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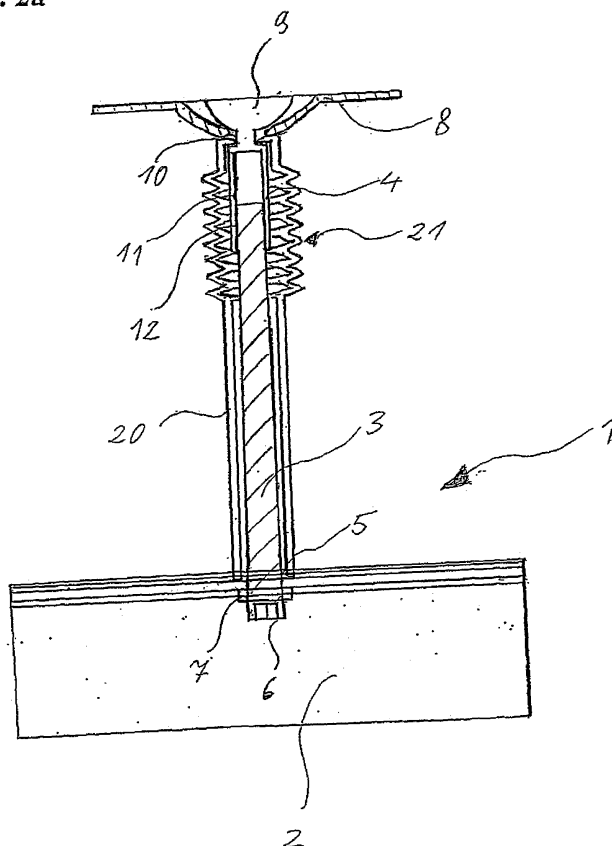
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(54) **Distance piece for patient rail system**

(57) A distance piece (20) for a hanging patient rail system (1), wherein the distance piece (20) is disposed between the rail system (1) and the ceiling to which the rail system (1) is attached, to stabilise the position and orientation of the rail system (1) with respect to the ceiling,

characterised in that: the distance piece (20) has a longitudinally compressible region (21) along its length, such that the length of the entire piece (20) can be controllably adjusted by means of a force acting along the longitudinal axis of the piece (20).

Fig. 2a



Description

Background

[0001] Figure 1a and 1b show a side view and cross sectional view, respectively, of a well known patient rail system 1, which is intended to be suspended from a ceiling. This system operates by providing a suspended rail section 2, to which a transportation device (not shown in the Figures) can be attached. Such a transportation device may be in the form of a lifting motor, which is connected to the rail and can run along the rail via its trolley (being more or less an integrated part of the lifting motor). The lifting motor can elevate and lower a suspension via its lifting band. A sling is fitted around a patient and is connected to the suspension via loops provided at its distal ends. Thus the transportation device in the form of a lifting motor will elevate and lower a patient. Movement along the rails may be performed either self propelled or manually.

[0002] The concept of lifting a patient is to transfer the patient from e. g. a chair to a bed or from a bed to a toilet etc. One possible use for such a system, would be in a hospital environment wherein a patient could readily be moved through numerous rooms and departments within the hospital, in particular by means of sling adapted for a person to sit in or by means of a stretcher. Another possible use would be in nursing homes or private homes where a disabled individual has to be moved from point A to point B.

[0003] One particular requirement of the suspended rail transportation system, is that the gradient of the rail section 2, must not be greater than a 5mm drop over a 1m section of the rail 2. Obviously, if the gradient of the rail were too steep, in one direction the care giver would be required to push the patient and transportation device up a significant gradient, and furthermore a patient at the top of the slope runs the risk of gravity pulling the transportation device down the slope.

[0004] In order to provide a fully adjustable ceiling attachment system for the transportation rail 2, it is common to provide a bolt 3 and nut 4 system as can be seen most clearly in Figure 1b. The nut 4 is attached to the ceiling to which the rail system 1 is to be attached, and the bolt 3 passes through an appropriate hole 5 in the rail section 2, such that the head 6 of the bolt 3 is on the underside of the rail section 2, and holds the section 2 in place. That is, the bolt 3 and nut 4 operate in a standard way for holding a further item, in this case the rail section 2. As can be seen in Figure 1b, it is common to provide a washer 7 to which the head 6 of bolt 3 abuts, simply to improve the wear and stability of the system. Obviously, this system functions perfectly well without said washer 7.

