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(54) STABILIZING DEVICE FOR A FURNITURE

(57) Stabilizing device (1) for furniture, to be arranged between a support of the furniture and a surface. The stabilizing device (1) comprises a cylinder (10) which walls (11, 12, 13) define a closed reservoir (15), a piston (20), having a piston head (21) arranged in the cylinder (10) and a piston rod (22) having a first end (22a) connected to the piston head (21) and a second end (22b) for connection to the support of the furniture, the piston head (21) being movable between first and second end walls (11, 12) of the cylinder (10). The stabilizing device (1) further comprises a fluid (40) arranged in the reservoir (15), a spring (50) arranged between the first end wall (11) and the piston head (21), wherein a gap (60) is arranged between at least a part of a circumference (23) of the piston head (21) and a sidewall (13) of the cylinder (10), such as the fluid (40) may flow past the piston head (21) when it moves within the reservoir (15).

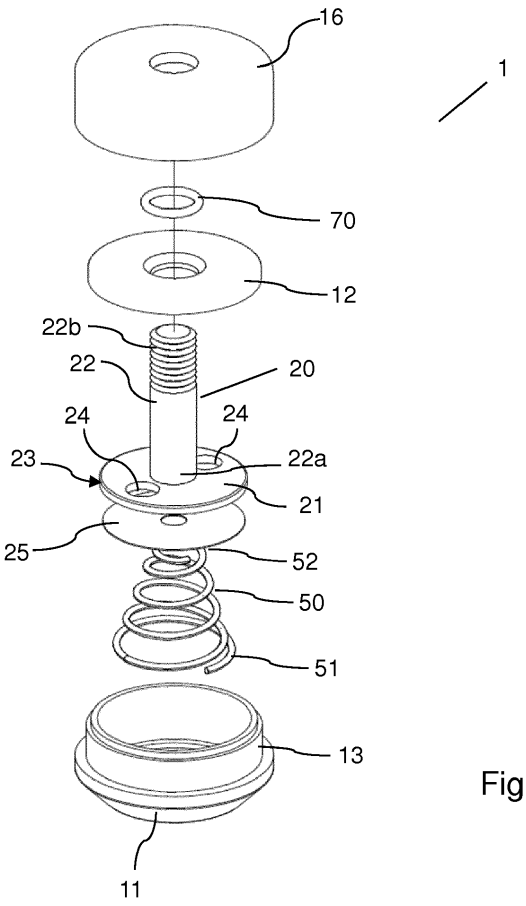

Fig. 1

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Description

Technical field

[0001] The invention considers a self-adjusting stabilizing device for use at a furniture such as a table, to eliminate an eventual gap between a leg end or a foot member of the furniture and a substrate such as a floor. By the inventive stabilizing device, an automatic stabilizing function of the furniture is achieved relative the substrate, when using the stabilizing device in one position of the object, for example at one of the legs or at one foot of a table.

Background art

[0002] A common problem when positioning an object on a substrate is how to eliminate the gap that occurs when the substrate is uneven. Below, this will be exemplified by positioning of tables with four contact points on an uneven floor. It's a known phenomenon that tables may not be steadily positioned on uneven floors and to avoid this, the legs of the table are length-adjustable or have length-adjustable foot members. These normally are adjusted manually to obtain contact between the leg/foot and the floor at all four positions, and by that the irregularities of the floor are taken care of by eliminating the play between the floor and the foot or leg. At a restaurant or a café, the tables are repositioned all the time, for example when cleaning the floor or rearranging the tables to fit the number of guests at an "individual" table. When an already adjusted table is repositioned from its position with no play between the floor and the foot member, to another location, the table often again is unstable, unless the floor is totally flat. It is inconvenient for the guests to take care of the problem their self, and it is also difficult for the personnel of the restaurant or the café to fix the problem swiftly, since it is rather time-consuming to adjust the legs or the feet of the table. As a consequence, the problem is taken care of by rapidly put a napkin or the like under one or two of the legs, which is not a very nice solution.

[0003] To take care of the problem, a number of solutions have been introduced on the market.

[0004] A known method relates to a so-called cross-foot tables, typically with one central pillar, which is arranged between the table top and the foot part and where the foot part looks like a cross (or a plus-sign). The foot part (cross-foot) may be divided into two parts, where two opposite feet forms a unit and where one of the intersecting parts comprises an adjustable pair of feet, which can be brought into contact with the substrate and locked in this position. This solution works well and works extra well when the substrate is very uneven. However, it is an expensive solution where the construction incorporates the entire table stand and this solution cannot be adapted to existing tables.

[0005] Another solution comprises four adjustable feet, interconnected by hydraulic coupling hoses. By pressing the table downwards, all four feet gets contact with the floor without a play, and on top of this, the level of the table may be adjusted to be horizontal. This is a very expensive solution since it incorporates the entire table stand and is not possible to apply on existing tables.

[0006] A third solution is a hydraulically adjustable foot, which has a built-in piston that divides a cylinder into two parts. The piston can move in the cylinder about 6 mm by two valves built into the piston. A liquid present in the cylinder flows between the space above and below the piston when the table top is subjected to pressure, as the two valves are affected by the liquid pressure. In addition to eliminating the play, the solution also allows two tables to align so that two adjacent table edges of two tables can be positioned at the same level. The hydraulic foot consists of many parts and seals and has a large built-in dimension in combination with a small adjustment height/stroke length.

