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(54) A closure device for closing an opening in a structure and use of the closure device for closing an opening in a floor, in particular a company service floor

(57) A closure device for closing an opening (11) in a structure (10) such as a wall or floor. The closure device has a sealing assembly (33) formed by a first clamping body (35), a second clamping body (36), a disc-shaped deformable member (37) of sealing material, placed between the oppositely spaced first and second clamping body (35, 36), and clamping means (25, 26) for moving the first and second clamping body (35, 36) in a direction (z) relative to each other, for compressing the deformable member (37) when the first and second clamping body (25, 26) are moved towards each other. By this compression, the deformable member (37) expands in outward direction (r) transverse to the moving direction (z) of the first and second clamping body (35, 36) for engaging an inner surface (12) of the opening (11). The first and second clamping body (35, 36) and the deformable member (37) are shaped for deflecting the deformable member (37) along the moving direction (z) of the first and second clamping body (35, 36) when the deformable member (37) is compressed.

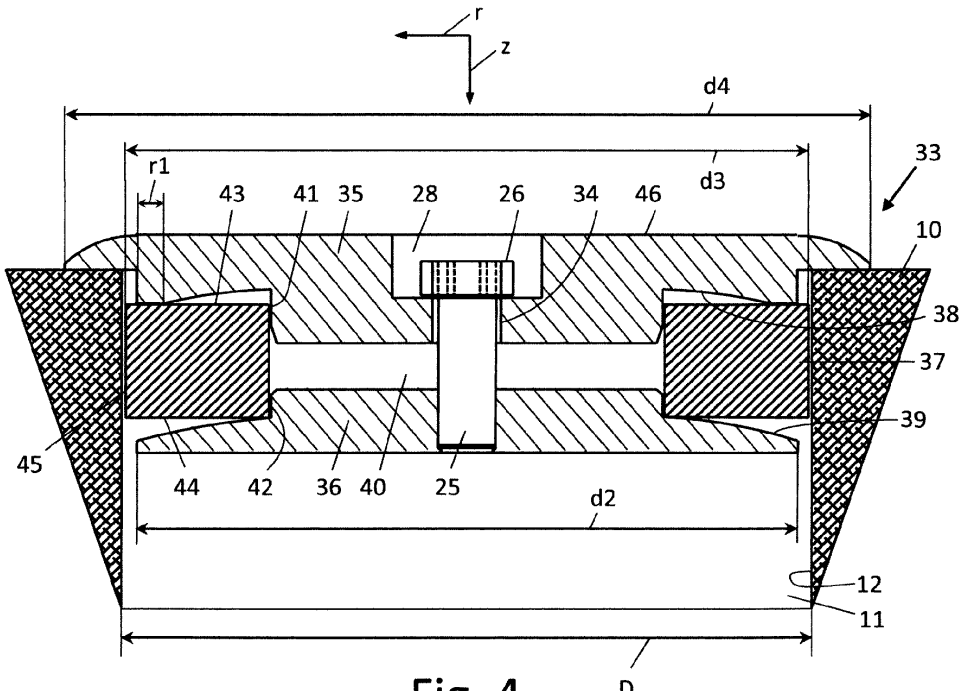

Fig. 4

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Description

Technical Field

[0001] The invention generally relates to closure devices for closing an opening in a structure, such as a preformed opening or borehole for pipes, ducts, conduits, soil monitoring, and the like and, more particularly, to closure devices for fluid-tightly closing or sealing of an opening in a surface, such as an opening in a wall or floor, either permanently or temporarily.

Background

[0002] European patent 1 122 366 discloses a closure device for closing or sealing an opening in a company service floor for soil air monitoring and for periodically testing whether the service floor is liquid-tight.

[0003] The sealing assembly or sealing arrangement of this known closure device comprises a first clamping body having a first clamping surface and a second clamping body having a second clamping surface. The first and second clamping body are oppositely spaced, such that the first and second clamping surface face each other. Between the first and second clamping surface of the oppositely spaced first and second clamping body, a deformable member of sealing material is placed, which deformable member is arranged for circumferentially engaging an inner surface of an opening or aperture in which the sealing assembly is positioned.

[0004] Clamping means are provided for moving the first and second clamping body in a direction relative to each other, for exerting a compression force on the-deformable member by the first and second clamping surface when the first and second clamping body are moved towards each other. When compressed, the deformable member expands in a direction transverse, i.e. crosswise, with respect to the moving direction of the first and second clamping body, for engaging the inner surface of the opening.

[0005] In practice, a hole or an opening in a structure such as a floor, pavement or street may generally slightly widen or diverge in outward direction. When placed in such a hole or opening and while compressing the deformable member, the sealing assembly may move in outward direction of the hole or opening when the deformable member expands and engages the inner surface of the hole or opening. In particular, when the hole or opening to be closed in axial or longitudinal direction thereof is just deep enough to receive the sealing assembly, there is a risk that in mounted position part of the sealing assembly, for example the clamping means, extend outside the hole or opening. Such outwardly projecting parts constitute a risk of damage to objects moving across the floor, such as shovels or vehicle tires or wheels in the case of a street or a floor of a petrol station or a motorcar repair shop or parking floor, and may also be a cause of injury to persons walking on the floor or pavement, for example.

[0006] In the case of closure device comprising a cover plate that extends externally from the hole or opening, either a cover plate separately connected to the sealing assembly, such as disclosed by EP 1 122 366, or a closure plate integral with the first clamping body, such as disclosed by European patent application EP 0 979 330, cars driving over the cover plate, which is the case when the closing device is used for closing or sealing an opening in a floor of a petrol station for soil air monitoring and/or for leakage testing of the floor, for example, exercise relative strong forces on the sealing assembly. In particular when the sealing assembly, during mounting thereof, moves upwards in the hole or opening, the cover plate may be raised over a distance with respect to the floor, pavement, street or wall wherein the hole or opening is formed.

[0007] When cars are driving over such raised cover plate, even when the cover plate is just slightly raised, even stronger torque or twisting momentum forces are exerted on the sealing assembly. By these forces, the sealing assembly of the closure device may be even more moved outwardly in axial or longitudinal direction of the hole or opening in the floor, with the result that the closure device eventually works its way out of the hole or opening. Not only the sealing assembly and the cover plate of the closure device may be damaged thereby, but also the inner wall of the hole or opening, and such that the hole or opening is no longer closed or sealed in a fluid tight, i.e. gas-tight and/or liquid-tight manner.

Summary

[0008] It is an objective of the invention to provide an improved closing device of the type described in the background part, preventing that the sealing assembly thereof moves outwards of a hole or opening of a structure, such as a hole or opening in a floor, when the deformable member is compressed.

[0009] In order to accomplish that objective, the closure device according to the invention is designed in that the first and second clamping surface of the first and second clamping body and the deformable member are shaped for deflecting the deformable member along the moving direction of the first and second clamping body, when exerting the compression force on the deformable member.

[0010] In accordance with the invention there is provided a closure device for closing an opening in a structure, such as an opening in a wall or floor, the closure device having a sealing assembly comprising:

- a first clamping body having a first clamping surface and a second clamping body having a second clamping surface, the first and second clamping body being oppositely spaced,
- a deformable member of sealing material, placed between the first and second clamping surface of the

oppositely spaced first and second clamping body, and arranged for circumferentially engaging an inner surface of the opening, and

- clamping means arranged for moving the first and second clamping body in a direction relative to each other, for exerting a compression force on the deformable member by the first and second clamping surface when the first and second clamping body are moved towards each other, thereby expanding the deformable member in a direction transverse to the moving direction of the first and second clamping body for engaging the inner surface of the opening, characterized in that the deformable member is disc-shaped, the first and second clamping surface of the first and second clamping body and the deformable member are shaped providing an increased distance between the first clamping surface and an opposite first surface of the deformable member in inward radial direction thereof, and providing an increased distance between the second clamping surface and an opposite second surface of the deformable member in outward radial direction thereof, for deflecting the deformable member along the moving direction of the first and second clamping body when exerting the compression force on the deformable member.

[0011] When the closure device according to the invention, i.e. the sealing assembly thereof formed by the first and second clamping body, the deformable member and the clamping means, is placed in a hole or opening in a structure, such as a floor, besides expanding the deformable member such that the circumference thereof increases and engages the inner surface of the hole or opening, the deformable member is first or simultaneously with the expansion thereof deflected in axial or longitudinal direction, for example downwards, of the hole or opening by the operation of the clamping means. Such a deflection of the deformable member effectively prevents the sealing assembly from moving upwards or outwards of the hole or opening, in particular when the hole or opening widens or flares out in axial or longitudinal direction thereof.

[0012] The thus deflected deformable member provides an increased resistance against upward movement of the sealing assembly by the above mentioned torque or twisting momentum forces exerted on the sealing assembly when motor vehicles or the like drive over a cover plate connected to the sealing assembly, thereby effectively preventing loosening of the closure device when mounted in a hole or opening. In practice, due to the deflection force acting in the deformable member of the sealing assembly according to the invention, the cover plate will be tightly fit to the surface of a floor or wall or other structure in which the hole or opening to be closed or sealed is formed. In many practical applications, this obviates the need for an additional sealing, such as a rubber ring or flap, between the cover plate and the surface of the floor.

