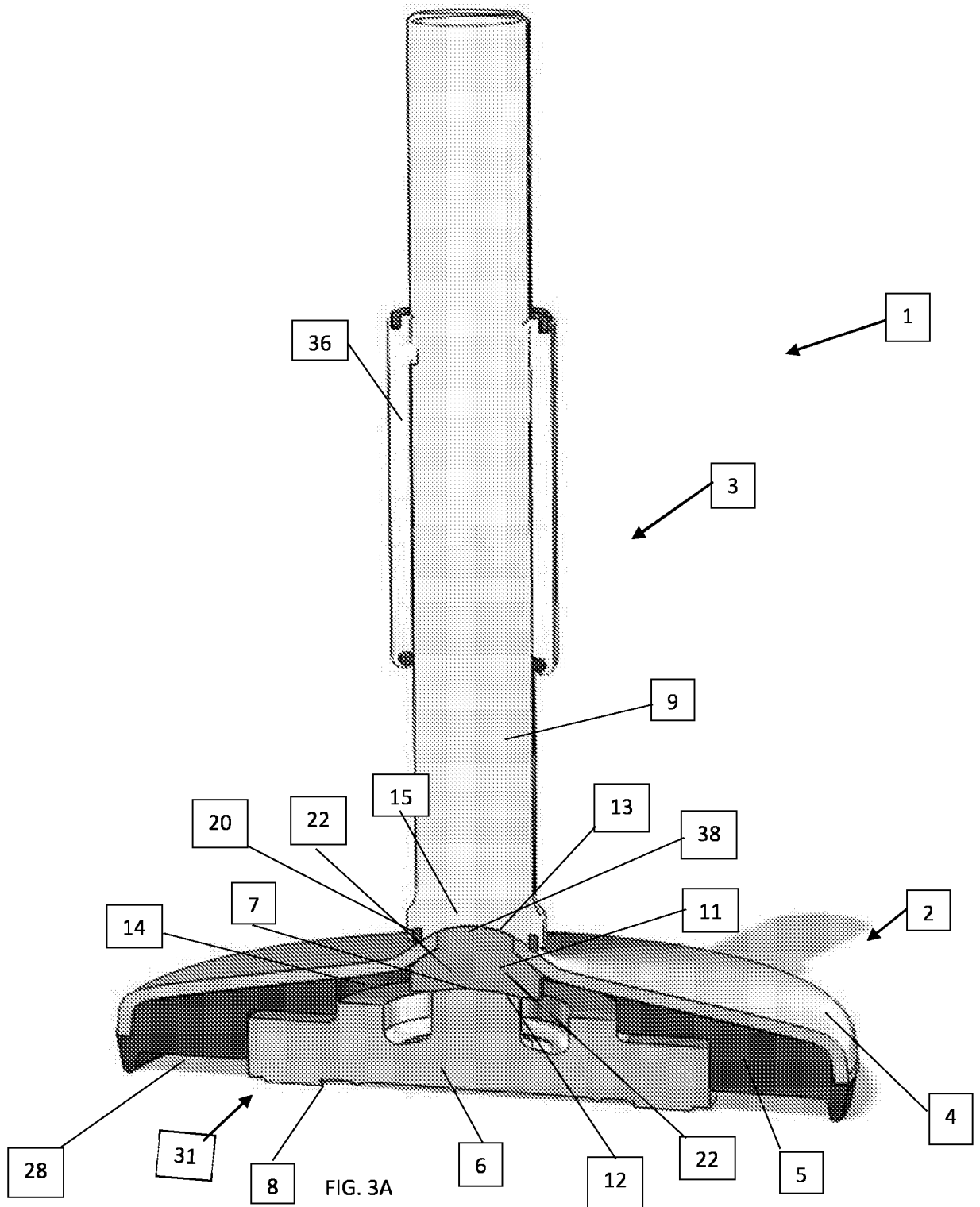
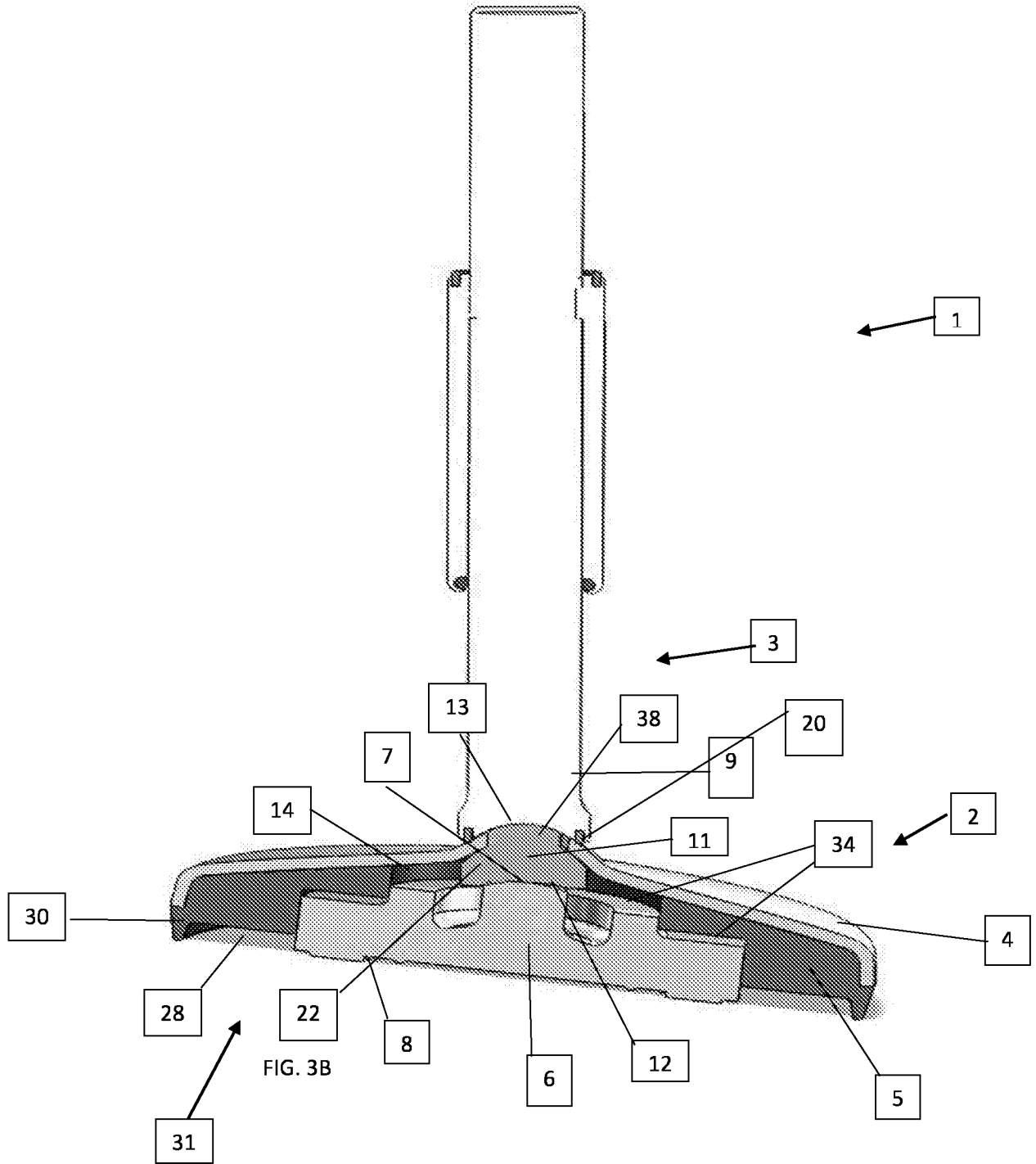