[0005] Whilst the system is described using an interacting bolt 3 and nut 4, it would be apparent to the skilled person that any standard fixing means which is length-adjustable, could be used. Possible further options would be a long screw which interacted with an appropriate hole

in the ceiling of the building, or furthermore a mounting block on the ceiling.

[0006] As can further be seen from Figure 1b, it is contemplated that the bolt 3 interacts with a nut 4 which is itself held to the ceiling by means of a mounting plate 8. It is not necessary to use mounting plate 8, and indeed bolt 3 could interact with a nut 4 which is directly attached to the ceiling. Additionally, bolt 3 could interact with a hole provided in the ceiling, which had an appropriate gripping means contained therein. Such appropriate gripping means, would be of the form of a raw1 plug, or the like. These means are well known to people in the art, and therefore further discussion will be omitted. One advantage of providing the nut 4 interacting with the ceiling via a mounting plate 8, is that the mounting plate 8 may be of a larger dimension than the nut 4, and therefore can be more securely held to the ceiling. Furthermore, as can be seen from Figure 1b, the mounting plate 8 could be provided with an approximately hemispherical protrusion, into which one end of an appropriately formed nut 4 can be held. This is clearly seen in Figure 1b, wherein the hemispherical hollow section of the mounting plate 8 is seen in cross section, as is an appropriately shaped hemispherical plug provided at one end of the nut 4. This plug 9, is held in place by the mounting plate 8, and a hole 10 provided through the mounting plate 8 allows the plug 9 of nut 4, to pass through. The nut 4 provides the appropriately internally threaded section 11 for interacting with the thread 12 on the bolt 3. A further advantage of providing the mounting plate 8 and nut 4 with plug 9 as described above, is that the orientation of the bolt 3 with respect to the ceiling can be appropriately maintained. Clearly, in a system wherein the nut 4 directly interacts with the ceiling, with any slight misalignment the bolt 3 would not hang vertically downward, and the rail section 2 may also be misaligned.

[0007] In use, the system described above will allow for the rail section 2 to be positioned at an appropriate distance from the ceiling, as so desired. In fixing the rail section 2 to the ceiling, the nut 4 is positioned at appropriate places in the ceiling, preferably by use of mounting plate 8 and plug 9 as disclosed above, and the bolt 3 is passed through appropriate holes 5 on the rail section 2 in order to interact with the nut 4 by means of threaded section 11 and external thread 12. As the rail sections 2 are attached to the ceiling, the height of each section may be adjusted perfectly such that the gradient is not too severe. Clearly, simply engaging the thread 12 with internally threaded region 11 of the nut 4, will raise or lower the rails section 2 as desired. In such a way, the suspended rail system 1 can be built-up throughout the care environment, and function appropriately.

[0008] One significant concern, however, by providing a suspended rail system 1 as described above, is that the bolt 3 interacting with nut 4 is subjected to numerous transverse forces (with respect to the longitudinal axis of the bolt 3) when in use. That is, when pushing a suspended carriage along the rail sections 2, the carriage is

apt to sway gently, which will translate relevant forces through the rail section 2 to the bolt 3 and nut 4. This is undesirable, as such forces will eventually lead to a weakening of the bolt 3 and nut 4, and will also increase the wear on the system. Both of these are undesirable, and can lead to a reduction in the lifetime of such a system.

[0009] In order to overcome such a difficulty, it is common practice to provide a distance piece 13 which interacts with both the rail section 2 and the ceiling. Such a distance piece 13 is provided in order to reduce the translational forces acting on the bolt 3 and nut 4, by providing some form of stabilising means to reduce the transverse motion. As can be seen in Figure 1a and 1b, this is currently achieved by providing a tube which slides over the bolt 3 and is positioned between the ceiling, or appropriate mounting means (as detailed above: mounting plate 8) and the rails section 2. Such a distance piece tube 13 has an appropriate diameter such that it stabilises the transverse motion of the rails section 2, and dramatically reduces it.