[0007] To be able to provide existing tables with a set of adjustable feet, or a set where only one of the four feet needs to be automatically adjusted, in order to eliminate play between the floor and the foot, normally requires that all the tables in the restaurant or café is equipped in this way, to be able to reorganize the table layout. When the table height is affected when changing the adjustable feet, it is of the utmost importance to have such a low adjustment foot as possible, otherwise the table tops may become uncomfortable to sit at (i.e. too high). The combination of low price, low building height and large adjustment range is desirable.

Summary of the invention

[0008] It is an object of the invention to address at least some of the problems and issues outlined above. It is possible to achieve these objects and others by using a stabilizing device as defined in the attached independent claims.

[0009] According to an aspect of the invention, a stabilizing device for a furniture is disclosed, which stabilizing device is to be arranged between a support of the furniture and a surface on which the furniture is standing. The stabilizing device comprises a cylinder with a first end wall, a second end wall which is arranged opposite the first end wall, and a sidewall which extends between the first and second end walls. The walls of the cylinder define a closed reservoir. Further the stabilizing device comprise a piston which has a piston head arranged in the cylinder and a piston rod with a first end connected to the piston head and a second end for connection to the support of the furniture. The piston head is movable between the first and second end wall of the cylinder. Further, a fluid is arranged in the reservoir and a spring is arranged between the first end wall and the piston head. The reservoir is not divided into two separate chambers as in prior art because a gap is arranged between at least a part of a circumference of the piston

head and the sidewall of the cylinder, such as the fluid within the reservoir may flow past the piston head when the piston head moves within the reservoir.

[0010] Such an arrangement is completely self-adjusting which is an advantage for solving the issues outlined above. If the stabilizing device is mounted at for example one of four supports (feet) of a table and the rest are fixed feet, the self-adjusting function makes all feet (the three fixed feet and the self-adjusting one) come into contact with the floor and prevents the table from wiggling. The self-adjusting stabilizing device adapts its height to the same level as a common plane of the three fixed feet. If the foot or leg that comprises the stabilizing device has a gap beneath it, that is between the floor and for example the foot, for example when the table is moved to a new position, typically a pair of two opposite feet have contact with the floor and thus the weight of the table acts on this pair of feet, while the other pair of two opposite feet (transverse the first pair and including the foot with the stabilizing device) have one foot just in contact with the floor and the other "in the air". When this happens, the stabilizing device expands because of that the spring-force is acting on the piston head of the stabilizing device and the fluid in the reservoir passes the piston head at the same time. In the opposite scenario, when the foot or leg that comprises the stabilizing device after movement of the table, lands on a higher level than before, the pair with the foot including the stabilizing device and the opposite foot both has contact with the floor, while in the other pair only one foot has floor contact and the other has a gap beneath it. When this happens, the force from the weight of the table acts on the stabilizing device and starts to compress it, and the fluid slowly passes the piston via the gap between the piston head and the wall, and the stabilizing device slowly is compressed and all four feet automatically get contact with the floor after some moments. By this, a simple, cost efficient and fully self-adjusting function for the furniture is achieved, wherein the stabilizing device also is retrofittable on a furniture. A far better solution compared to prior art is thereby achieved.

[0011] According to an embodiment, the gap extends along the entire circumference of the piston head, such as there is no contact between the piston head and the sidewall of the cylinder. By that, there is no friction between the piston head and the sidewall of the cylinder, why the spring doesn't need to overcome also the friction force between the piston head and the sidewall. The solution has very low total friction which enables the self-adjusting function.

[0012] According to an embodiment, the piston head comprises at least one trough hole, and further a unidirectional valve is arranged at the at least one through hole, wherein the unidirectional valve is arranged to open for fluid flow through the at least one through hole when the piston head moves within the reservoir upon a spring force of the spring. This means that the fluid may pass the piston head both at the gap at the circumference of the piston head and the sidewall as well as through the at least one, but preferably two opposite, through hole/holes when the spring force is activated. As said above, this scenario occurs when there suddenly arises a gap beneath the foot/support with the stabilizing device and the substrate (floor), since there is no or low weight on this foot/support. Since it is a unidirectional wall, it is closed for fluid flow when the piston head moves in the opposite direction, which means that when the stabilizing device is compressed, the fluid only flows through the gap at the circumference of the piston head and the sidewall. Thereby the stabilizing device acts quickly in the expanding direction and slower in the compressing direction.

[0013] According to an embodiment, the unidirectional valve is a flexible sheet arranged at a first side of the piston head which first side faces the spring. The flexible sheet is preferably a thin sheet metal which is flexible due to that it is thin. When the spring forces the piston head to move, the fluid on the other side of the piston head must evacuate from this part of the reservoir because of the movement of the piston head. This causes a pressure on the flexible sheet at the through hole/holes wherein the flexile sheet is bent such as the through hole/holes opens for fluid flow. The fluid may pass quickly through the through holes why a quick movement of the piston head is possible compared to if only the gap is open for fluid flow. When the piston head moves in the opposite direction, such as the spring is compressed, the fluid on the spring side of the piston head will press the flexible sheet towards the piston head wherein the through hole is closed/sealed. The only possible fluid flow in this direction is through the gap between the sidewalls and the outer edge of the piston head. A flexible sheet is a very simple valve with few parts and thereby a far more cost efficient solution for providing a unidirectional valve compared to prior art solutions.