[0013] The closure device of the invention, when mounted in a hole or opening, shows an increased resistance against moving outside the hole or opening, thereby minimizing the risk of being damaged or being worked out of the hole or opening in a floor or ground surface, even when the hole or opening is closed off by a cover attached to the sealing assembly, and does neither constitute a danger to vehicles or persons or the like moving across the floor or ground surface. Accordingly, the closure device of the invention provides a long lasting fluid-tight sealing.

[0014] The distance between a clamping surface of a clamping body and the opposite surface of the deformable member may be achieved by suitably shaping the respective clamping surface, the respective opposite surface of the deformable member and/or both.

[0015] In an example of the closure device according to the invention, wherein the deformable member having a flat or substantially or essentially flat first and second surface, the first clamping body comprises a sloping first clamping surface providing an increased distance with respect to the first surface of the deformable member in inward radial direction thereof, and the second clamping body comprises a sloping second clamping surface providing an increased distance with respect to the second surface of the deformable member in outward radial direction thereof.

[0016] When compressing the disc-shaped deformable member, by moving the first and second clamping body towards each other, the first and second sloping clamping surfaces provide a larger deflection of the deformable member at the outer circumference of the deformable member compared to the center thereof. By this asymmetric deflection, the deformable member exerts a force on the inner wall of the hole or opening to be closed in both radial and axial direction, thereby keeping the sealing assembly of the closure device firmly in the hole or opening.

[0017] It will be appreciated that the amount in which the first and second clamping surfaces are sloping, viewed across the cross-section of the disc-shaped deformable member, the elastic properties of the deformable member, amongst others determined by the type of material and thickness of the deformable member, and the friction force between the inner wall of the hole or opening and the part of the deformable member acting thereon, will contribute to the resistance against movement of the mounted sealing assembly in axial direction of the hole or opening. In general, the more the disc-shaped deformable member is deflected at its circumference, the stronger the resistance will be.

[0018] In an other example of the closure device according to the invention, the deformable member having a flat or substantially flat first surface and a sloping second surface such that the deformable member having a reduced thickness towards its outer circumference, the first clamping body comprising a sloping first clamping surface providing an increased distance with respect to

the first surface of the deformable member in inward radial direction thereof, and the second clamping body comprising a flat or substantially flat second clamping surface providing an increased distance with respect to the second surface of the deformable member in outward radial direction thereof.

[0019] It has been found that when the first clamping surface starts inwardly sloping at a distance from an outer circumferential edge of the deformable member in a further example of the closure device according to the invention, the inner surface of the hole or opening will be engaged by the disc-shaped deformable member over substantially the whole of its thickness, thereby providing an excellent fluid-tight sealing by the closure device, even in the case of a tapered hole or opening, such as an outwardly flaring or diverging hole or opening.

[0020] The first and second clamping surface may slope over the whole or part of the width of the disc-shaped deformable member in radial direction thereof. The length of the sloping part of the first and second clamping surface, measured in radial direction, can be used to control the axial and compression forces exerted.

[0021] In yet another example of the closure device according to the invention wherein the deformable member having a flat or essentially or substantially flat second surface and a sloping first surface, such that the deformable member having an increased thickness towards its outer circumference in outward radial direction, the first clamping body comprises a flat or essentially or substantially flat first clamping surface and the second clamping body comprising a sloping second clamping surface providing an increased distance with respect to the second surface of the deformable member in outward radial direction thereof.

[0022] In a yet further example of the closure device according to the invention, the deformable member having a sloping first and second surface such that the deformable member having a substantially constant thickness, the first and second clamping body comprising a flat or substantially flat first and second clamping surface, the deformable member being positioned between the first and second clamping surfaces providing an increased distance between the first clamping surface and the second surface of the deformable member in inward radial direction thereof, and providing an increased distance between the second clamping surface and the second surface of the deformable member in outward radial direction thereof.

[0023] That is, besides shaping the first and/or second clamping surfaces, the deflection of the deformable member may also, or additionally, effected by suitably shaping the deformable member.

[0024] In the examples above, a sloping surface may be any of a continuously or discontinuously sloping surface. An example of a discontinuously sloping surface is a stepped inclined surface and an example of a continuously sloping surface is a curvedly inclined surface. For the purpose of the invention other shapes may be applicable.

[0025] Those skilled in the art will appreciate that the examples of the above disclosed clamping surfaces and deformable members may be interchanged and combined to provide a desired deflection of the deformable member in a desired direction when in its compressed state.

[0026] In a further example of the closure device according to the invention, the deformable member is ring-shaped having a center opening, wherein the first and second clamping body comprises a disc-shaped center part to be received in the center opening of the deformable member, and wherein at least one of the first and second clamping surface is formed by part of the first and second clamping body extending radially outwardly from the disc-shaped center part.

[0027] By varying the diameter of the center opening of the deformable member, the deformable properties thereof can be controlled to provide a desired expansion and deflection force thereof, for example adapted to the mechanical properties of the structure wherein the hole or opening to be closed by the closing device according to the invention is formed.

[0028] It has been found that the expansion of the deformable member in radial direction may be advanced in a further example of the closure device according to the invention, comprising a reduced distance between the first clamping surface of the first clamping body and the opposite first surface of the deformable member over a length from the disc-shaped center part of the first clamping body in outward radial direction of the deformable member.

[0029] Such a reduction in the distance between the first clamping surface of the first clamping body and the opposite first surface of the deformable member at or near the center part of the first clamping body may be achieved by locally shaping, i.e. thickening or gradually thickening, the first clamping surface, by locally increasing or gradually increasing the thickness of the deformable member and/or both. The respective distance at the center part may even be reduced to zero.

[0030] For longer or deeper holes or openings, for example, and/or to improve the fluid tightness of the closure device as a whole, in another example of the invention, the closure device comprises a stack or stacked sealing assembly of at least two oppositely positioned sealing assemblies or sealing arrangements comprised by an oppositely spaced first and second clamping body, a deformable member of sealing material and clamping means.

[0031] For such a stack of sealing assemblies, the clamping means may be integral for the whole of the stack. That is, the deformable members of the stack may be compressed jointly by operating one and the same clamping means. However, clamping means operating on just a single stack may be also provided.

[0032] In a constructive efficient example of the closure device comprising a stack of a first and second sealing

assembly, the second clamping body of a first assembly and the first clamping body of an oppositely positioned second assembly are integral comprising a second clamping surface engaging the deformable member of the first assembly and a first clamping surface engaging the deformable member of the second assembly.

[0033] Those skilled in the art will appreciate that any clamping body between two oppositely spaced deformable members may be integral.

[0034] In order to enable clamping of the deformable member against the inner wall of a hole or opening and to provide an axial deflection of the deformable member that can be controlled sufficiently precisely, in an example of the closure device according to the invention, the clamping means comprise threaded joint means extending in the direction through the spaced first and second clamping body and the deformable member for moving the first and second clamping body relative to each other by operating the threaded joint means.

[0035] In a specific example of the closure device according to the invention, the threaded joint means comprise a bolt and nut joint, wherein the bolt is fixedly connected to one of the first and second clamping body and the nut is received in a recess of a surface of the other of the first and second clamping body opposite the clamping surface thereof. The closure device according to this specific example does not comprise any parts that extend or project externally, as a result of which the risk of damage and/or injury is effectively eliminated.

[0036] For being completely received in a hole or opening of a structure, the invention provides a closure device comprising a substantially disc-shaped sealing assembly of a first and second clamping body and a deformable member, having dimensions such that the deformable member in its compressed state extends in outward radial direction of the disc-shaped sealing assembly beyond the first and second clamping body.

[0037] Those skilled in the art will appreciate that the outer circumference of the first and second clamping body and the deformable member can be adapted to the circumference of the hole or opening, for example a circle shaped circumference. The closure device may comprise a cover plate for completely covering a hole or opening in a structure that is separate or separately attached to the sealing assembly.

[0038] In an example of the closure device according to the invention, comprising a substantially disc-shaped sealing assembly of a first and second clamping body and a deformable member, the second body has dimensions such that the deformable member in compressed state thereof extends in outward radial direction of the disc-shaped sealing assembly beyond the second clamping body and the first body having dimensions extending in outward radial direction of the disc-shaped sealing assembly beyond the deformable member in a compressed state thereof. By suitably dimensioning, the first clamping body forms an integral cover plate for covering the hole or opening to be closed or sealed.

[0039] In a practical embodiment of the closure device according to the invention the first clamping body acting as a cover plate is a circular plate having a first diameter, the second clamping body is a circular plate having a second diameter smaller than the first diameter, and the deformable member is a ring or ring-shaped disc having a third diameter, which third diameter ranges between the first and second diameter. The dimensions of the first clamping body acting as a cover plate and the dimensions of the second clamping body, as well as the dimensions of the deformable member are selected such that when the closure device is fitted for the purpose of closing a hole or opening in a floor or in the ground in a fluid-tight manner, the first clamping body is supported on the ground or on the floor comprising the hole or opening, and the second clamping body and the deformable member are accommodated in the hole or opening, whereby the deformable member engages the circumferential wall of the hole or opening in a fluid-tight manner in its clamped condition and provides a deflection force in axial direction of the hole or opening to attach the first clamping body tightly to the floor.

[0040] The deformable member may be made of a suitable elastic sealing material, which is selected in dependence on the field of application of the closure, for example a deformable member which is made of an oil and fuel-resistant or other chemical substances resistant elastic rubber or other material having suitable elastic properties for use in industrial or chemical environments such as service floors of petrol stations, workshops, in particular motorcar repair shops and the like.