FIG. 2





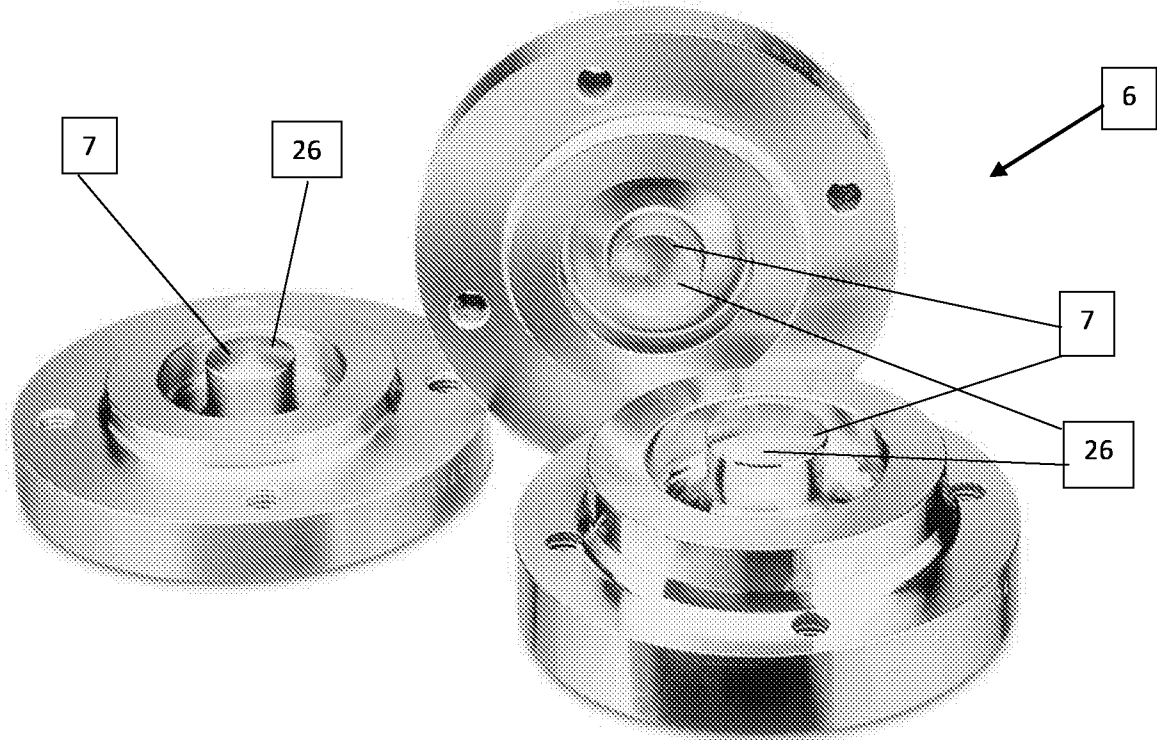


FIG. 4

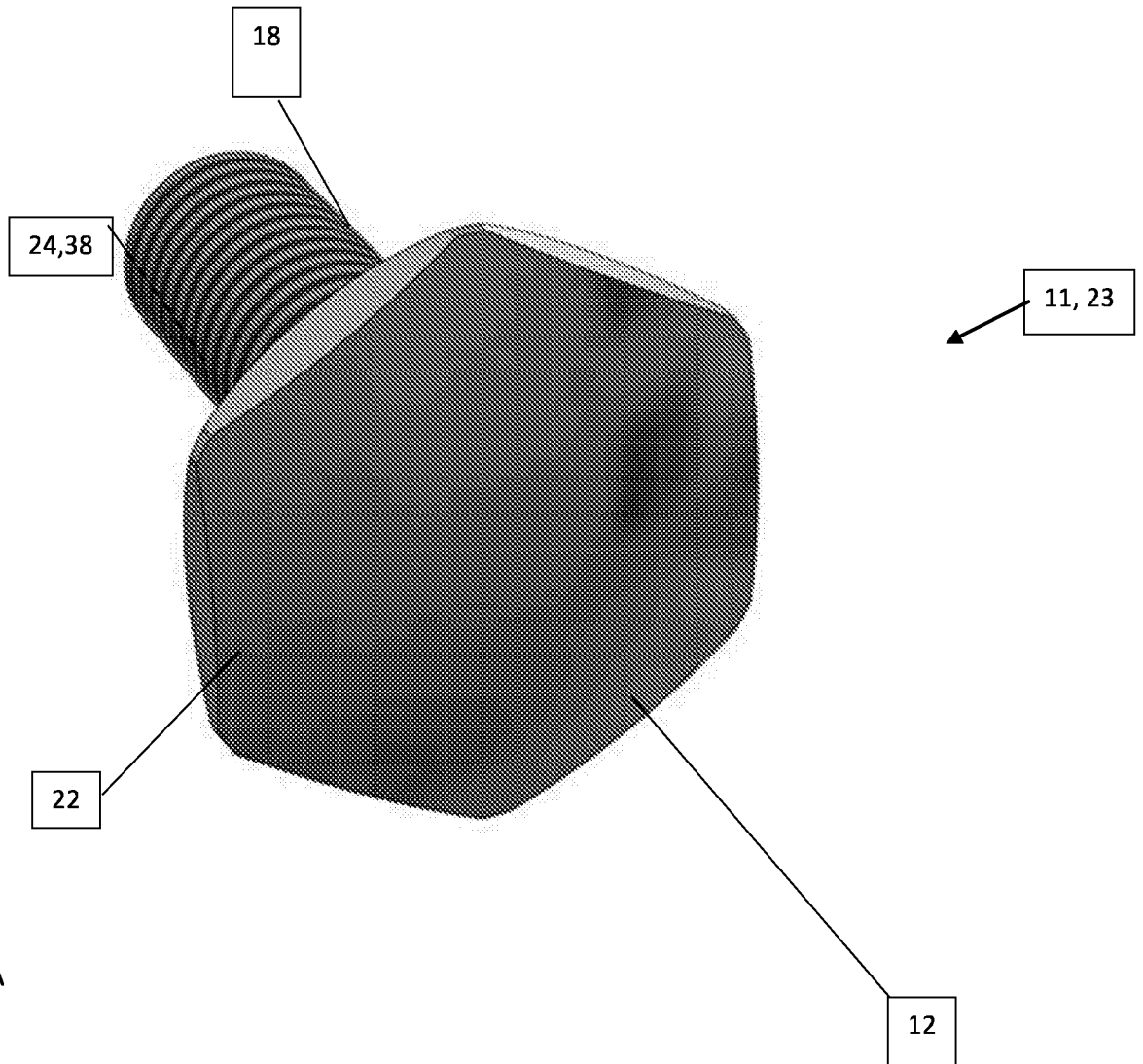