[0014] According to an embodiment, the fluid is a gel. A gel is per definition a bit viscous which is an advantage since it slows down the movement of the piston head within the cylinder. The viscosity of the gel is tested and chosen to fit the wanted function of the stabilizing device. In the compressing direction, the fluid only may pass the gap as explained above, which means a slow movement of the piston head, which is positive since low speed means less resistance caused by "friction" between the fluid and surrounding surfaces when passing the gap, as well as any friction around the piston rod and its surrounding surfaces. In the other direction - the expanding direction of the stabilizing device, the gel may anyhow pass the piston head quickly, due to the open valve which allows fluid flow through the open through hole of the piston head.

[0015] According to an embodiment, the spring is a conical wire spring, which is conical from a wide first end towards a narrower second end, wherein the conical wire spring is compressible such as when the spring is fully compressed, the height of the spring is the substantially

the same as a wire diameter of the spring. This enables very low total height of the complete stabilizing device, since the spring in its compressed state is completely flat or very near flat. When the spring is compressed, every turn of the wire, from the widest first end towards the narrower second end, falls inside the diameter of the former turn of the wire, wherein the narrowest second end is positioned in the center when the spring is compressed. Thereby, the use of a spring doesn't affect the height much at all.

[0016] According to an embodiment, the piston head is a plate which is thin compared to the available height of the reservoir, preferably the thickness of the plate is maximum 20% of the available height of the reservoir. To use a thin plate as a piston head instead of a "normal" piston head, the total height of the stabilizing device is kept very low. Further, the possible friction, when fluid passes the piston head via the gap around the circumference and the sidewalls, is kept very low, since the piston head/the plate is very thin. More preferred, the height is much lower than 20% of the available height of the reservoir. The stabilizing device has thereby very low total height compared to prior art solutions.

[0017] According to an embodiment, the first end wall comprises a recess arranged to accommodate the spring in its compressed state. The first end wall is the end wall on the spring-side of the piston head and by that the first end wall comprises a recess, which is arranged to totally accommodate the spring in its compressed state, the use of a spring doesn't effect the height of the stabilizing device at all. Further, the recess provides a fixed position of the wide first end of the spring, preferably centered in first end wall and by that in the cylinder. Since the spring is conical from the wide first end towards the narrower second end, the second end abuts the spring-faced side of the piston head at its center. Thus, the force of the spring acts centric on the piston head which is positive for the movement of the same within the cylinder.

[0018] According to an embodiment, the piston head comprises a centrally arranged through hole, and the piston rod comprises a gudgeon pin part at the first end of the piston rod. The gudgeon pin part is adopted to be fixedly fit into the centrally arranged through hole of the piston head. Further, the unidirectional valve i.e. the flexible sheet is fixedly fit to the gudgeon pin part, preferably by that the flexible sheet has a centrally positioned hole arranged for the gudgeon pin part. Yet another function of the gudgeon pin part is to guide the second end of the spring, which second end is arranged to enclose the gudgeon pin part and by that the spring is guided by the gudgeon pin part.

[0019] According to an embodiment, the spring is fixedly attached with its second end to the gudgeon pin part. This means that the spring is not only guided by the gudgeon pin part but also fixed to it.

[0020] According to an embodiment, the flexible sheet is pressed to the first side of the piston head by the spring force of the spring. This means that the flexible sheet (the unidirectional valve) is kept in place with its center towards the piston head, since the spring presses the flexible sheet with the narrower second end of the conical spring. Thus, the flexible sheet always has contact/is pressed towards the piston head at the center, but still the flexible sheet has the possibility to flex since the spring is narrow near the flexible sheet and wider at the first end, at a distance from the flexible sheet. This is a simple and cost-efficient solution with few parts.

[0021] According to an embodiment, the piston rod extends through the second end wall of the cylinder, and the second end wall of the cylinder comprises a seal, which is arranged to seal between piston rod and the second end wall, for preventing leakage of the fluid from the reservoir. Since the piston head moves within the cylinder with no contact with the sidewalls of the cylinder, the only friction between the moving piston including piston head and piston rod and surrounding surfaces, is the friction between the seal and the piston rod. Friction only at one place means very low total friction when the piston moves between expanded and compressed state and vice versa. And further, since a gel is used, the movement during compression is slow which means less resistance when the fluid passes the piston head via the gap, which also is positive and enables the use of a spring with low spring force, i.e. a quite "weak" spring like a conical wire spring. Further, the use of a gel in the reservoir also lubricates the piston rod, and the piston rod has a smooth surface which contributes to low friction.

[0022] According to an embodiment, the first end wall and the sidewall of the cylinder is one part, and the second end wall is fixedly attached to the sidewall by snap connection. Preferably the first end wall and the sidewall of the cylinder is made of plastic or metal produced in one piece (like a bowl), there is no risk of leakage between the first end wall and the sidewall. And by that the second end wall and the sidewalls of this bowl-like part is arranged for snap connection between them, it is easy to fill the reservoir with fluid (gel) and to seal the reservoir by snapping the second end wall to the sidewall. The snap connection works like a seal which is sufficiently tight to prevent leakage.

[0023] According to an embodiment, the a housing encloses at least an upper part of the sidewall and the second end wall of the cylinder, wherein the housing is arranged to be fixedly attached to the sidewall and further arranged to hold the sealing of the second end wall in position between the housing and the second end wall. The fixed connection between the housing and the sidewall may for example be done by press fit, snap, glue, thread etc.