[0041] In an embodiment of the closure device according to the invention the first and second clamping body and the clamping means are, for example, and/or a separate cover plate are made of aluminium and/or stainless steel and/or of composite material like reinforced plastics such as fiber-reinforced polymer and metal composites, in order to ensure a high-quality seal for a prolonged period of time, also in the outside air and/or in aggressive environments.

[0042] The surface of the first clamping body acting as a cover plate, or a separate cover plate if applicable, may be gradually flattened at its circumferential outer edge of the surface extending at a floor surface, for example, such to provide a practically stepless transition between the floor surface and the cover plate, as a result of which the forces acting on the cover plate and thereby on the sealing assembly and the risk of the closure device being "grabbed" by a tire of for example a shovel or a car or a lorry is effectively reduced. In particular in the case of stepped transitions between the floor surface and the surface of a closure, there is a danger that the closure is grabbed by a tire rolling over the cover plate, which may cause the closure to twist and/or turn in the opening, thus affecting its sealing action, or that the closure as a whole is pulled or flung from the opening, with all the dangers and risks this may involve. In an example of the closure device according to the invention, the cover plate is flat-

tened along a radius of curvature. Such radius of curvature is selected such that a very smooth, nearly stepless transition to the floor surface is effected.

[0043] In another example of the closure device according to the invention, the second clamping body intended to be received in a hole or opening is a massive, plate-shaped body, in order to give the closure sufficient rigidity and sturdiness and to support the clamping means.

[0044] It has become evident that tightening bolts which are for example provided with a socket-like recess for moving the first and second clamping body towards and from each other by means of a rotational movement, provide adequate protection against easy removal of closures by unauthorized persons. Instead of using socket-like recesses, it is also possible, of course, to use tightening bolts and nuts having other, suitably shaped heads, and which may or may not have the advantage of providing additional protection against unauthorized rotation and removal of closures.

[0045] The invention also relates to use of the closure device according to the inventive concept for the fluid-tight closure of an opening in a floor for at least one of soil, soil-air or soil-water monitoring and testing whether the floor is fluid-tight, in particular a company service floor such as a floor of a petrol station, a floor of a motorcar repair shop, a floor at a chemical or other industrial location or site, a parking floor and many more.

[0046] The invention will be described and explained in more detail hereafter with reference to the accompanying drawings.

Brief Description of the Drawings

[0047]

Fig. 1 shows, in a schematic cross-sectional view, an example of a closure device according to the invention, in non-compressed state thereof positioned in a hole or opening of a structure.

Fig. 2 shows, in -a schematic cross-sectional view, the closure device of Fig. 1 in compressed or mounted state.

Fig. 3 shows, in a schematic cross-sectional view, the closure device of Fig. 1 in compressed or mounted state in a tapered hole or opening.

Fig. 4 shows, in a schematic cross-sectional view, another example of a closure device according to the invention, in non-compressed state thereof positioned in a hole or opening of a structure.

Fig. 5 shows, in a schematic cross-sectional view, a further example of a closure device according to the invention, in non-compressed state thereof positioned in a hole or opening of a structure.

Fig. 6 shows, in a schematic cross-sectional view, an example of a stacked closure device according to the invention, in non-compressed state thereof positioned in a hole or opening of a structure.

Fig. 7 shows, in a schematic cross-sectional view, a still further example of a closure device according to the invention, in non-compressed state thereof positioned in a hole or opening of a structure.

Fig. 8 shows, in a schematic cross-sectional view, a still another example of a closure device according to the invention, in non-compressed state thereof positioned in a hole or opening of a structure.

Fig. 9 shows, in a schematic cross-sectional view, an example of a closure device according to the invention, in non-compressed state thereof positioned in a hole or opening of a structure, with an advanced radial expansion of the deformable member.

Detailed Description

[0048] In the present description, for the several examples disclosed, like parts are designated by like reference numerals. The invention is not restricted to the examples explicitly disclosed. Within the teaching and scope of the invention, those skilled in the art may modify the inventive concept and examples presented without exercising inventive skills.

[0049] Fig. 1 shows part of a structure 10, such as a wall or a floor, with a hole or opening 11 having a circumferential inner wall 12. In the opening 11 a closure device according to an example of the invention is received, comprising a sealing assembly 13, for closing or sealing the opening 11. For the purpose of the present description of the several examples, it is assumed that the hole or opening 11 and the sealing assembly 13 are both circle cylindrical. Those skilled in the art will appreciate that closure device according may be designed and adapted for closing or sealing non-round or non-circle cylindrical shaped openings in a structure.

[0050] In the embodiment of the example shown, the sealing assembly 13 comprises a first round, plate shaped clamping body 15, having a first diameter d1, and a second round, plate shaped clamping body 16, having a diameter d2. The first and second clamping body 15, 16 are oppositely positioned in a spaced parallel relationship. A deformable member 17 of an elastic sealing material, for example a circular cylindrical flat or essentially or substantially flat plate-shaped disc or ring made of rubber or another chemical substance resistant material, having a diameter d3, is provided between the first and second clamping body 15, 16. The deformable member 17 has a flat or essentially or substantially flat first side or surface 20, a flat or essentially or substantially flat second side or surface 21 opposite the first side or surface 20 thereof, an edge or circumference wall 22, and

a thickness t, measured between its surfaces 20 and 21. The deformable member 17 is shown in its non-compressed state.

[0051] The first clamping body 15 has a first clamping surface 18 facing the deformable member 17 at the first surface 20 thereof, and the second clamping body has a second clamping surface 19 facing the deformable member 17 at the second surface 21 thereof.

[0052] From the second clamping body 16 clamping means in the form of a tightening bolt 25 extend through a center opening 23 in the deformable member 17 and a center opening 24 in the first clamping body 15 into a recess 28 formed in a surface 29 opposite the first clamping surface 18 of the first clamping body 15. The bolt 25, at an end thereof, is fixed to the second clamping body 16. At another end of the bolt 25, received in the recess 28, a corresponding nut 26 joins the bolt 25, forming a threaded joint means. The recess 28 is sufficiently wide to receive a tool for operating the nut 26. In practice, the end or head of a the threaded bolt 25 may be provided with a hexagonal or socket-like recess 27 for receiving a complementary shaped tool for preventing turning of the bolt 25 when the nut 26 is turned, for example. By operating the threaded joint means 25, 26 the first and second clamping body 15, 16 can be moved from and towards each other in axial or longitudinal direction z of the opening 11.

[0053] In the example of the invention shown, the first clamping body 15 has a sloping first clamping surface 18 formed such that the distance of the first clamping surface 18 with respect to the facing first surface 20 of the deformable member 17 is increased in inward radial direction of the first clamping body 15, i.e. towards the center thereof, compared to the distance between the first clamping surface 18 and the first facing surface 20 of the deformable member 17 at the circumferential edge thereof. The second clamping body 16 has a sloping second clamping surface 19 formed such to provide an increased distance with respect to the facing second surface 21 of the deformable member 17 in outward radial direction, i. e. towards the circumferential edge of the second clamping body 16.

[0054] For clarity purposes, in the present description, the phrase "outward radial direction" refers to a direction in which the arrow r points, whereas the phrase "inward radial direction" refers to a direction opposite in which the arrow r points. The term "distance" refers to the spacing, i.e. is measured in or against the direction in which the arrow z points.

[0055] In the example shown, the sealing arrangement 13 is completely received in the hole or opening 11, having a diameter D. The diameter d1 of the first clamping body 15, the diameter d2 of the second clamping body 16 and the diameter d3 of the deformable member 17 are all smaller than the diameter D of the hole or opening 11.

[0056] By operating the clamping means, i.e. the threaded joint means 25, 26, such that the first and second clamping body 15, 16 are moved in a direction towards each other, a compression force is exerted at the deformable member 17, reducing the thickness t thereof, and as a result of which the deformable member substantially expands in outward radial direction r, i.e. transverse to the moving direction of the first and second clamping body 15, 16, as illustrated in Fig. 2. The diameter d3 of the deformable member 17 is selected such that the deformable member 17, with its edge or circumferential wall 22, when compressed, firmly, circumferentially, engages the inner surface 12 of the hole or opening 11, thereby fluid-tightly closing or sealing the opening 11.

[0057] Due to the sloping shape of the first 18 and the second 19 clamping surfaces as disclosed, the plate shaped deformable member 17 is not only expanded in radial direction r, indicated by arrow Fr, but is also simultaneously deflected in axial or longitudinal direction z of the opening 11, i.e. in the direction from the first clamping body 15 towards the second clamping body 16, indicated by arrow Fz, when exerting the compression force on the deformable member 17. By this deflection Fz of the deformable member 17 the resistance against axial movement of the sealing assembly 13 outward of the hole or opening 11, i.e. opposite the direction in which the arrow z points, is increased compared to the prior art embodiments disclosed in the background part above, in which just a radial expansion Fr of the deformable member is accomplished when compressing the deformable member 17.