[0010] One significant problem with a distance means provided in such a manner, is that each distance piece 13 must have the exact length of the distance between the rail section 2 and the ceiling. Clearly, when providing and fitting a suspended rail system 1, it cannot be guaranteed that the ceiling is perfectly horizontal, and therefore the distance between the top of the rail section 2 and the ceiling will change. In order, therefore, to provide a rail system 1 where the rail sections 2 do not have a gradient greater than 5mm for every 1m of rail section 2, each distance tubing 13 must be cut exactly to length for every single bolt 3 and nut 4 connection point. This is very time consuming, and furthermore any small error in the cutting of the distance tube 13 will lead to significant wastage, as the tube 13 is useless.

[0011] It is an object of the current invention to overcome these significant drawbacks in the prior art distance tubes 13, by providing a distance piece which stabilises the bolt 3 and nut 4 engagement, whilst also requiring no cutting of the distance piece. Indeed, the distance piece of the present invention is provided such that its length will change as the rail section 2 is being attached to the ceiling by means of the bolt 3 and nut 4, or the like.

[0012] Such a distance piece is described in claim 1, wherein a distance piece is provided with a region which can have its length reduced by a force acting along the central axis of the piece. By having a deformation zone, the distance piece can be integrated with the hanging rail section 2 during fitting, and as the bolt 3 integrates with nut 4, the force of threading the bolt 3 and nut 4 acts on the distance piece, and thereby reduces its length.

[0013] The clear advantage of providing such a distance piece, is that the distance piece need not be specifically cut to the appropriate length for integrating with the hanging rail section 2. The distance between the ceiling and the top of the rail section 2 can be set at the appropriate height for the general system 1, and the length of the distance piece will be adjusted during this

fitting. As such, time need not be wasted in precisely cutting a distance piece tube, and also there will be no significant wastage as none of the tubes would be cut to the wrong length. The distance pieces of the current invention provide the same stabilising effects as the prior art distance tubes described above, in that they are positioned such that the transverse motion of the rails section 2 when in use, is reduced.

[0014] A further advantage of providing a distance piece with a deformation zone, is seen with regards the bolt 3 and nut 4. Because the deformation zone of the distance piece is shortened by means of an appropriate compressive force along the axis of the distance piece, the material in the deformation zone will tend to react against this compressive force. As such, when the distance piece is integrated within a hanging rail system 1, after the distance between the ceiling and the rail section 2 has been appropriately chosen, the compressive force acting on the distance piece and deformation zone will remain constant. The deformation zone is so structured, such that it then generates an extension force along the longitudinal axis of the distance piece. That is, the distance piece will generally be formed out of metal, and the deformation zone will generate an extension force along the axis of the distance piece in response to the compressive force in the same direction as a result of the elasticity of the metal. Whilst metal is discussed for the material of the tube, any material which may be compressed by some degree, but still maintain its integrity can be used. This will tend to act to push the rail section 2 away from the ceiling, and will further cause the same force between the bolt 3 and nut 4. The thread 12 on the bolt 3 will then push against the internal threaded region 11 of the nut 4, which will give a locking effect. This has the added bonus, in that when the rail system 1 is in use, not only will the distance piece of the current invention reduce the transverse movement of the rail section 2, but it will also provide a locking force between the bolt 3 and nut 4, such that any play in the system is removed, and the engagement is held securely. Clearly, both of these advantages lead to a significant reduction in the wear on the system, and to a general improvement in the stability and lifetime of such a system.

Figures 1a + 1b: A prior art patient rail system showing a simple distance tube.

Figures 2a + 2b: A rail system similar to that of Figure 1, wherein one possible structure for a distance piece in line with the invention is shown.

Possible Embodiments of the Current Invention

[0015] Looking at Figures 2a and 2b, the distance piece 20 of the current invention can be seen. These Figures are very similar to those of Figures 1a and 1b discussed above, however the distance piece or tube 13 of the prior art has been replaced by one possible em-

bodiment of that of the current invention.