[0024] According to another aspect, a furniture is disclosed, which comprises at least four supports for supporting the furniture on a surface on which the furniture is standing, and wherein at least one of the supports of the furniture comprises a stabilizing device according to any of the embodiments described above.

[0025] Further possible features and benefits of this

solution will become apparent from the detailed description below.

Brief description of drawings

[0026] The solution will now be described in more detail by means of exemplary embodiments and with reference to the accompanying drawings, in which:

Fig. 1 shows an exploded view of a stabilizing device according the invention.

Fig. 2 shows a section of the stabilizing device according to the invention in an expanded state.

Fig. 3 shows a section of the stabilizing device according to the invention in a compressed state.

Fig. 4 shows a perspective view of an underside of a so-called cross-foot of a table where the stabilizing device according to the invention is a foot and which foot replaces one of the four feet on the cross-foot.

Fig. 5 shows a perspective view of an underside of a so-called cross-foot of a table with an alternative assembly of the stabilizing device, where the stabilizing device is more or less an up-side-down foot like stabilizing device like the one of Fig. 4, which is recessed into one of the foot-members, to provide the possibility to use the same type of feet on all four positions.

Detailed description

[0027] Briefly described, a cost-efficient and well-functioning stabilizing device is provided that gives a self-adjusting function to a furniture or the like.

[0028] Fig. 1 shows an exploded view of a stabilizing device 1, which is to be arranged between a support of a furniture and a surface on which the furniture is standing, typically to be arranged between a foot or foot member and a floor. In the most preferred embodiment, the stabilizing device is a stabilizing foot, which is exemplified in Fig. 1-4, but also in Fig. 5, the same or very similar design may be used. Below the stabilizing device 1 is a stabilizing foot. The stabilizing device 1 comprises, from the bottom to the top in Fig. 1, a first end wall 11, a sidewall 13 which protrudes upwards from the first end wall 11, a spring 50 arranged between the first end wall 11 and a unidirectional valve 25. The unidirectional valve 25 is in the form of a flexible thin sheet metal disc 25, preferably only 0,1 mm thick. Then a piston head 21 with a circumference 23 and two through holes 24, arranged opposite each other for good balance of the piston head 21. The piston head 21 is fixedly attached to a first end 22a of a piston rod 22 which piston 22 has a second end 22b, distal from the first end 22a, which second end 22b comprises a thread for connection to a corresponding thread of for example an insert in a foot member or the like, for fixation of the stabilizing device 1 to a foot member of for example a table. Other connection possibilities than a thread connection is of course also possible. The piston head 21 and the piston rod 22 are parts of a complete piston 20. Above the piston 20 is a second end wall 12 visible, and the second end wall 12 comprises a recess in which a seal 70 is to be arranged. An enclosing housing 16 is arranged to enclose and cover the parts when assembled and further arranged to be fixed to the sidewalls 13/first end wall 11, see description below.

[0029] Fig. 2 shows a section of the stabilizing device 1 in an expanded state where the piston 20 is in a highest position such as a total height h of the stabilizing device 1 is the maximum height of the stabilizing device 1. Fig. 3 shows a section of the stabilizing device 1 in a compressed state where the piston 20 is in a lowermost position such as a total height h of the stabilizing device 1 is the minimum height of the stabilizing device 1.

[0030] The first end wall 11, the second end wall 12 and the sidewall 13 forms a cylinder 10 and as explained above, the walls 11, 12, 13 define a closed reservoir 15 and this reservoir is filled with a fluid 40 in the form of a gel. The gel 40 more or less fills the remaining volume of the reservoir 15 that is not occupied by the interior parts - piston head 21, piston rod 22 (part of), spring 50 and unidirectional valve 25. The first end wall 11 and the sidewall 13 of the cylinder 10 is formed as one single part, preferably made of plastic (the grey area of Fig. 2 and 3) and the second end wall 12 is fixedly attached to the sidewall 13 by snap connection. By this, it is easy to fill the reservoir 15 with gel 40 and to seal the reservoir 15 by snapping the second end wall 12 to the sidewall 13. The piston 20 comprises the piston head 21 and the piston rod 22, and the piston head 21 is arranged in the cylinder 10 and is movable between the first and second end walls 11, 12 of the cylinder 10 (compressed and expanded state), wherein the position of the piston head 21 within the reservoir 15 effects the total height h of the stabilizing device 1. As said above, the piston rod 22 is connected to the piston head 21 with its first end 22a and the second end 22b is arranged for connection to the support of the furniture, for example by a thread or the like. The piston rod 22 has a gudgeon pin part 22c, on which the piston head 21 is attached, by that the piston head 21 comprises a centrally arranged through hole which is adopted to be fixedly fitted to the gudgeon pin part 22c. The piston head 21 is actually a thin plate which thickness preferably is maximum 20% of the available height of the reservoir 15, to gain maximum stroke of the piston 20 despite a very low total height h of the stabilizing device 1. The piston rod 22 extends with its second end 22b through the second end wall 12 of the cylinder 10, and the second end wall 12 of the cylinder 10 has a recess which comprises a seal 70, which seal 70 is arranged to seal between piston rod 22 and the second end wall 12, such as the gel 40 does not leak from the reservoir 15. The piston rod 22 has in this area a very smooth finish

to minimize the friction between the seal 70 and the piston rod 22. To keep the seal 70 in place and to enclose the cylinder 10 with a nice outer shield, a housing 16 is arranged to enclose at least an upper part of the sidewall 13 and the second end wall 12 of the cylinder 10. The housing 16 is arranged to be fixedly attached to the sidewall 13 and as said arranged to hold the seal 70 of the second end wall 12 in position between the housing 16 and the second end wall 12. The fixed attachment between the housing 16 and the sidewall 13 may for example be done by press fit, snap, glue, thread etc.