[0058] As illustrated in Fig. 2, which shows the deformable member 17 in a compressed state, the deflection of the deformable member is largest at its circumferential outer edge 22. It will be appreciated that the amount in which the first and second clamping surfaces 18, 19 are sloping, i.e. the distance and distance variation between the clamping surfaces 18, 19 and the corresponding facing surfaces 20, 21 of the disc-shaped deformable member 17, viewed across the cross-section of the deformable member 17, i.e. the radial direction r, the elastic properties of the-deformable member 17, amongst others determined by the type of material and thickness t of the deformable member 17, the friction force between the inner wall 12 of the hole or opening 11 and the edge or circumference wall 22 of the deformable member 17 acting thereon, as well as the distance in radial direction r over which the clamping surfaces 18, 19 slope, all contribute in controlling the resistance against movement of the mounted sealing assembly in axial direction of the hole or opening. In general, the more the disc-shaped deformable member 17 is deflected at its circumference 22, the stronger the resistance will be.

[0059] Fig. 3 shows the sealing assembly 13 in its compressed state mounted in a hole or opening 31 of a structure 30. The hole or opening 30 has an inner surface 32 and widens or diverges or flares out in the direction opposite in which the arrow z points, such that the diameter D1 of the opening 31 is larger than the diameter D thereof. It will be appreciated that by the deflection Fz of the de-

formable member 17, the edge or circumferential wall 22 thereof, over its whole thickness, engages the inner wall 32 of the opening. Accordingly, the deflection does not only provide an improved resistance against movement in the opening or hole 31, but also an improved fluid-tight sealing by the closure device.

[0060] When the first clamping body 15 and the second clamping body 17 are moved away from each other by appropriately turning the nut 26 with respect to the bolt 25 to loosen the threaded joint, the deformable member 17 will more or less return to its original circumferential dimension, i.e. the non-compressed state, such that the sealing assembly can be removed from the hole or opening 11, 31.

[0061] Fig. 4 shows an alternative example of the closure device. In this example, in a sealing assembly 33 between a first clamping body 35 and a second clamping body 36, which are oppositely positioned in a spaced parallel relationship, a flat or essentially or substantially flat disc-shaped, more particularly a ring-shaped deformable member 37 is positioned. The ring-shaped deformable member 37 has a center opening 40, a flat or essentially or substantially flat first surface 43, a flat or essentially or substantially flat second surface 44 and a circumferential wall or edge 45. The first and second clamping body 35; 36 comprise a disc-shaped center part 41, 42, respectively, received in the center opening 40 of the deformable member 37, which is shown in its non-compressed state.

[0062] The first clamping body 35 has a first clamping surface 38 at part of the first clamping body 35 extending radially outwardly from the disc-shaped center part 41, opposite the facing first surface 43 of the ring-shaped deformable member 37. The second clamping body 36 has a second clamping surface 39 at part of the second clamping body 36 extending radially outwardly from the disc-shaped center part 42, opposite the facing second surface 44 of the ring-shaped deformable member 37.

[0063] For moving the first and second clamping body 35, 36 with respect to each other, i.e. in axial or longitudinal direction z of the opening 11, threaded joint means 25, 26 are provided, extending through the center opening 40 of the deformable member 37 and a center opening 34 in the first clamping body 35.

[0064] The first clamping surface 38 starts inwardly sloping at a distance r1 from the outer circumferential wall or edge 45 of the deformable member 37, such that the distance measured in z-direction from the first clamping surface 38 to the facing first surface 43 of the deformable member 37 increases in inward radial direction, i.e. in the direction of the center of the first clamping body, opposite the direction in which the arrow r points. The second clamping body 36, in the example shown in Fig. 4, has a sloping second clamping surface 39 formed such to provide an increased distance with respect to the facing second surface 44 of the deformable member 37 in outward radial direction, i.e. towards the circumferential edge of the second clamping body 36, i.e. in the direction in which the arrow r points.

[0065] When compressed, the deformable member 37 first will start to deflect in the axial direction in which the arrow z points, as explained above. At least when the first and second clamping surface 38, 39 engage the first and second surface 43, 44 of the deformable member 37, respectively, the deformable member 37 starts to expand substantially in outward radial direction, i.e. in the direction in which the arrow r points. Accordingly, the inner surface 12 of the hole or opening 11 will be firmly engaged by the deflected circumferential wall 45 of the disc-shaped deformable member 37, thereby providing an excellent resistance against movement of the sealing assembly 33 in axial direction of the hole or opening 11, in particular in the direction opposite in which the arrow z points, and providing an excellent fluid-tight sealing, also in the case of a tapered hole or opening, such as an outwardly flaring hole or opening 31 shown in Fig. 3.

[0066] In addition to the deformable member 17, the width of the center opening 40 may be dimensioned to further control the axial deflection of the deformable member 37.

[0067] Different from the sealing assembly shown in Figs. 1, 2 and 3, comprising a substantially disc-shaped sealing assembly 13 of a first and second clamping body 15, 16 and a deformable member 17, having dimensions d1, d2, d3 such that the deformable member 17 in its compressed state extends in outward radial direction of the disc-shaped sealing assembly 17 beyond the first and second clamping body 15, 16 for being completely received in a hole or opening 11, the first clamping body 35 of the substantially disc-shaped sealing assembly 33 has a diameter d4 extending in outward radial direction of the disc-shaped sealing assembly 33 beyond the diameter d3 of the deformable member 37 in a compressed state thereof, that is beyond the diameter D of the hole or opening 11. In this way, the first clamping body 35 forms an integral cover plate 46 having an outer surface opposite the first clamping surface 38, extending externally of the hole or opening 11.

[0068] It will be appreciated that by the deflection of the deformable member 37 in the direction in which the arrow z points, the cover plate 46 will be firmly attached to the surface of the structure 10 at which the cover plate rests.

[0069] Although not explicitly shown, those skilled in the art will appreciate that the first clamping body 15 shown in Figs. 1, 2 and 3 may also be dimensioned to form an integral cover plate, in the same manner as the first clamping body 35 shown in Fig. 4. On the other hand, the first clamping body 35 may have a diameter d1 like the first clamping body 15, such that the sealing assembly 33 can be completely received in the hole or opening 11.

[0070] Instead of an integral cover plate, a separate cover plate may be used, whether or not connected to the sealing assembly 13, for completely covering the opening 11.

[0071] Fig. 5 shows another example of the closure

device comprising a sealing assembly 53, having a disc-shaped, more particularly a ring-shaped deformable member 47, having a center opening 40, a first surface 49, a second surface 44, and an edge or circumferential wall 52. The deformable member 47, which is shown in its non-compressed state, is placed between a first and second clamping body 55, 36 which are oppositely positioned in a spaced parallel relationship.

[0072] The first clamping body 55 comprises a disc-shaped center part 41, received in the center opening 40 of the deformable member 47, and a flat or essentially or substantially flat first clamping surface 48 at part of the first clamping body 55 extending radially outwards from the disc-shaped center part 41, opposite the facing first surface 49 of the ring-shaped deformable member 37. The first clamping body 55 forms an integral cover plate 46 in the same manner as disclosed with reference to Fig. 4. The second clamping body 36 is dimensioned and shaped as shown and described with reference to Fig. 4, and its second clamping surface 39 faces the second surface 44 of the deformable member 47.

[0073] In the example of Fig. 5, the second surface 44 of the deformable member has a flat or essentially or substantially flat second surface 44 opposite the second clamping surface 39 of the second clamping body 36 and a sloping first surface 49 opposite the first clamping surface 48 of the first clamping body 55, such that the deformable member 47 has an increased thickness from the center opening 40 towards the outer edge or circumference wall 52 thereof.

[0074] When compressing the deformable member 47 by moving the first and second clamping body 55, 36 towards each other by the clamping means 25, 26, the deformable member 47 will be deflected in the axial direction, in which the arrow z points, and will expand radially, in the direction in which the arrow r points. Accordingly, the inner surface 12 of the hole or opening 11 will be firmly engaged by the deflected and expanded circumference wall 52 of the disc-shaped deformable member 47, as explained above with reference to Figs. 1-4.

[0075] Fig. 6 shows an example of a stacked closure device having a sealing assembly 63. In the example shown, the sealing assembly 63 is constructed from two sealing assemblies 33 shown and described with reference to Fig. 4, arranged in a spaced parallel relation, and shown in the non-compressed state. The stacked sealing assembly 63 comprises a first and second clamping body 35, 36 and a common or integral third clamping body 50, arranged between the first and second clamping body 35, 36. The third clamping body 50 comprises a first clamping surface 58, identical to the first clamping surface 38 of the first clamping body 35, facing the second surface 44 of the upper deformable member 37, viewed in the plane of the drawing, and a second clamping surface 59, identical to the second clamping surface 39 of the second clamping body 36, facing or opposite the first surface 43 of the lower deformable member 37, viewed in the plane of the drawing. Integral threaded clamping means are provided, comprising a bolt 56, received in a center opening 57 of the third clamping body 50, and a co-operating nut 26, comparable to the nut and bolt 25, 26 of Figs. 1-5. The operation of the stacked sealing assembly or arrangement 63 is comparable to operation of the sealing assembly or arrangement 33, however providing an even improved fluid-tight closure and increased resistance against being moved out of the hole 11 when mounted.

[0076] Fig. 7 shows a still further example of the closure device according to the invention comprising a sealing assembly 73, having a disc-shaped, more particularly a ring-shaped deformable member 77, having a center opening 40, a first surface 49, a second surface 74, and an edge or circumferential wall 72. The deformable member 77, which is shown in its non-compressed state, is placed between a first and second clamping body 55, 76 which are oppositely positioned in a spaced parallel relationship.