[0016] Given that the hanging rail system 1, sections 2 and the attachment means via nut 4 and bolt 3, are considered as substantially the same, no further discussion as to these aspects will be given. Indeed, it is to be assumed that the discussion in the background section applies equally to the current discussion, with the only significant difference being the structure and operation of the distance piece 20.

[0017] As is shown most clearly in Figure 2b, the distance piece 20 is provided with a compressible section or deformable region 21. As can be seen in Figure 2a, the compressible region comprises sections of gradually increasing and decreasing diameter to the external surface of the distance piece 20. This forms a substantially corrugated or undulating section to the distance piece 20, such that a longitudinal force acting along the central axis of the distance piece 20, will tend to lead to a reduction in the distance between the corrugations, which will lead to a general reduction in the length of the distance piece 20.

[0018] Whilst the corrugations in the exterior surface of the distance piece 20 are shown to have an approximate saw-tooth profile, it is also possible for these corrugations to be of a principally sinusoidal nature. Indeed, any appropriate shape is considered as falling within the general scope of amendments according to the skilled person, with the only requirement being that the length of the compressible region 21 can be reduced by means of a longitudinal force. Any shape to the external surface of the distance piece 20 which allows for such a compression would be obvious to the skilled person, and is considered to fall within the scope of a current invention.

[0019] When the profile of the corrugations in the compressible region 21 is chosen to be that of a saw-tooth, the angle between the two sides of the distance piece 20 making up the saw-tooth, lies between approximately 35° and 75°. In particular, the angle between these two sides may lay between approximately 50° and 70°, such that these two sides provide a tooth which has an approximately equilateral triangle profile.

[0020] Additionally, the length of the compressible region 21 is chosen, such that the difference in length of the whole piece 20 between fully extended and fully compressed lies between approximately 5 mm and 35 mm. That is, the compressible region 21 is of such a length that when it is fully compressed such that the sides of each of the corrugations lie adjacent each other, the length of the distance piece 20 has been adjusted by between 5 mm and 35 mm.

[0021] Despite the compressible region 21 in Figure 2a and 2b shown to lay close to the top (in a region adjacent to the mounting plate 8), it is clear that the compressible region 21 can be located anywhere on the distance piece 20 (e. g. in a top region, middle region or bottom region). It may well be that to position the compressible region 21 close to the rail carrying system 1 may enhance stability of the entire system.

[0022] Clearly, as discussed above and as seen in Figure 2b, the distance piece 20 is seen as being some form of hollow tube which is positioned between the ceiling or mounting means for the rail section 2, and the rail section 2 itself. As is shown in Figure 2b, the distance piece 20 could form a tube of a dimension, that it is positionable over the bolt 3 and nut 4 as in the prior art system. In so doing, the diameter of the distance piece 20 would also be great enough such that the transverse motion of the suspended rail section 2 will be reduced.

[0023] The hollow tube surrounding the bolt 3 and nut 4, is not the only possible structure for the distance piece 20. It is also conceivable, that the distance piece 20 would be provided by an almost completely solid rod structure. The compressible region 21, could either be provided by a section in this rod, again saw-tooth and sinusoidal variations to this section are considered appropriate, such that the length of the rod would be reduced by a longitudinal compression force. A further possibility, would be that the rod is provided as being primarily solid, with a hollow section at one end, and the compressible region as discussed above provided at this hollow section. That is, the sides of the rod in the hollow section would be provided with a corrugated structure, again such that a compressible force acting along the rod would lead to a forcing together of each of the corrugations and reduction in the length of the rod. If a rod were to be integrated with the rail carrying system 1, clearly it would not be intended to pass around the bolt 3, as shown in Figure 2b. Indeed, it would be possible to provide a series of the rods with compressible regions, at positions toward the outer side of the rails section 2. These would then extend between the outer side of the tops of the rails sections 2 and the ceiling. Such numerous distance pieces would again lead to a transverse stability to the rail section 2 whilst in use, whilst also providing a straightforward mechanism of adjusting the length thereof whilst attaching the rail section 2 to the ceiling. A further possibility, is that the distance pieces 20 of the deformable rod structure, could be fully integrated with the rails sections 2. Indeed, it could be envisaged that the hollow tube as seen in Figure 2b could be an integral part of the rail section 2.