[0031] The spring 50 is arranged between the first end wall 11 and the piston head 21, and the spring is a conical wire spring 50, which is conical from a wide first end 51 towards a narrower second end 52. The conical wire spring 50 is compressible such as when the spring 50 is fully compressed, the height of the spring 50 is the substantially the same as a wire diameter of the spring 50 (see Fig. 3). This is possible due to the conical shape wherein when the spring 50 is compressed, every turn of the wire, from the widest first end 51 towards the narrower second end 52, falls inside the diameter of the former turn of the wire, such as the narrowest second end 52 is positioned in the center when the spring 50 is compressed. To minimize the space needed for the spring 50 inside the reservoir 15, the first end wall 11 comprises a recess 14, which is arranged to accommodate the spring 50 in its compressed state. The recess 14 also provides a fixed position of the wide first end 51 of the spring 50, which is centered in first end wall 11 and the cylinder 10. The second end 52 of the spring 50 is attached to the gudgeon pin part 22c of the piston rod 22. Further, the unidirectional valve 25, i.e. the flexible sheet metal valve 25 is arranged with a central through hole (see Fig. 1) and is attached with the through hole around the gudgeon pin part 22c as well and thereby, the flexible sheet metal valve 25 is arranged such as the spring 50 abuts the spring-facing side of the flexible sheet metal valve 25, which is kept in place on a spring-facing first side 26 of the piston head 21 by the spring 50.

[0032] The unique design of the stabilizing device 1 further comprises a gap 60, arranged between the circumference 23 of the piston head 21 and the sidewall 13 of the cylinder 10, such as the fluid 40 within the reservoir 15 may flow past the piston head 21 when it moves within the reservoir 15. In other words, the reservoir 15 is one single cavity in which the piston head 21 is moveable without contact with the sidewalls 13. The piston head 21 comprises two though holes 24, arranged on opposite sides of the piston rod 22. When the weight from the furniture, on which the stabilizing device 1 is mounted, ceases, the force of the spring 50 pushes the piston head 21 towards the second end wall 12 and at the same time, when the piston head 21 is moving, the flexible sheet metal valve 25 bends in the opposite direction, because of the movement of the piston head 21 and that the gel 40 is slightly compressed on the other side of the piston head 21 and thereby obtains a small pressure which also acts for opening the flexible sheet metal valve 25. The dashed line in Fig. 2 shows the bent flexible sheet metal valve 25 during the movement of the piston head 21. A small amount of gel 40 may also pass the piston head 21 via the gap 60, but since the area of through holes 24 is much greater than the gap area, most of the gel 40 passes the through holes 24 and a rather rapid expansion of the stabilizing device 1 occurs.

[0033] When the weight from the furniture, on which one stabilizing device 1 is mounted, is applied on the stabilizing device 1, that is for example when the stabilizing device/foot 1 lands on an elevation (of the floor), the height h of the stabilizing device 1 slowly decreases until equilibrium occurs. When the force is applied on the piston 20/piston rod 22, the piston head 21 slowly moves towards the first end wall 11 because that the gel 40, which is viscous, has to pass the piston head 21 only at the gap 60, since the flexible sheet metal valve 25 either already is closed or directly closes due to the movement of the piston head 21 towards the compressed state. Also the force of the spring 50 acts against the movement. As seen in Fig. 3, the end position of the compressed state is reached, which happens if not the equilibrium occurs before this, and the spring 50 is totally compressed into the recess 14 in which also the gudgeon pin part 22c is accommodated. By that, the length of the stroke of the piston head 21 within the reservoir 15 is not affected by the spring 50 at all.

[0034] Fig. 4 shows a perspective view of an underside of a so-called cross-foot 100 of a furniture (table) where the stabilizing device 1 is a stabilizing foot 1 and which stabilizing foot 1 replaces one of the four feet 101 on the cross-foot 100. Typically, the stabilizing foot 1 is attached to one of four foot members 102 of the cross-foot 100, for example by that the piston rod 22 is attach to a corresponding attachment arrangement 103, for example a threaded pin, a threaded hole or the like.

[0035] Fig. 5 shows a perspective view of the underside of a cross-foot 100 where the stabilizing device 1 has an alternative assembly to one of the foot-members 102. The stabilizing device 1 is more or less an up-side-down foot like stabilizing device 1 like the one of Fig. 4, which is recessed into a recess 104 in one of the foot-members 102 of the cross-foot 100, to provide the possibility to use the same type of foot 101 in all four positions. The piston rod 22 is in this case arranged for attachment to the "standard" foot 101 and the recess 104 as well as the stabilizing device 1 may have arrangements for fixation of the stabilizing device 1 in the recess 104.