[0077] In the example of Fig. 7 as shown, the first clamping body 55 is dimensioned and shaped as shown and described with reference to Fig. 5, and its first clamping surface 48 faces the first surface 49 of the deformable member 77.

[0078] The second clamping body 76, in the example shown in Fig. 7, has a flat or essentially or substantially flat second clamping surface 79 at part of the second clamping body 76 extending-radially outwardly from the disc-shaped center part 42, opposite the facing second surface 74 of the disc or ring-shaped deformable member 77.

[0079] In the example of Fig. 7, the deformable member 77 has a sloping second surface 74 opposite the second clamping surface 79 of the second clamping body 76, such to provide an increased distance between the facing second surface 74 of the deformable member 77 and the second clamping surface 79 in outward radial direction. That is, when measured in the direction of the arrow z, the distance between the second surface 74 and the second clamping surface 79 increase in the direction towards the circumferential edge of the second clamping body 76, i.e. in the direction in which the arrow r points.

[0080] The deformable member 77, measured in axial direction, i.e. the direction in which the arrow z points, between the sloping first surface 49 and the sloping second surface 74 from the center opening 40 towards the outer edge or circumference wall 72 thereof, may have a constant thickness.

[0081] When compressing the deformable member 77 by moving the first and second clamping body 55, 76 towards each other by the clamping means 25, 26, the deformable member 77 will be deflected in the axial direction, in which the arrow z points, and will expand radially, in the direction in which the arrow r points. Accordingly, the inner surface 12 of the hole or opening 11 will be firmly engaged by the deflected and expanded circumference wall 72 of the disc-shaped deformable member 77, in the manner as explained above with reference

to Figs. 1-6.

[0082] Fig. 8 shows a still another example of the closure device according to the invention comprising a sealing assembly 83, having a disc-shaped, more particularly a ring-shaped deformable member 87, having a center opening 40, a flat or essentially or substantially flat first surface 43, a sloping second surface 74, and an edge or circumferential wall 82. The deformable member 77, which is shown in its non-compressed state, is placed between a first and second clamping body 35, 76 which are oppositely positioned in a spaced parallel relationship and has a reduced thickness towards its outer circumference 82.

[0083] In the example of Fig. 8 as shown, the first clamping body 35 is dimensioned and shaped as shown and described with reference to Fig. 4, and the second clamping body is dimensioned and shaped as shown and described with reference to Fig. 7.

[0084] When compressing the deformable member 87 by moving the first and second clamping body 35, 76 towards each other by the clamping means 25, 26, the deformable member 87 will be deflected in the axial direction, in which the arrow z points, and will expand radially, in the direction in which the arrow r points. Accordingly, the inner surface 12 of the hole or opening 11 will be firmly engaged by the deflected and expanded circumference wall 82 of the disc-shaped deformable member 87, as explained above with reference to Figs. 1-7.

[0085] Fig. 9 shows a closure device in an alternative example of the invention, having a sealing assembly 93 comprised of a first clamping body 95, a second clamping body 36, which are oppositely positioned in a spaced parallel relationship, and a flat or essentially or substantially flat disc-shaped, more particularly a ring-shaped deformable member 37. The ring-shaped deformable member 37, the second clamping body 36 and the first clamping body 95, except the first clamping surface 98 thereof, are similarly shaped and designed as the second clamping body 35, the deformable member 37 and the first clamping body 35 shown in Fig. 4.

[0086] The radial expansion of the deformable member 37, when moving the first and second clamping body 95, 36 towards each other, is advanced with respect to the examples of the sealing assemblies discussed and shown above in Figs. 4-8, by having an asymmetrically shaped first clamping surface 98 of the first clamping body 95. That is, by reducing the distance between the first clamping surface 98 of the first clamping body 95 and the opposite first surface 43 of the deformable member 37 over a length r2 from the disc-shaped center part 41 of the first clamping body 95 measured in outward radial direction r.

[0087] The distance between the first clamping surface 98 of the first clamping body 95 and the first surface 43 of the deformable member may even reduce to zero at the center part 41 of the first clamping body.

[0088] In the example of the closure device shown in Fig. 9, when compressing the deformable member 37 by moving the first and second clamping body 95, 36 towards each other by the clamping means 25, 26, the deformable member 37 will start sooner to expand in outward radial direction compared to the example of the closure device shown in Fig. 4, thereby further improving the clamping performances of the sealing assembly 93 in a hole 11 of a structure 10, for example.

[0089] Although not explicitly shown, It will be appreciated that a reduction in the distance between the first clamping surface of the first clamping body and the opposite first surface of the deformable member at or near the center part of the first clamping body may also be achieved by locally increasing the thickness of the deformable member instead of adapting the first clamping surface of the first clamping body.

[0090] Those skilled in the art will appreciate that if a deflection of the deformable member is required in a direction opposite in which the arrow z points, contrary to the examples shown in the Figs. 1-9, the first and second clamping surfaces and/or the first and second surfaces of the deformable member, whenever applicable, may be interchanged. Those skilled in the art will likewise appreciate that the clamping surfaces and deformable members disclosed with the several examples may be interchanged and combined to provide a desired deflection of the deformable member in a desired direction when in its compressed state.

[0091] Although in the examples above a single clamping means in the form of a single bolt and nut are shown, those skilled in the art will appreciate that more than one, for example three, tangentially spaced bolt and nut clamping means may be used, for tighten or compressing a deformable member. This to even more precisely control the compression and deflection of a deformable member, for example. Instead of using a bolt and nut, the threaded joint may be arranged such that the second clamping body, for example, comprises a threaded bus for receiving a bolt inserted from the first clamping body, for example.

[0092] The elastic sealing material from which the deformable member is made can be selected in dependence on its intended use, for example an oil or fuel-resistant rubber for sealing holes in floors of workshops, such as motorcar repair shops, petrol stations and the like. Of course also other applications and sealing materials which are adapted thereto are conceivable.

[0093] The first and second clamping bodies and the cover plate are massive plate-shaped bodies, such that same will be sufficiently capable of providing the compression force required and for withstanding loads or forces by shovels or wheels of cars, lorries and the like.

[0094] In an embodiment of the invention the cover plate, the clamping bodies and the tightening bolt and nut are made of stainless steel, or aluminium, for example, in order to provide a high-quality seal, for example in aggressive environments. It will be apparent to those skilled in the art that also suitable plastic materials or composite materials may be used for this purpose, with

this understanding that the mechanical and/or chemical loads which are expected to be exerted on the closure device in its mounted condition will have to be taken into account in that case.

[0095] As is clearly shown in Fig. 4, the cover plate 46 comprises a gradually flattened portion on its outwardly facing edge, which extends over some distance towards its circumferential edge. The figure shows a gradual rounding along a radius of curvature which may be in the order of the radius of the plate-shaped cover plate 46. Due to the deflection of the deformable member 17, 37, 47 in axial direction of a hole or opening 11, 31, the cover plate 46 strongly fits to or attaches the surface of the floor or wall surrounding the opening 11, 31, such that in many applications no additional sealing between the cover plate 46 and the surface of the floor or wall needs to be provided, such as a rubber ring or flap. When the closure device is mounted in a floor, for example, in this way a practically stepless transition between the cover plate 46 and the surface of the floor is obtained which will effectively prevent the closure device from being grabbed, for example, via the profile of the tires of wheels of shovels, cars and lorries rolling over the cover plate 46.

[0096] A typical use of the closure device according to the invention is for a temporarily or permanently fluid-tight closing of an opening in a company service floor or platform, such as a floor or platform of a petrol station, a motorcar repair shop, a chemical or other industrial location or site, a parking space floor and many others. For example openings provided for soil, soil air and/or soil water monitoring and inspection of leaks in the floor, such as disclosed by European patent application EP 0 979 330. The closure device is not limited, however, to this use and may be applied for closing openings in swimming pools, barrels, clean-rooms, and the like.

Claims

1. A closure device for closing an opening (11; 31) in a structure (10; 30), such as an opening in a wall or floor, said closure device having a sealing assembly (13; 33; 53; 63; 73; 83; 93) comprising:

   - a first clamping body (15; 35; 55; 95) having a first clamping surface (18; 38; 48; 98) and a second clamping body (16; 36; 76) having a second clamping surface (19; 39; 79), said first and second clamping body being oppositely spaced,
   - a deformable member (17; 37; 47; 77; 87) of sealing material, placed between said first and second clamping surface of said oppositely spaced first and second clamping body, and arranged for circumferentially engaging an inner surface (12; 32) of said opening (11; 31), and
   - clamping means (25, 26; 56, 26) arranged for moving said first and second clamping body in a direction (z) relative to each other, for exerting a compression force on said deformable member by said first and second clamping surface when said first and second clamping body are moved towards each other, thereby expanding said deformable member in a direction transverse (r) to said moving direction (z) of said first and second clamping body for engaging said inner surface of said opening, **characterized in that** said deformable member (17; 37; 47; 77; 87) is disc-shaped, said first (18; 38; 48; 98) and second clamping surface (19; 39; 79) of said first (15; 35; 55; 95) and second clamping body (16; 36; 76) and said deformable member are shaped providing an increased distance between said first clamping surface (18; 38; 48; 98) and an opposite first surface (20; 43; 49) of said deformable member in inward radial direction thereof, and providing an increased distance between said second clamping surface (19; 39; 79) and an opposite second surface (21; 44; 74) of said deformable member in outward radial direction thereof, for deflecting said deformable member along said moving direction (z) of said first and second clamping body when exerting said compression force on said deformable member.