FIG. 5A

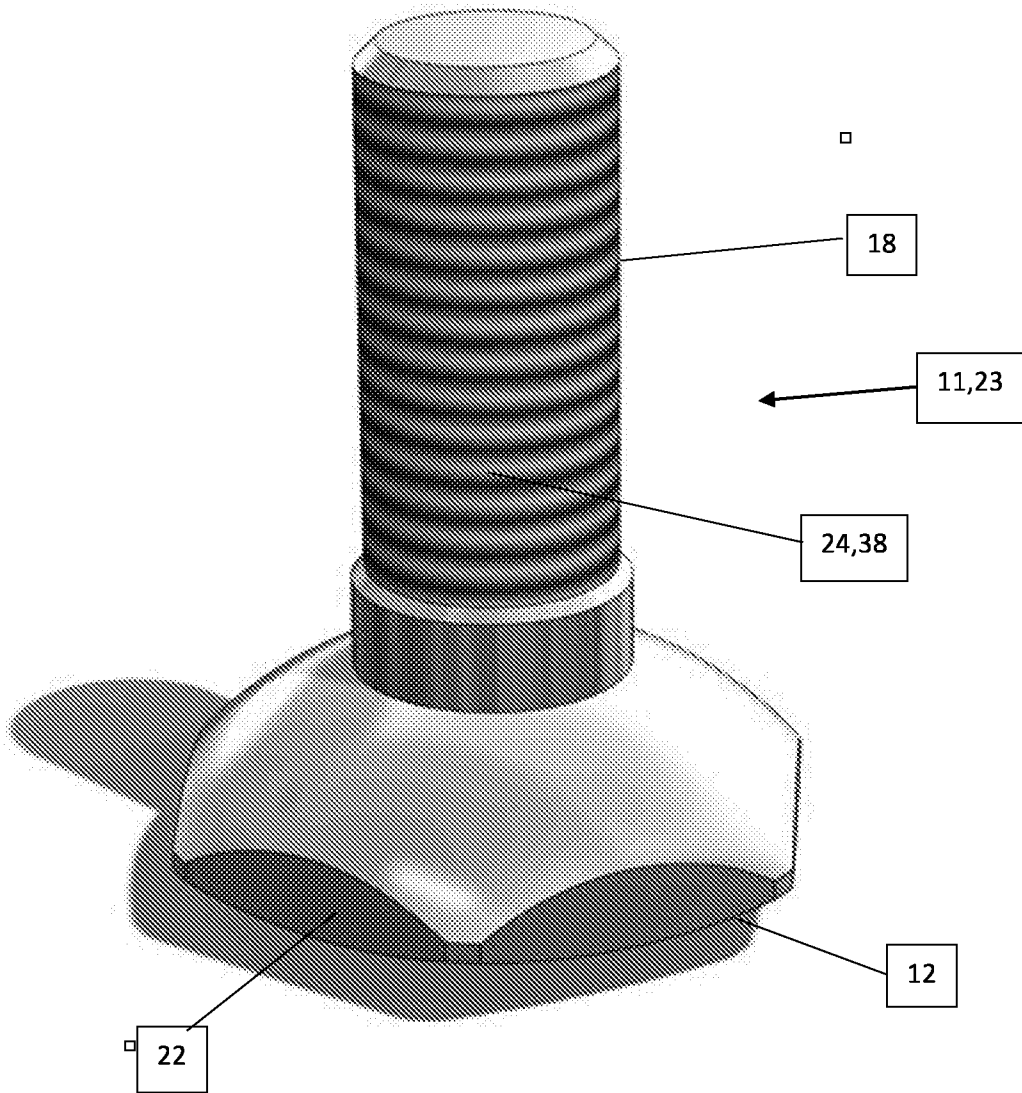


FIG. 5B