[0036] To summarize the function of the stabilizing device 1, and the use of such device in the form of a stabilizing foot 1, arranged at for example a table with a cross-foot 100, the following summarizing description is applied. The stabilizing foot 1 functions well together with three fixed feet 101 so that an existing table always has four support points in contact with the floor, to prevent the table from wiggling. The stabilizing foot 1 adjusts its

height automatically to a common level of the three fixed feet 101, but it does not adjust the table level. The table's cross-foot 100 is centrally located, and if one of four fixed feet 101 is removed, the table will be unstable with only a small force at the position where one of the fixed feet 101 has been removed. The table's total weight is now only applied on two opposite feet and the table can be tilted back and forth. If a force is positioned below the position of the removed foot 101, it must not be greater than half the weight of the table, since it otherwise will lift the table and the table will still be unstable. This principle also applies to less rigid table constructions without a cross-foot.

[0037] The self-adjusting stabilizing foot 1 consists as explained above of a piston rod 22 with threads at the second end 22b and a piston head 21 in the form of a thin disc attached at the first end 22a of the piston rod 22. The piston head 21 is cylindrical and moves inside the cylindrical reservoir 15 with a narrow gap 60 between the piston head 21 and the sidewall 13 of the reservoir 15. The piston head 21 does not seal against the sidewall 13 but allows a viscous gel 40 to pass when the piston head 21 is subjected to pressure. The high viscosity of the gel 40 causes that this movement is slow. The conical spring 50 positioned under the piston head 21 only has a marginal restraining effect. As the piston head 21 does not touch the sidewalls 13, no friction arises here. The only friction that inhibits the movement occurs at the seal 70 (O-ring) which seals around the piston rod 22. The gel 40 also has a lubricating function so that friction and wear during movement is minimized. As explained, there are two opposite through holes 24 arranged in the piston head 21, which through holes 24 are covered by the flexible sheet metal valve 25 which is positioned on the spring-side of the piston head 21. The flexible sheet metal valve 25 is a unidirectional valve which prevents the gel 40 from passing the piston head 21 when the stabilizing foot 1 is compressed. When the weight of the table compress the stabilizing foot 1 so much that the three fixed feet 101 reach the floor, the compressing force on the stabilizing foot 1 ceases. If the table is lifted or repositioned to a position that requires the stabilizing foot 1 to expand again, the conical spring 50 pushes the piston head 21 in return. This movement is fast because the flexible sheet metal valve 25 opens for fluid flow through the holes 24 and the large area of the through holes 24 allow the gel 40 to pass easily.

[0038] Although the description above contains a plurality of specificities, these should not be construed as limiting the scope of the concept described herein but as merely providing illustrations of some exemplifying embodiments of the described concept. Reference to an element in the singular is not intended to mean "one and only one" unless explicitly so stated, but rather "one or more." All structural and functional equivalents to the elements of the above-described embodiments that are known to those of ordinary skill in the art are expressly incorporated herein and are intended to be encompassed hereby.

Claims

1. A stabilizing device (1) for a furniture, to be arranged between a support of the furniture and a surface on which the furniture is standing, the stabilizing device (1) comprising:

   a cylinder (10) with a first end wall (11), a second end wall (12) arranged opposite the first end wall (11), and a sidewall (13) extending between the first and second end wall (11, 12), wherein the walls (11, 12, 13) of the cylinder (10) define a closed reservoir (15),
   a piston (20), having a piston head (21) arranged in the cylinder (10) and a piston rod (22) having a first end (22a) connected to the piston head (21) and a second end (22b) for connection to the support of the furniture, the piston head (21) being movable between the first and second end wall (11, 12) of the cylinder (10),
   a fluid (40) arranged in the reservoir (15),
   a spring (50) arranged between the first end wall (11) and the piston head (21),

   wherein a gap (60) is arranged between at least a part of a circumference (23) of the piston head (21) and the sidewall (13) of the cylinder (10), such as the fluid (40) within the reservoir (15) may flow past the piston head (21) when the piston head (21) moves within the reservoir (15).

2. Stabilizing device (1) according to claim 1, wherein the gap (60) extends along the entire circumference (23) of the piston head (21), such as there is no contact between the piston head (21) and the sidewall (13) of the cylinder (10).

3. Stabilizing device (1) according to claim 1 or 2, wherein the piston head (21) comprises at least one trough hole (24), and further an unidirectional valve (25) is arranged at the at least one through hole (24), wherein the unidirectional valve (25) is arranged to open for fluid flow through the at least one through hole (24) when the piston head (21) moves within the reservoir (15) upon a spring force of the spring (50).

4. Stabilizing device (1) according to claim 3, wherein the unidirectional valve (25) is a flexible sheet arranged at a first side (26) of the piston head (21) which first side (26) faces the spring (50).

5. Stabilizing device (1) according to any of the preceding claims, wherein the fluid (40) is a gel.

6. Stabilizing device (1) according to any of the preceding claims, wherein the spring (50) is a conical wire spring (50) which is conical from a wide first end (51) towards a narrower second end (52), wherein the conical wire spring (50) is compressible such as when the spring (50) is fully compressed, the height of the spring (50) is the substantially the same as a wire diameter of the spring (50).

7. Stabilizing device (1) according to any of the preceding claims, wherein the piston head (21) is a plate which is thin compared to the available height of the reservoir (15), preferably the thickness of the plate is maximum 20% of the available height of the reservoir (15).

8. Stabilizing device (1) according to any of the preceding claims, wherein the first end wall (11) comprises a recess (14) arranged to accommodate the spring (50) in its compressed state.