2. The closure device according to claim 1, wherein said deformable member (17; 37) having a flat or substantially flat first (20; 43) and second surface (21; 44), said first clamping body (15; 35; 95) comprising a sloping first clamping surface (18; 38; 98) providing an increased distance with respect to said first surface (20; 43) of said deformable member in inward radial direction thereof, and said second clamping body (16; 36) comprising a sloping second clamping surface (19; 39) providing an increased distance with respect to said second surface (21; 44) of said deformable member in outward radial direction thereof.

3. The closure device according to claim 1, wherein said deformable member (87) having a flat or substantially flat first surface (43) and a sloping second surface (74) such that said deformable member having a reduced thickness towards its outer circumference (82), said first clamping body (35) comprising a sloping first clamping surface (38) providing an increased distance with respect to said first surface (43) of said deformable member in inward radial direction thereof, and said second clamping body (76) comprising a flat or substantially flat second clamping surface (79) providing an increased distance with respect to said second surface (74) of said deformable member in outward radial direction thereof.

4. The closure device according to claim 2 or 3, wherein said first clamping surface (38) starts sloping at a

distance (r1) from an outer circumferential edge (45; 82) of said deformable member (37; 87).

5. The closure device according to claim 1, wherein said deformable member (47) having a flat or substantially flat second surface (44) and a sloping first surface (49) such that said deformable member having an increased thickness towards its outer circumference (52), said first clamping body (55) comprising a flat or substantially flat first clamping surface (48) and said second clamping body (36) comprising a sloping second clamping surface (39) providing an increased distance with respect to said second surface (44) of said deformable member in outward radial direction thereof.

6. The closure device according to claim 1, wherein said deformable member (77) having a slopping first (49) and second surface (74) such that said deformable member having a substantially constant thickness, said first (55) and second clamping body (76) comprising a flat or substantially flat first (48) and second clamping surface (79), said deformable member being positioned between said first and second clamping surfaces providing an increased distance between said first clamping surface (48) and said second surface (49) of said deformable member in inward radial direction thereof, and providing an increased distance between said second clamping surface (79) and said second surface (74) of said deformable member in outward radial direction thereof.

7. The closure device according to any of the claims 2, 3, 4, 5 or 6, wherein a sloping surface is any of a continuously or discontinuously sloping surface.

8. The closure device according to any of the previous claims, wherein said deformable member (37; 47; 77; 87) is ring-shaped having a center opening (40), wherein said first (35; 55; 95) and second clamping body (36; 76) comprises a disc-shaped center part (41; 42) received in said center opening (40) of said deformable member (37; 47; 77; 87), and wherein at least one of said first (38; 48; 98) and second clamping surface (39; 79) is formed by part of said first and second clamping body extending radially outwardly from said disc-shaped center part (41; 42).

9. The closure device according to claim 8, comprising a reduced distance between said first clamping surface (98) of said first clamping body (95) and said opposite first surface (43) of said deformable member (37) over a length (r2) from said disc-shaped center part (41) of said first clamping body (95) in outward radial direction of said deformable member (37).

10. The closure device according to any of the previous claims, comprising a stacked sealing assembly (63) of at least two oppositely positioned sealing assemblies (13; 33; 53; 63; 73; 83; 93) comprised of an oppositely spaced first and second clamping body, a deformable member of sealing material and clamping means (26, 56), wherein said clamping means are integral for said stacked sealing assembly (63).

11. The closure device according to claim 10, wherein said second clamping body of a first assembly and said first clamping body of an oppositely positioned second assembly are integral (50) comprising a second clamping surface engaging said deformable member of said first assembly and a first clamping surface engaging said deformable member of said second assembly.

12. The closure device according to any of the previous claims, wherein said clamping means (25, 26; 56, 26) comprise threaded joint means extending through said spaced first and second clamping body and said deformable member for moving said first and second clamping body relative to each other by operating said threaded joint means, such as threaded joint means comprising a bolt and nut joint, wherein said bolt is fixedly connected to one of said first and second clamping body and said nut is received in a recess (28) of a surface of said other of said first and second clamping body opposite said clamping surface thereof.

13. The closure device according to any of the previous claims, comprising a substantially disc-shaped sealing assembly of a first and second clamping body and a deformable member, having dimensions such that said deformable member in its compressed state extends in outward radial direction of said disc-shaped sealing assembly beyond said first and second clamping body.

14. The closure device according to any of the claims 1 - 12, comprising a substantially disc-shaped sealing assembly of a first and second clamping body and a deformable member, wherein said second body having dimensions such that said deformable member in compressed state thereof extends in outward radial direction of said disc-shaped sealing assembly beyond said second clamping body and said first body having dimensions extending in outward radial direction of said disc-shaped sealing assembly beyond said deformable member in a compressed state thereof.

15. Use of the closure device according to any of the previous claims for closing an opening in a company service floor, in particular a floor of a petrol station, a floor of a motorcar repair shop, a floor at a chemical

or other industrial location or site, and a parking floor.

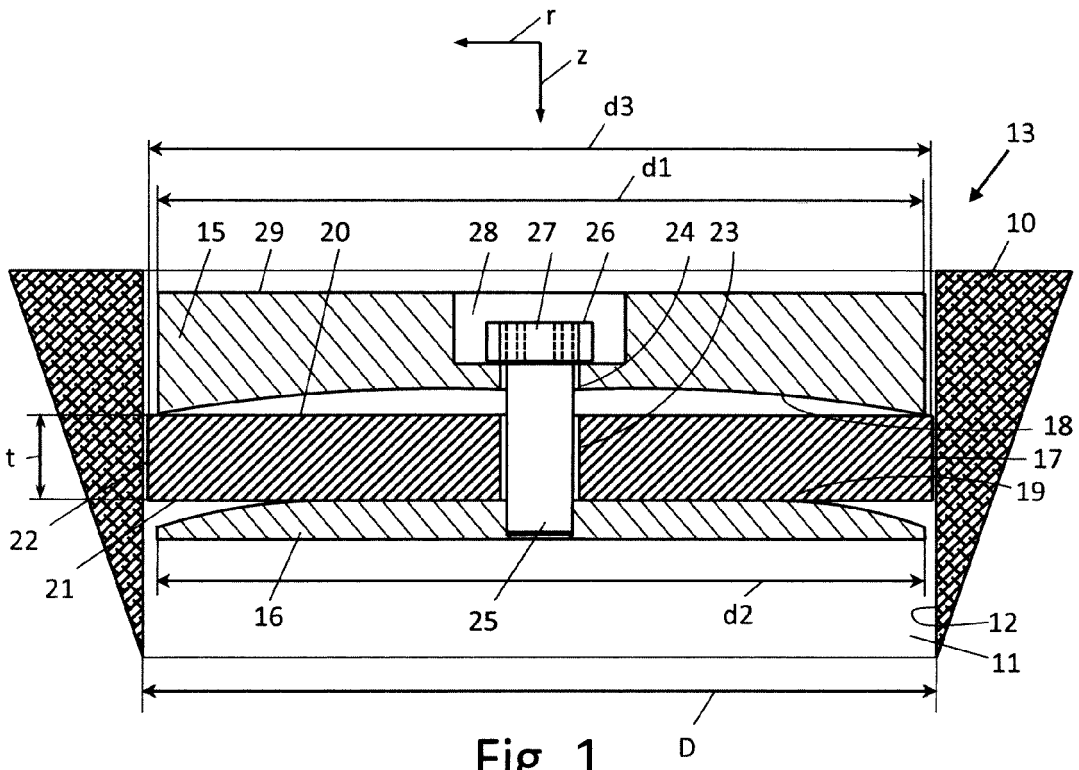
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Fig. 1

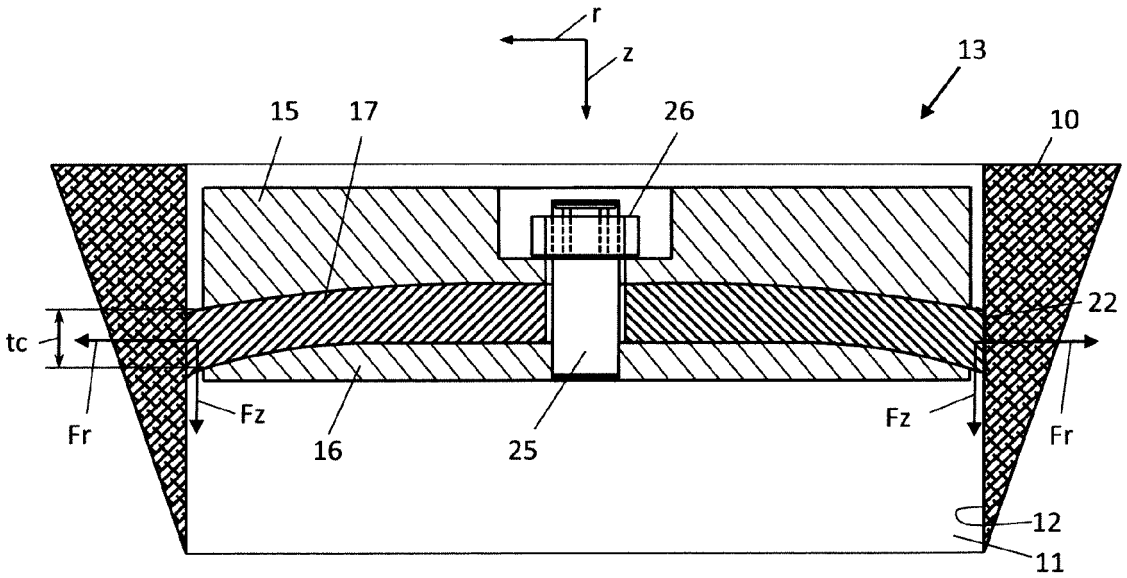
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Fig. 2