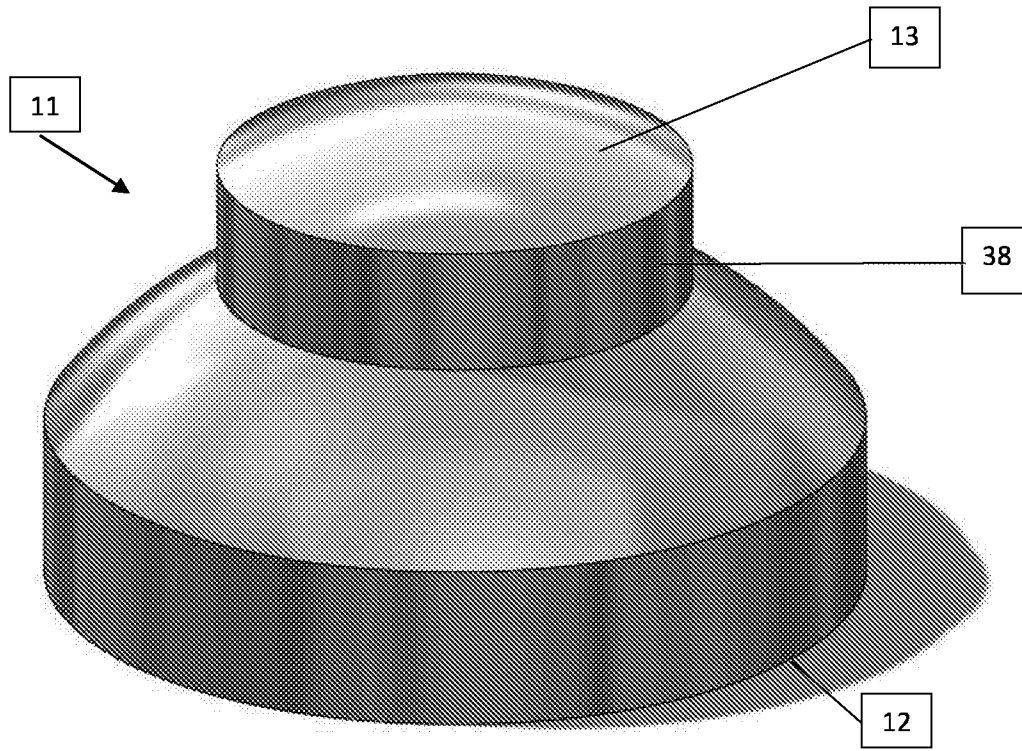
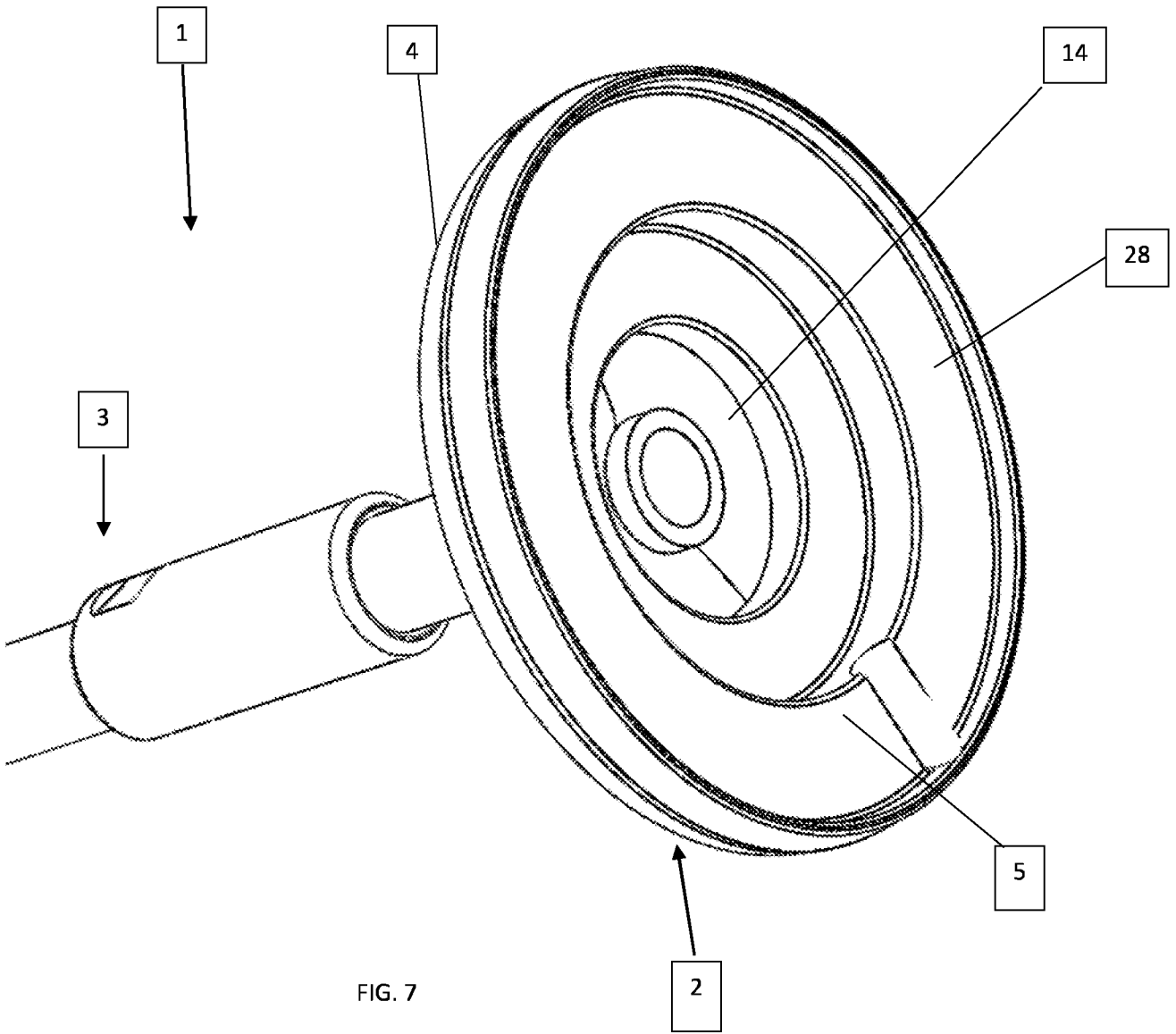