9. Stabilizing device (1) according to any of the preceding claims, wherein the piston head (21) comprises a centrally arranged through hole (27), and the piston rod (22) comprises a gudgeon pin part (22c) at the first end (22a) of the piston rod (22), which gudgeon pin part (22c) is adopted to be fixedly fit into the centrally arranged through hole (27) of the piston head (21).

10. Stabilizing device (1) according claim 9, wherein the spring (50) is fixedly attached with its second end (52) to the gudgeon pin part (22c).

11. Stabilizing device (1) according to any of claims 4 - 10, wherein the flexible sheet (25) is pressed to the first side (26) of the piston head (21) by the spring force of the spring (50).

12. Stabilizing device (1) according to any of the preceding claims, wherein the piston rod (22) extends through the second end wall (12) of the cylinder (10), and the second end wall (12) of the cylinder (10) comprises a seal (70), which is arranged to seal between piston rod (22) and the second end wall (12).

13. Stabilizing device (1) according to any of the preceding claims, wherein the first end wall (11) and the sidewall (13) of the cylinder (10) is one part, and the second end wall (12) is fixedly attached to the sidewall (13) by snap connection.

14. Stabilizing device (1) according to any of claims 12 -13, wherein a housing (16) encloses at least an upper part of the sidewall (13) and the second end wall (12) of the cylinder (10), wherein the housing (16) is arranged to be fixedly attached to the sidewall (13) and further arranged to hold the sealing (70) of the second end wall (12) in position between the housing (16) and the second end wall (12).

15. Furniture (100) comprising at least four supports (101) for supporting the furniture (100) on a surface (200) on which the furniture (100) is standing, wherein at least one of the supports (101) of the furniture (100) comprises a stabilizing device (1) according to any of claims 1 - 14.