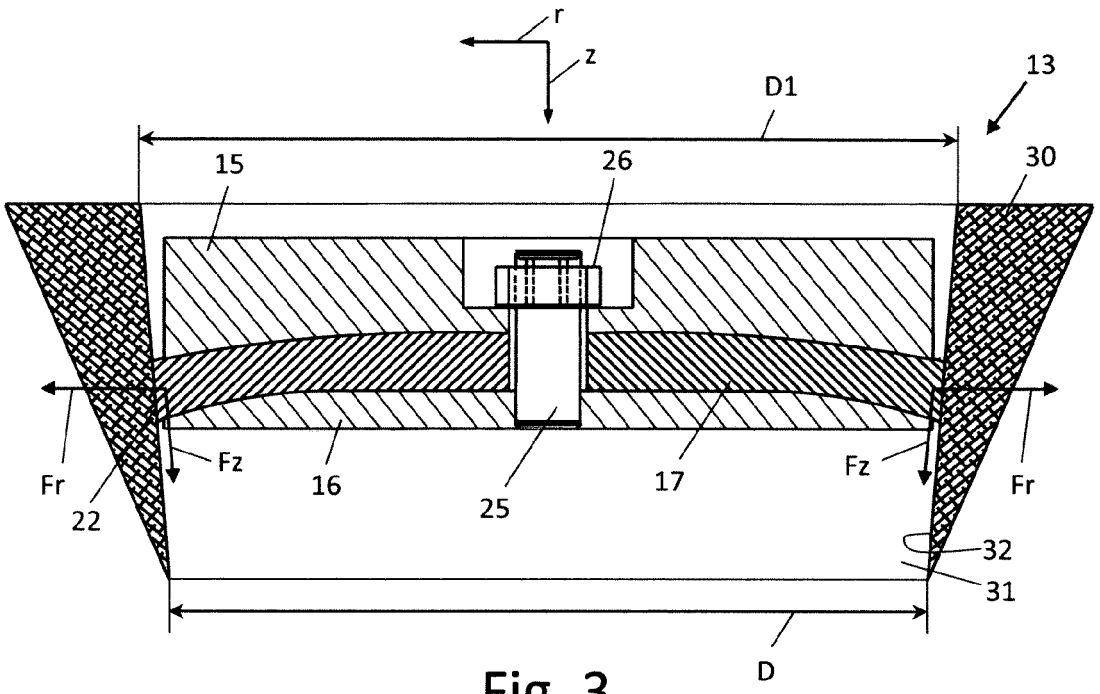
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Fig. 3

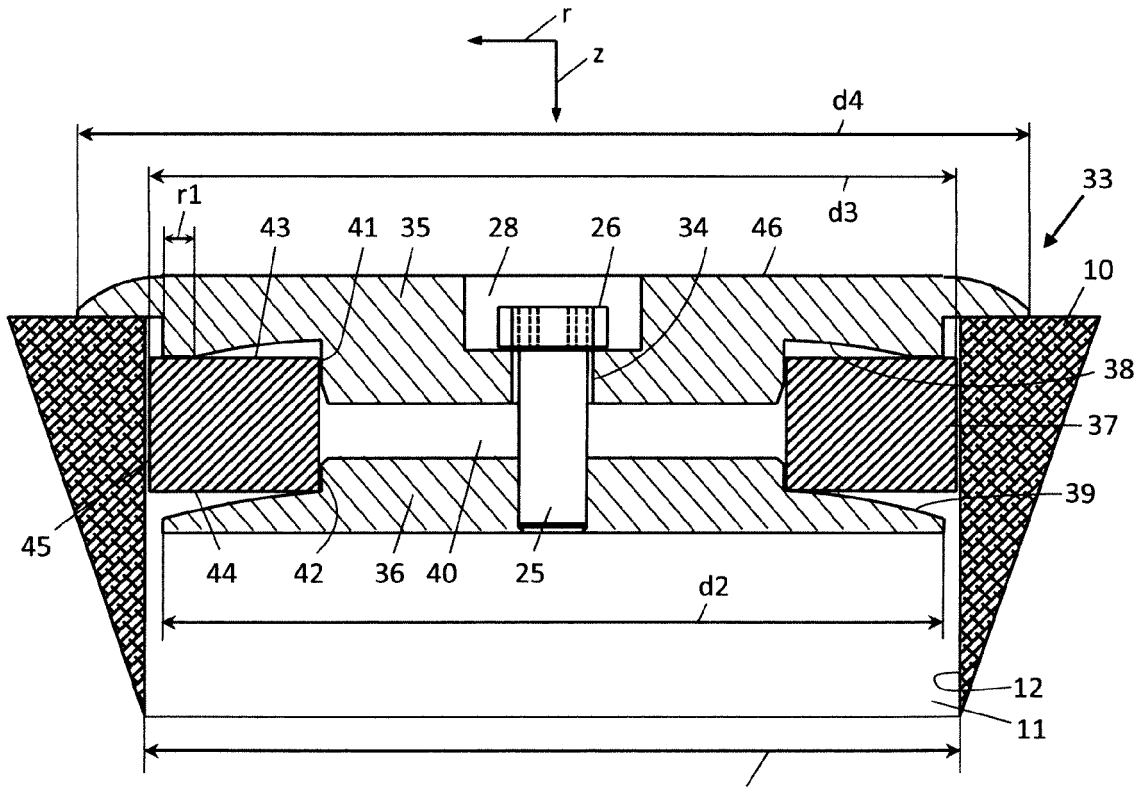
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Fig. 4

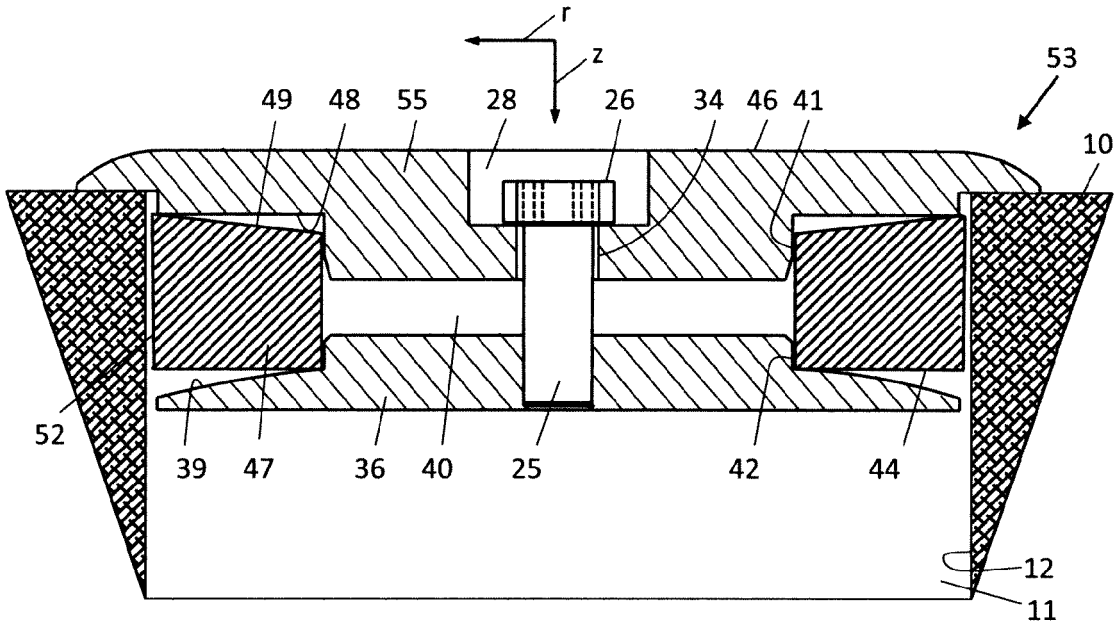
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Fig. 5