FIG. 6



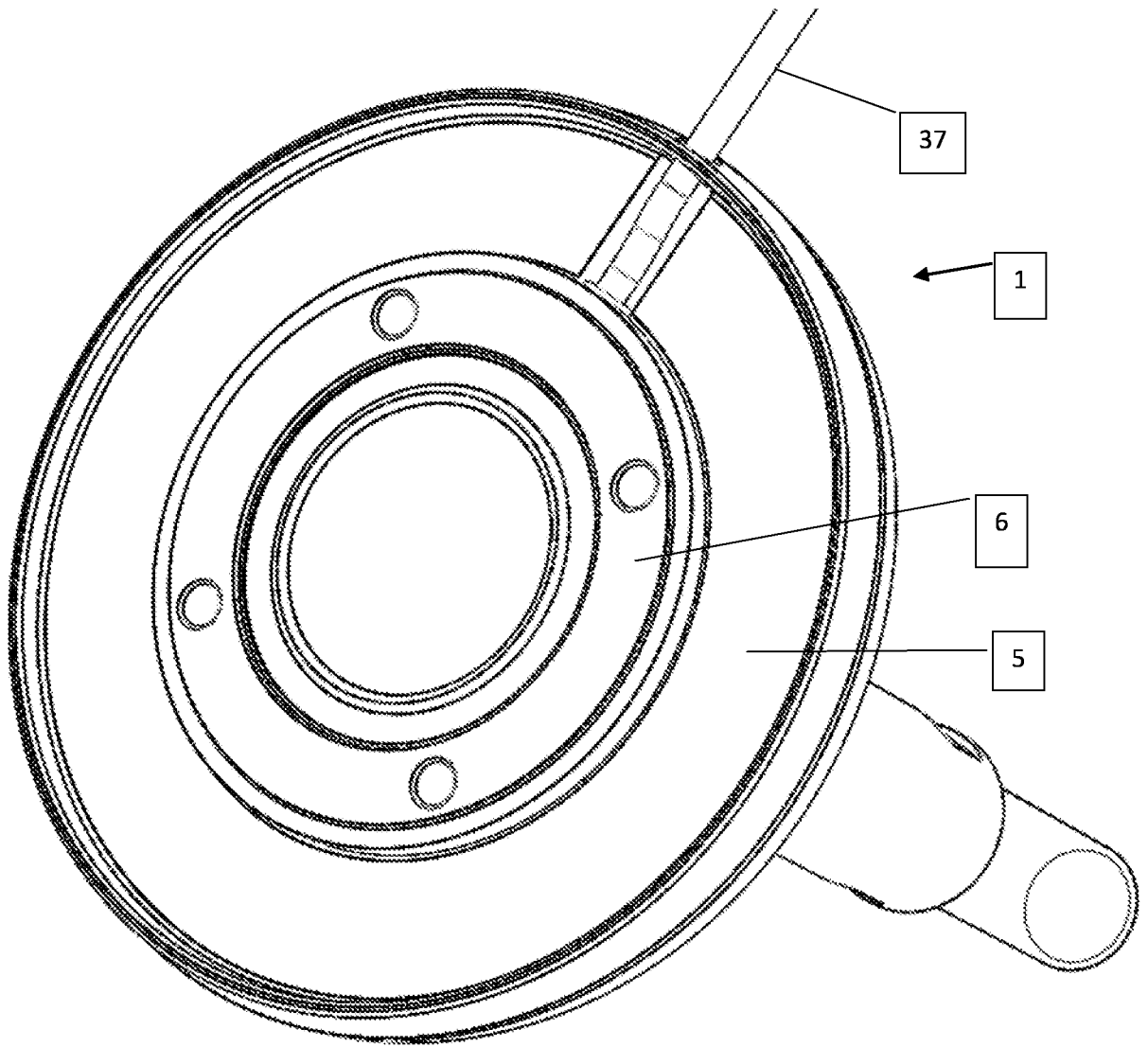


FIG. 8

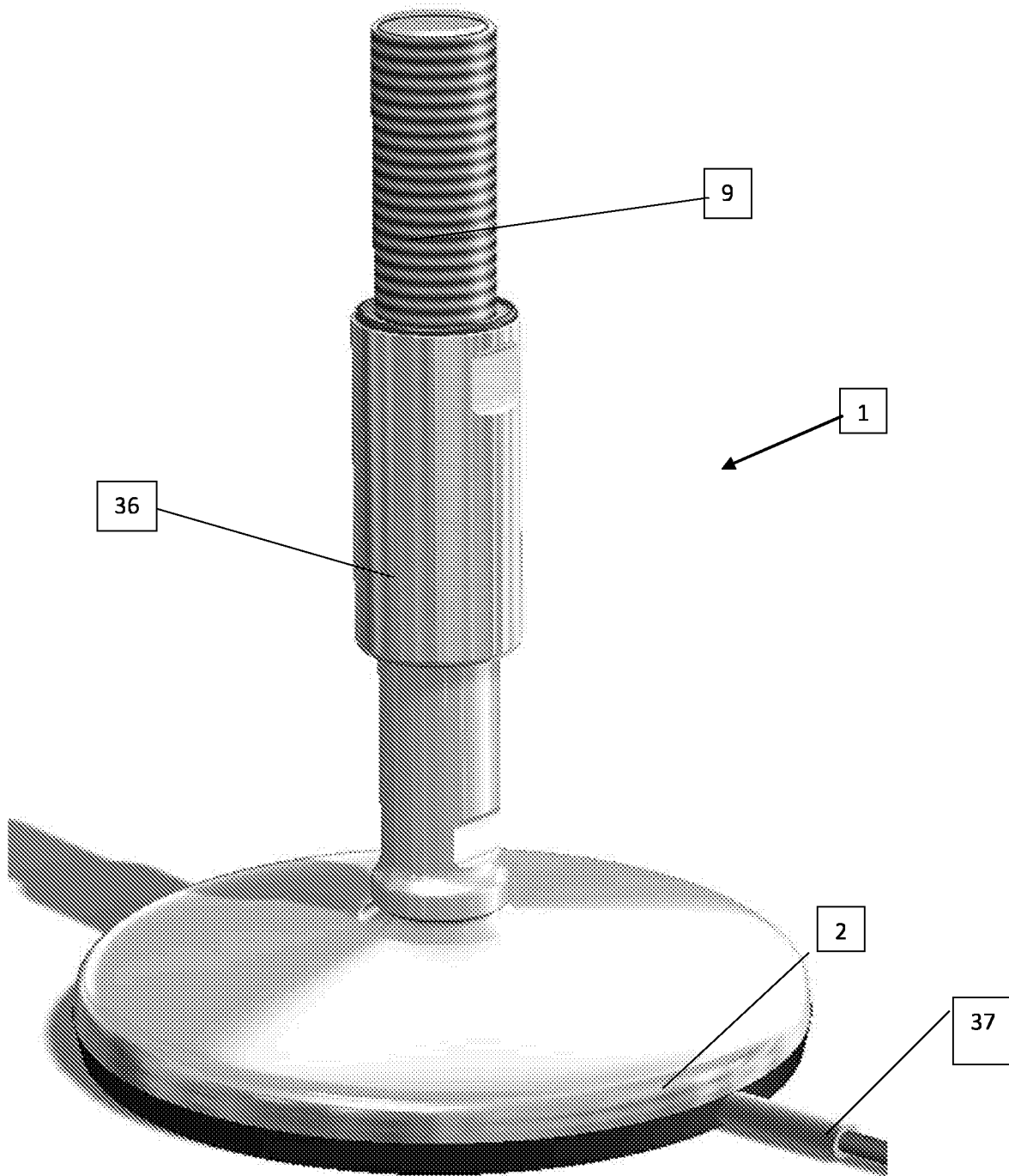


FIG. 9

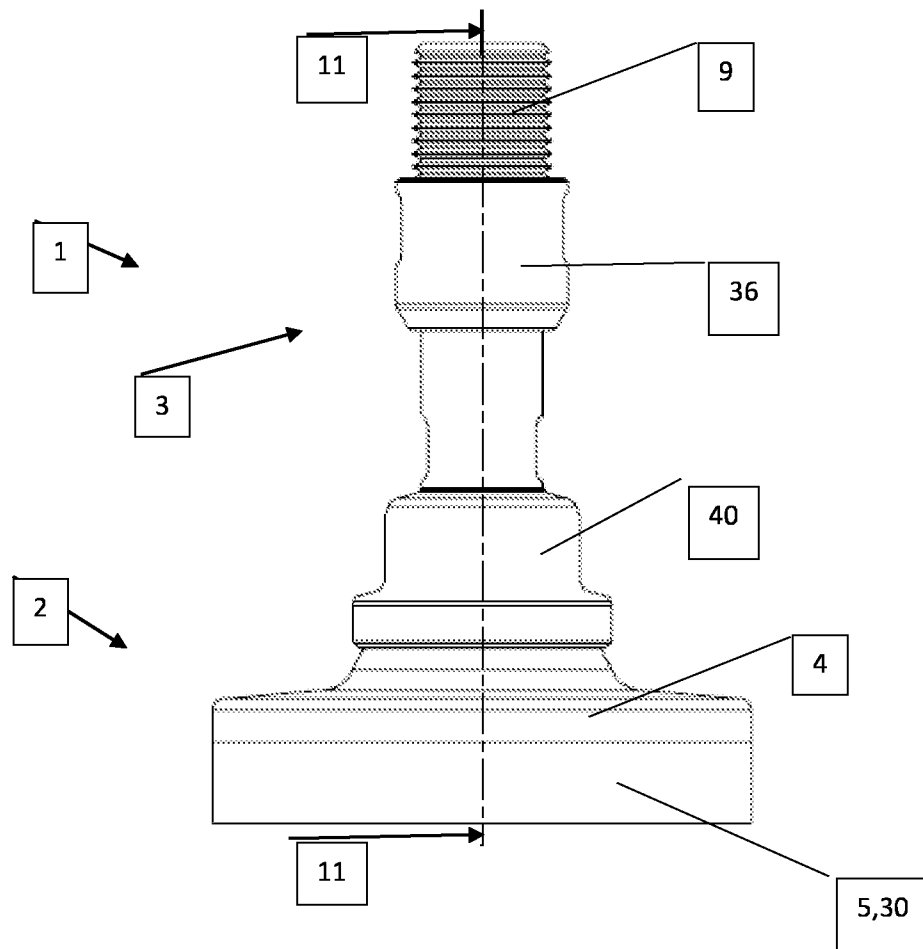


FIG. 10

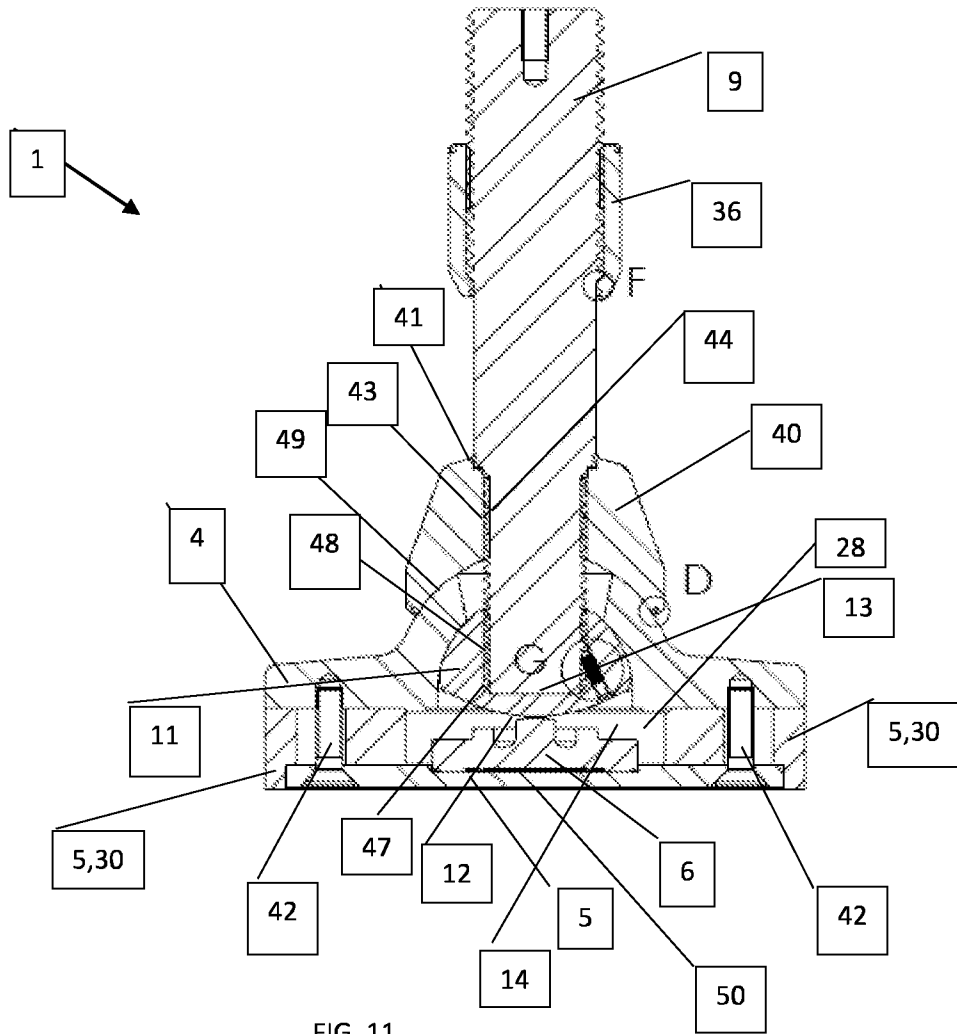


FIG. 11

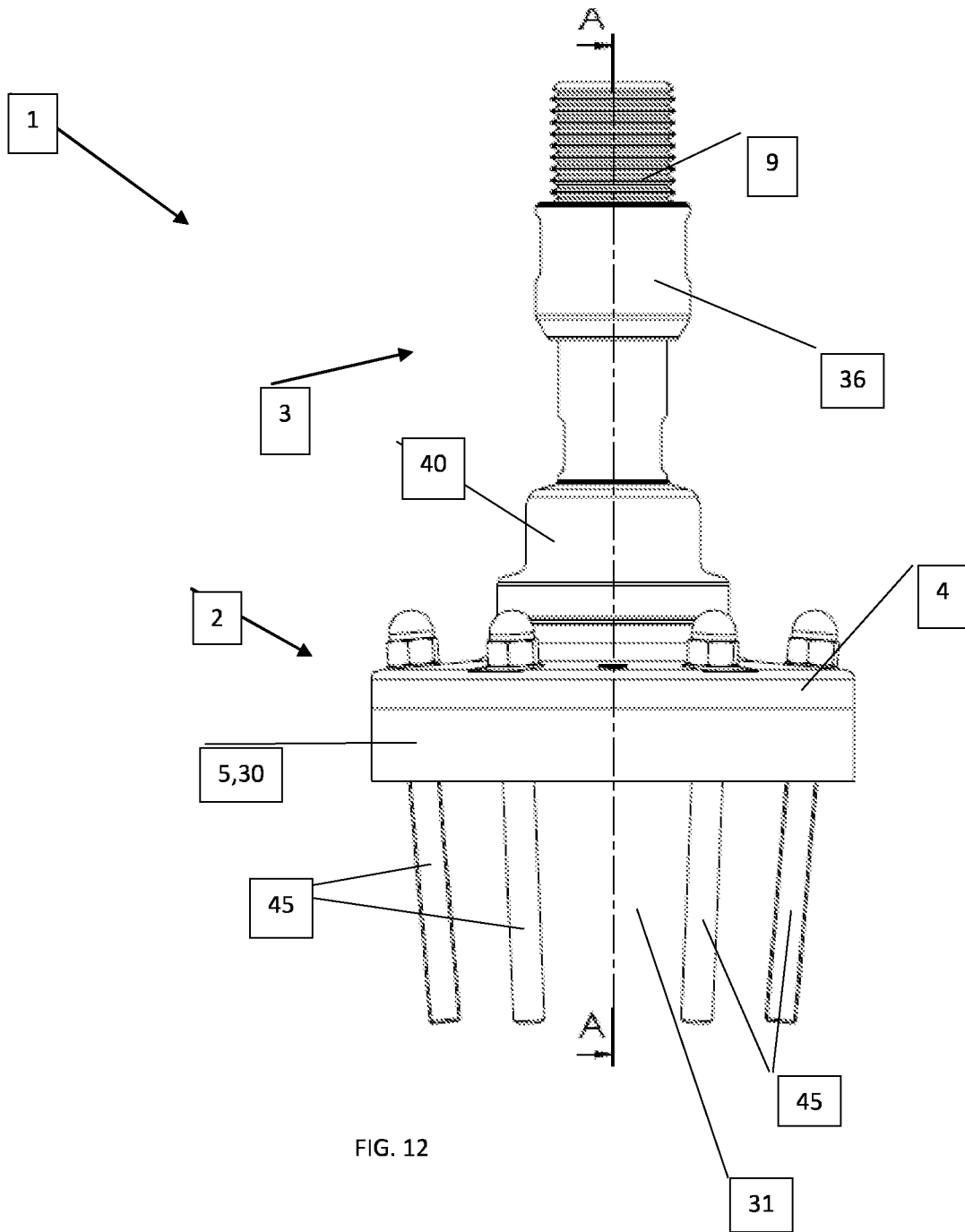


FIG. 12

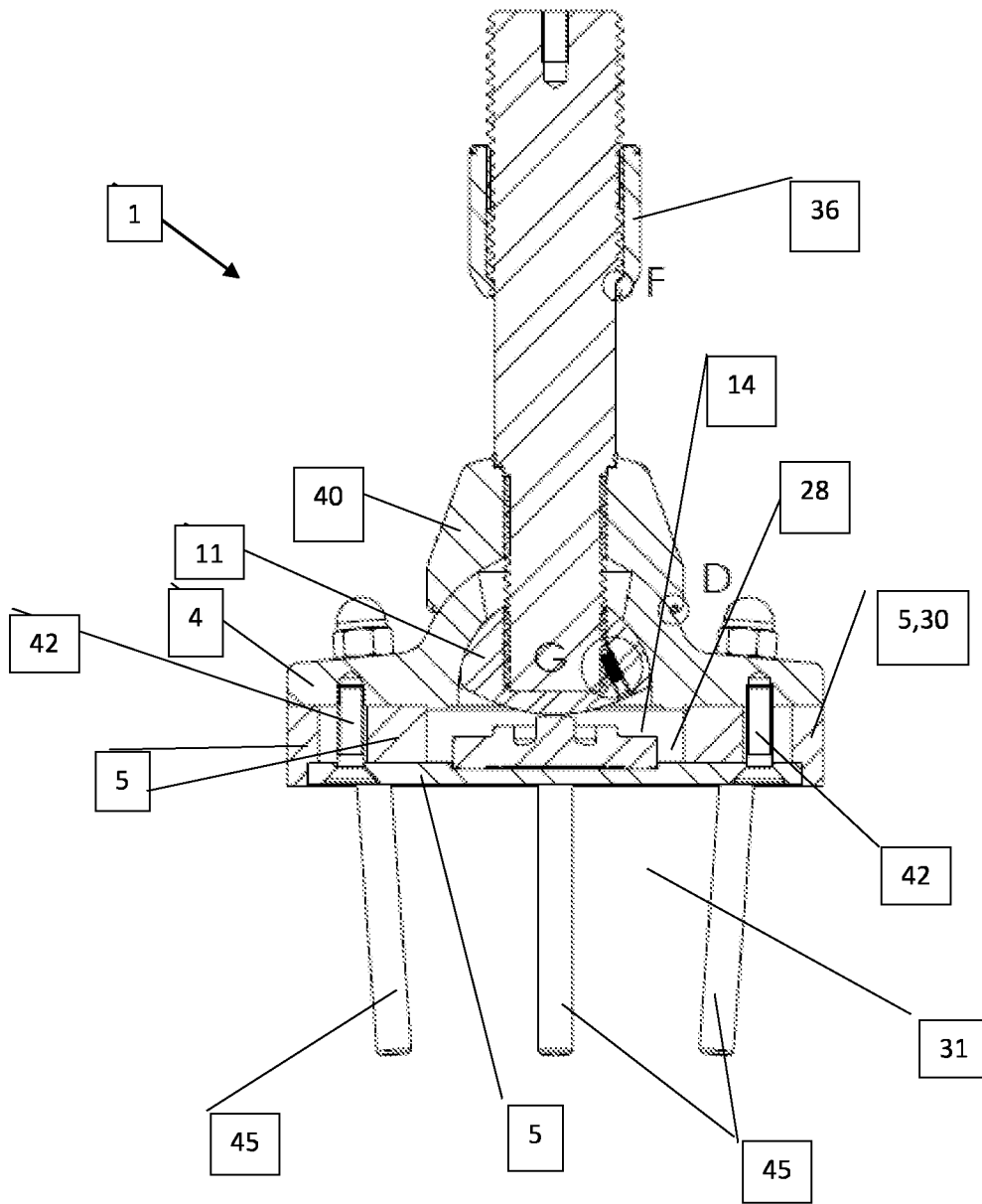


FIG. 13

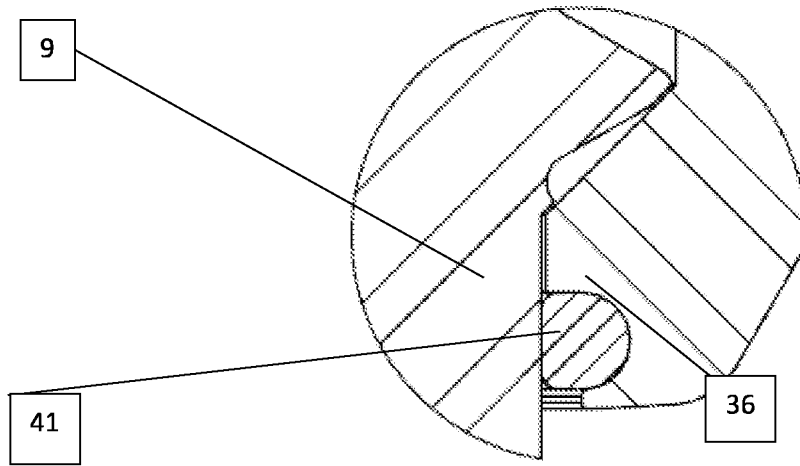


FIG. 14

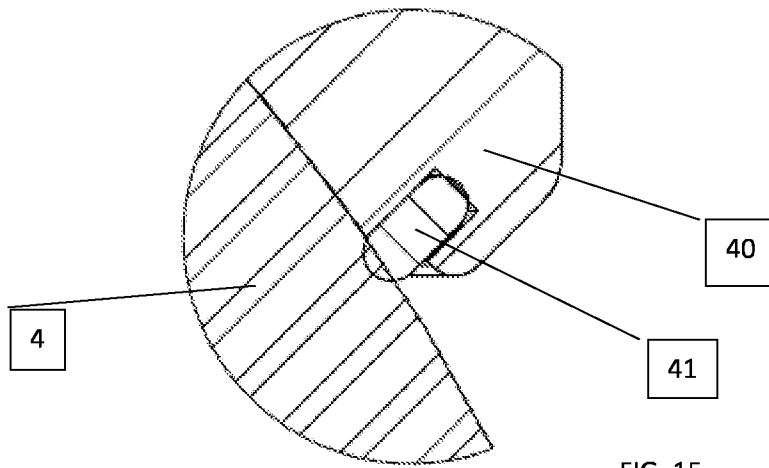


FIG. 15

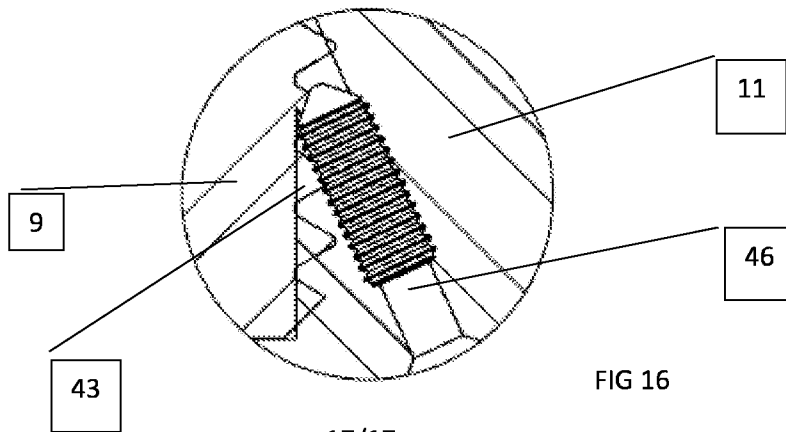


FIG 16

INTERNATIONAL SEARCH REPORT

International application No PCT/DK2015/050151