[0024] The further advantage of providing the distance pieces 20 as disclosed above, either that of the hollow tube with deformable rod, is that upon compression deformation, the distance piece 20 will tend to provide an extension force in the opposite direction. This extension force is a result of the compressible force acting upon the corrugated region, and the internal strength/resistance of the material making up the distance piece 20. After compression, the distance piece 20 will tend to provide an extension force along the longitudinal axis of the distance piece 20, such that the rod or hollow tube will attempt to extend slightly. Such an extension force will act upon the bolt 3 and nut 4 arrangement, such that the threads 11, 12 of each piece will be forced against each other. This will tend to lead to a locking engagement between the bolt 3 and nut 4, such that the bolt 3 will not

disengage from nut 4 when the system 1 is in use. Obviously this leads to a reduction in wear of the system, whilst also providing a more secure and locked nut 4 and bolt 3 engagement.

[0025] Preferably the compressible region 21 is a region adapted to be mainly plastically or irreversibly deformed whilst certainly in a preferred embodiment the above described effect that a small fraction of an elastical force adapted to provide a locking engagement between bolt 3 and nut 4 is maintained.

[0026] Suitable materials for the distance piece are considered to be aluminium or aluminium alloy or steel.

[0027] Whilst elements of the distance piece 20 have been discussed above, it is clear that these features can be intercombined to guarantee further embodiments. The full scope of protection is as embodied in the claims.

LIST OF REFERENCE SIGNS

[0028]

1	rail system
2	transportation rail
3	bolt
4	nut
5	hole
6	head
7	washer
8	mounting plate
9	plug
10	hole
11	internally threaded section
12	thread
13	distance tubing
20	distance piece
21	compressible region

Claims

1. A distance piece (20) for a hanging patient rail system (1), wherein the distance piece (20) is disposed between the rail system (1) and the ceiling to which the rail system (1) is attached, to stabilise the position and orientation of the rail system (1) with respect to the ceiling,

characterised in that:

the distance piece (20) has a longitudinally compressible region (21) along its length, such that the length of the entire piece (20) can be controllably adjusted by means of a force acting along the longitudinal axis of the piece (20).

2. The distance piece (20) of claim 1, wherein the rail system (1) is attachable to the ceiling by releasable and adjustable length fixing means (3, 4, 8, 9) which cause the compression of the compressible region

(21) between the rail and the ceiling and adjust the length of the piece (20); and
the compressible region (21) of the distance piece (20) is adapted to generate a longitudinal force against the compression caused by the fixing means (3, 4, 8, 9).

3. The distance piece (20) of either of claims 1 or 2, wherein the compressible region (21) comprises a hollow section of the distance piece (20).

4. The distance piece (20) of any of the preceding claims, wherein the whole distance piece (20) comprises a hollow tube.

5. The distance piece (20) of either claim 1, claim 2 or claim 4, wherein the piece comprises a hollow tube and is dimensioned so as to surround the fixing means (3, 4) of the rails system (1).

6. The distance piece (20) of any of the preceding claims, wherein the compressible region (21) comprises regions of increased and decreased diameter in the external surface of the distance piece (20), when viewed along the longitudinal direction of the distance piece (20).

7. The distance piece (20) of claim 6, wherein the profile of the regions of increased and decreased diameter is a saw-tooth.

8. The distance piece (20) of claim 7, wherein the angle between the two sides making up the saw-tooth, lies between 35° and 75°, in particular between 50° and 70°.

9. The distance piece (20) according to claim 6, wherein the profile of the regions of increased and decreased diameter is sinusoidal.

10. The distance piece (20) of any of the preceding claims, wherein the compressible region (21) allows for a length compression of the whole distance piece (20) of between 5 mm and 35 mm.