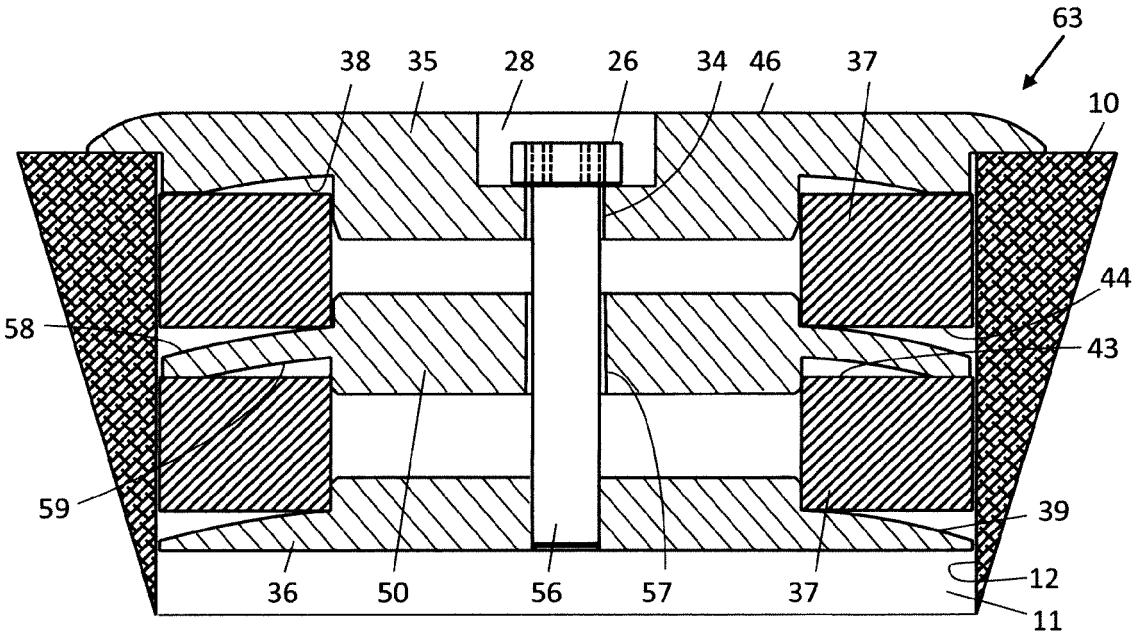
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Fig. 6

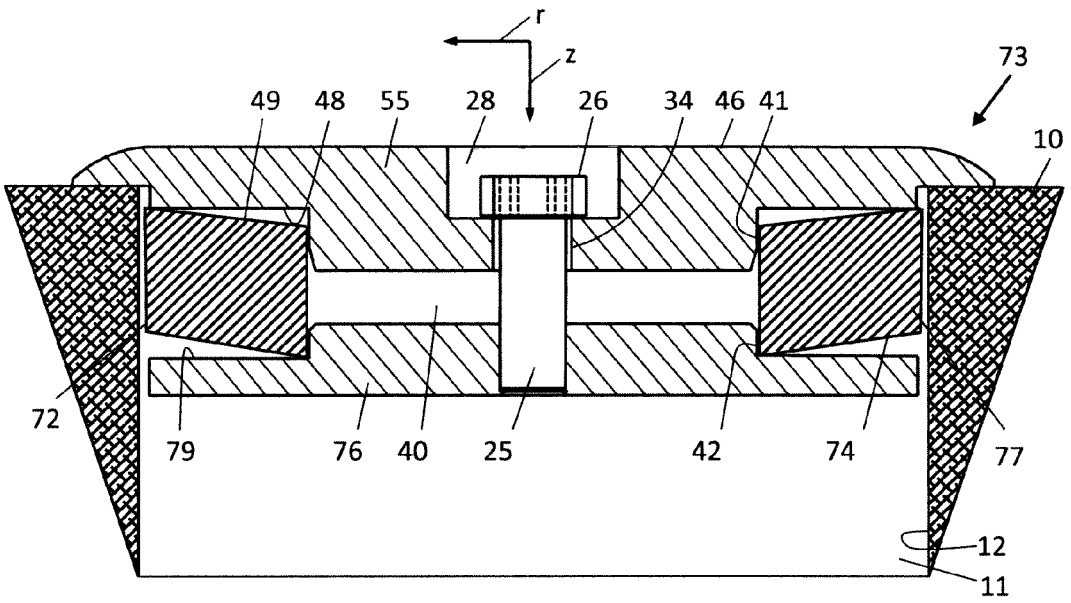
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Fig. 7

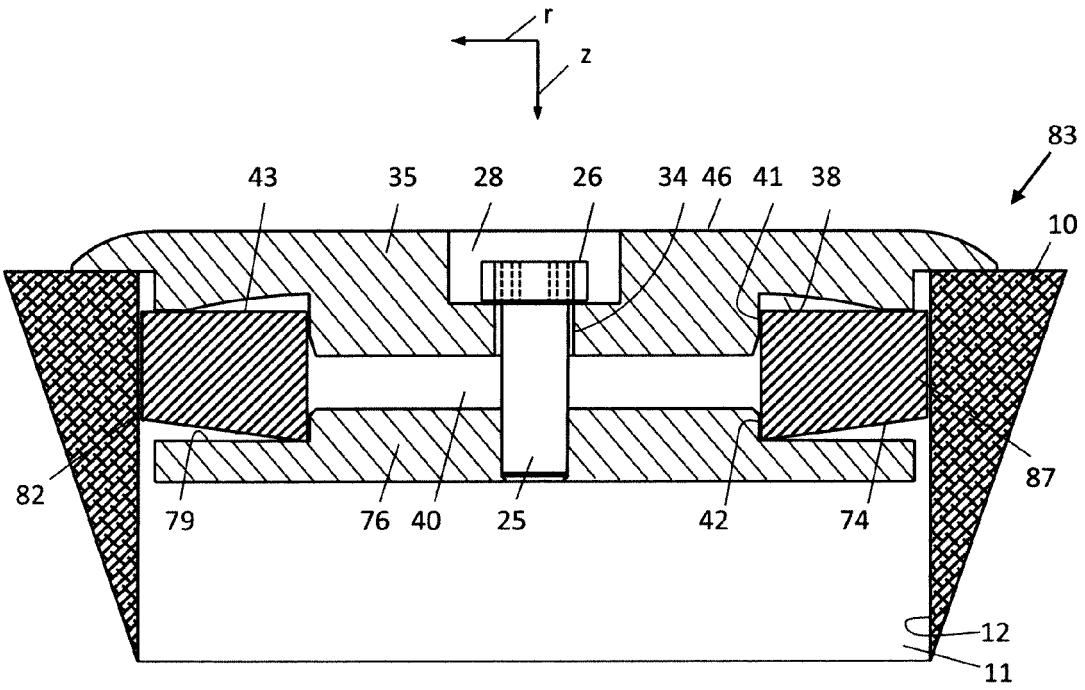
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Fig. 8

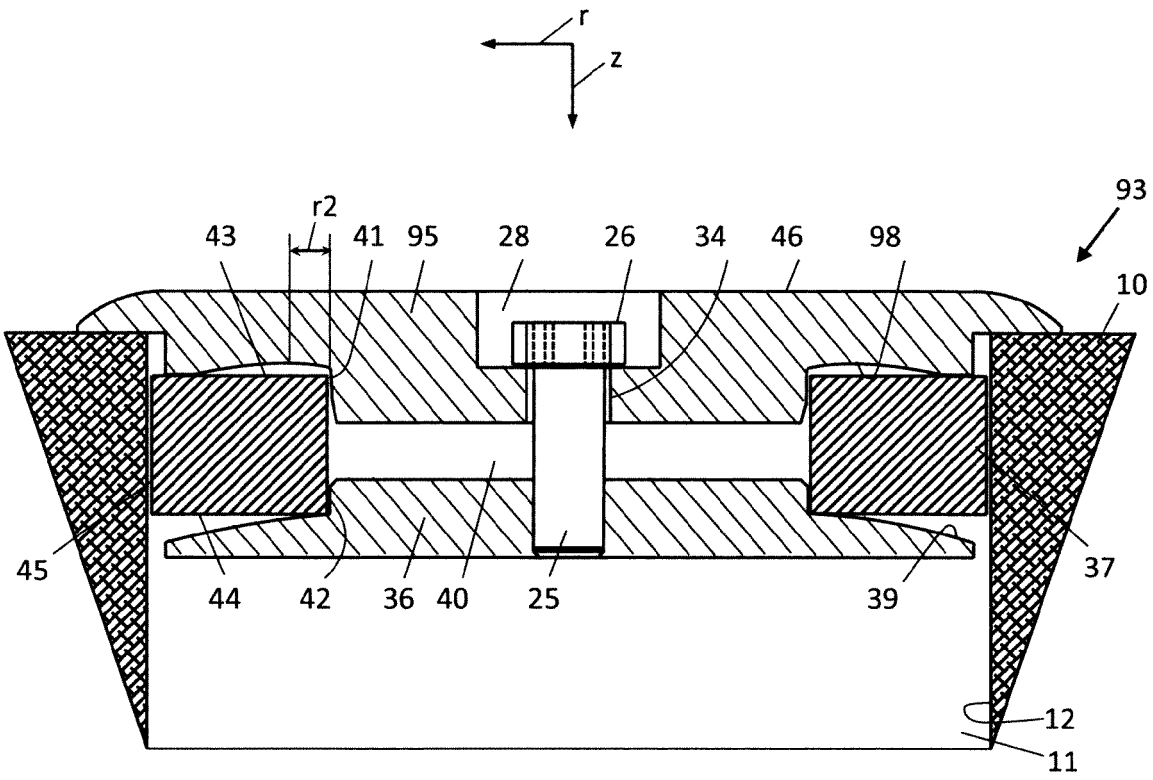

Fig. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 14 00 0148

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	EP 1 122 366 A1 (ZEVEN SON B V DE [NL]) 8 August 2001 (2001-08-08) * the whole document * -----	1-15	INV. E02D29/14
			TECHNICAL FIELDS SEARCHED (IPC)
			E02D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	21 May 2014	Geiger, Harald

CATEGORY OF CITED DOCUMENTS

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21-05-2014

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		DE 60109071 D1	07-04-2005
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REFERENCES CITED IN THE DESCRIPTION

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