A. CLASSIFICATION OF SUBJECT MATTER INV. F16M7/00 A47B91/02 G01G21/23 G01G21/30 ADD.				
According to International Patent Classification (IPC) or to both national classification and IPC				
B. FIELDS SEARCHED				
Minimum documentation searched (classification system followed by classification symbols) F16M A47B G01G				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched				
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	EP 0 670 480 A1 (TRU TEST LTD [NZ]) 6 September 1995 (1995-09-06) abstract; figures 1,2 -----	1-8, 11-17 9,10		
Y	-----	-----		
X	FR 2 926 634 A1 (RITECS SARL [FR]) 24 July 2009 (2009-07-24) page 4 - page 5; figures 2a,2b -----	1-5, 13-17		
X	US 5 881 533 A (FOCKE HEINZ [DE] ET AL) 16 March 1999 (1999-03-16) column 3 - column 4; figures 2,3 -----	1-5,12, 13		
X	CA 2 287 583 A1 (SCALECO [CA]) 25 April 2001 (2001-04-25) page 8, line 1 - line 4; figure 2 -----	1-5, 12-14,17		
Y	FR 2 709 181 A3 (SCANVAEGT AS [DK]) 24 February 1995 (1995-02-24) page 4, line 25 - line 30; figures 1,2 -----	9,10		
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.				
* Special categories of cited documents : <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed </td> <td style="width: 50%; border: none; vertical-align: top;"> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family </td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
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Date of the actual completion of the international search	Date of mailing of the international search report			
16 October 2015	23/10/2015			
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Kepka, Maciek			

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Information on patent family members

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