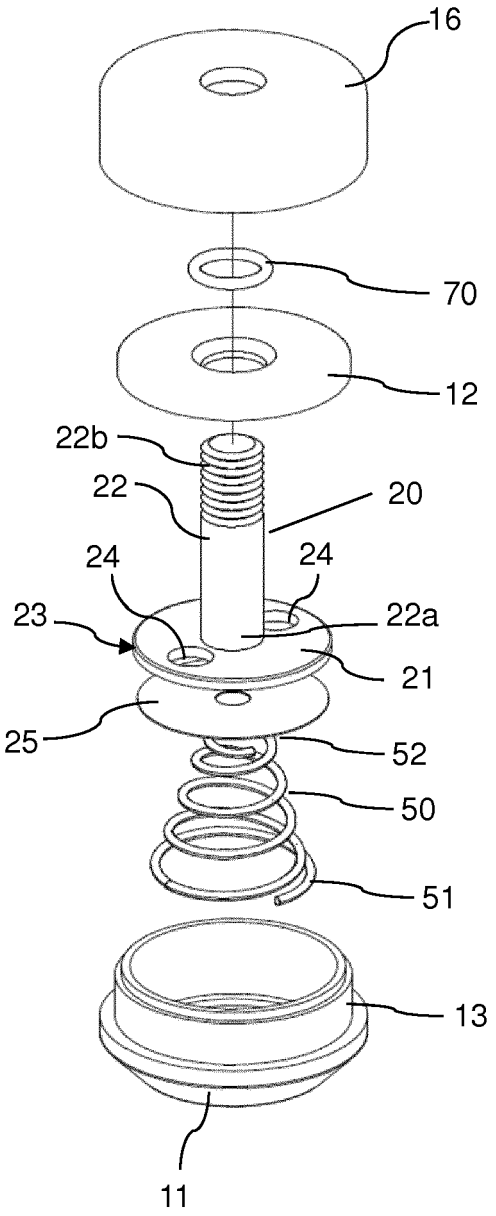


Fig. 1

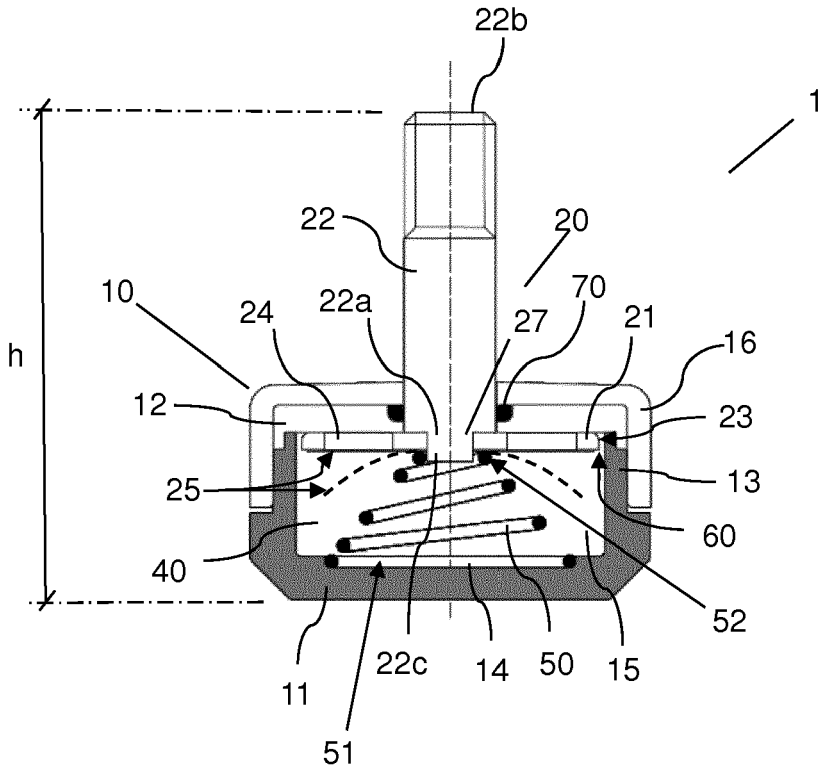
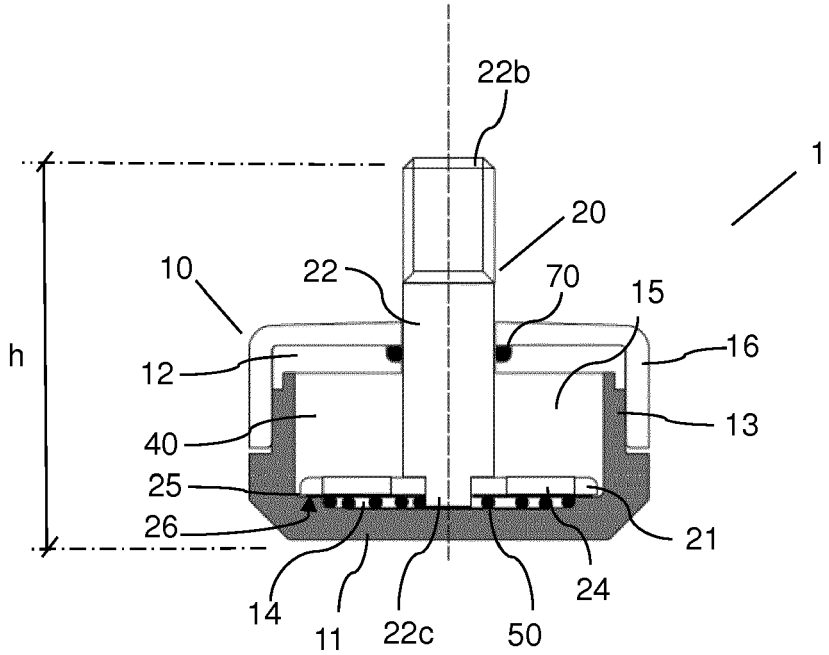

22b
1
22
20
10
24
22a
27
70
21
16
h
12
23
25
13
60
40
52
11
22c
14
50
15
51

Fig. 2


22b
1
20
10
22
70
15
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12
13
40
25
26
21
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11
22c
50
24

Fig. 3

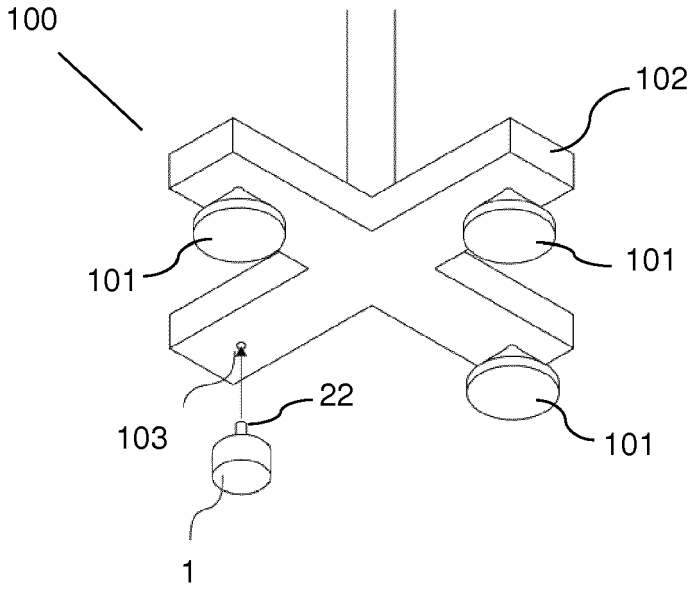

Fig. 4

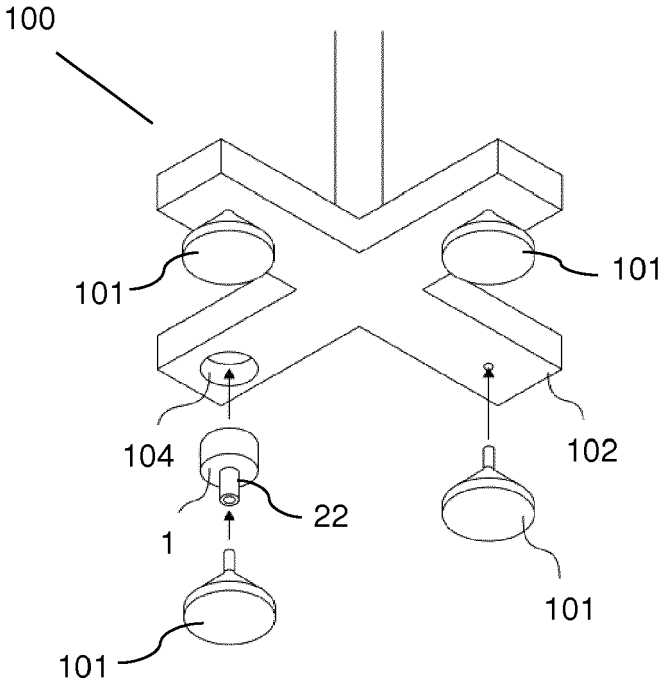

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 19 18 2635

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 October 2019	Kohler, Pierre

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