11. The distance piece (20) according to any of the preceding claims, wherein the piece (20) is made from a material chosen from aluminium or aluminium alloy or steel.

Fig. 1a

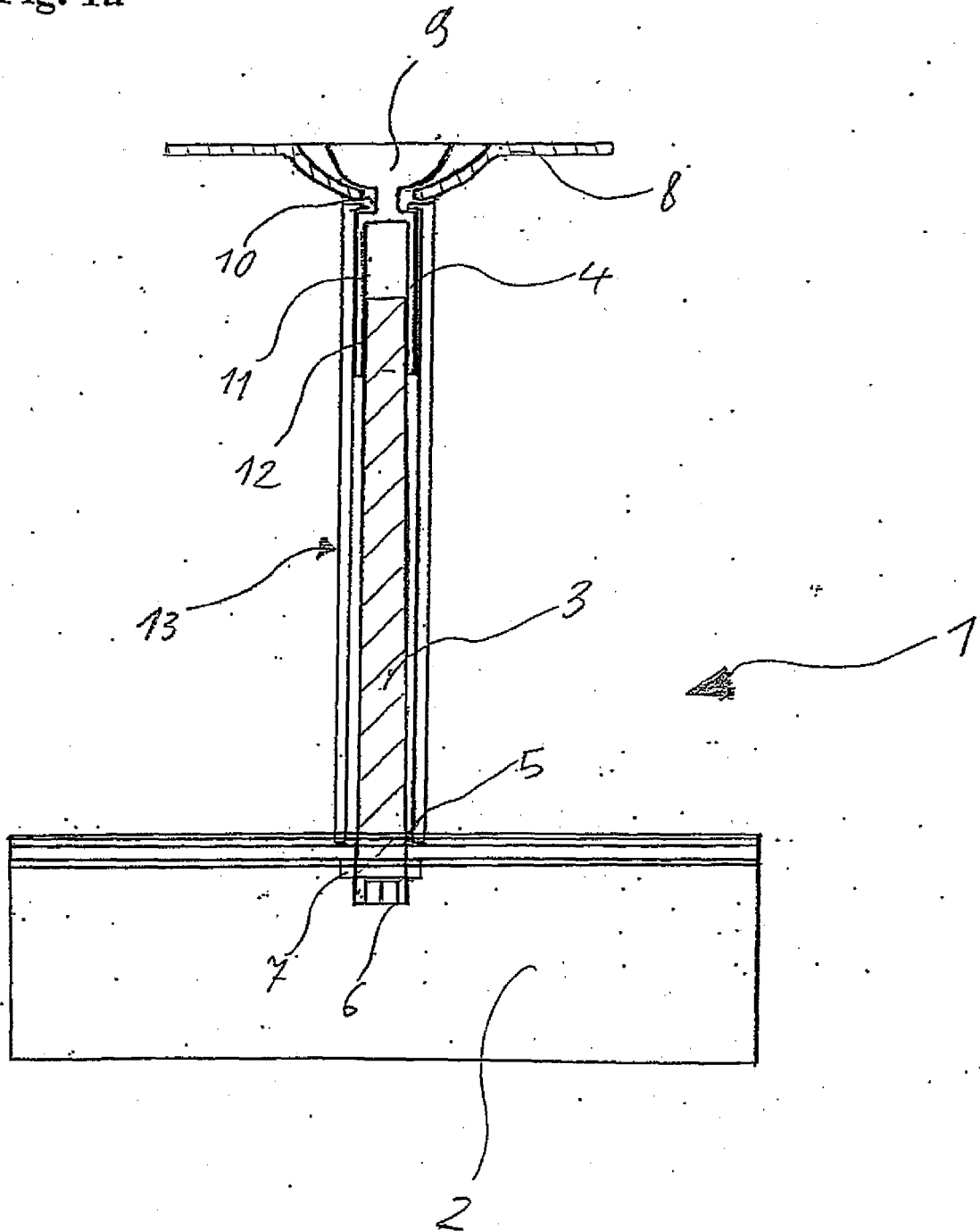


Fig. 1b

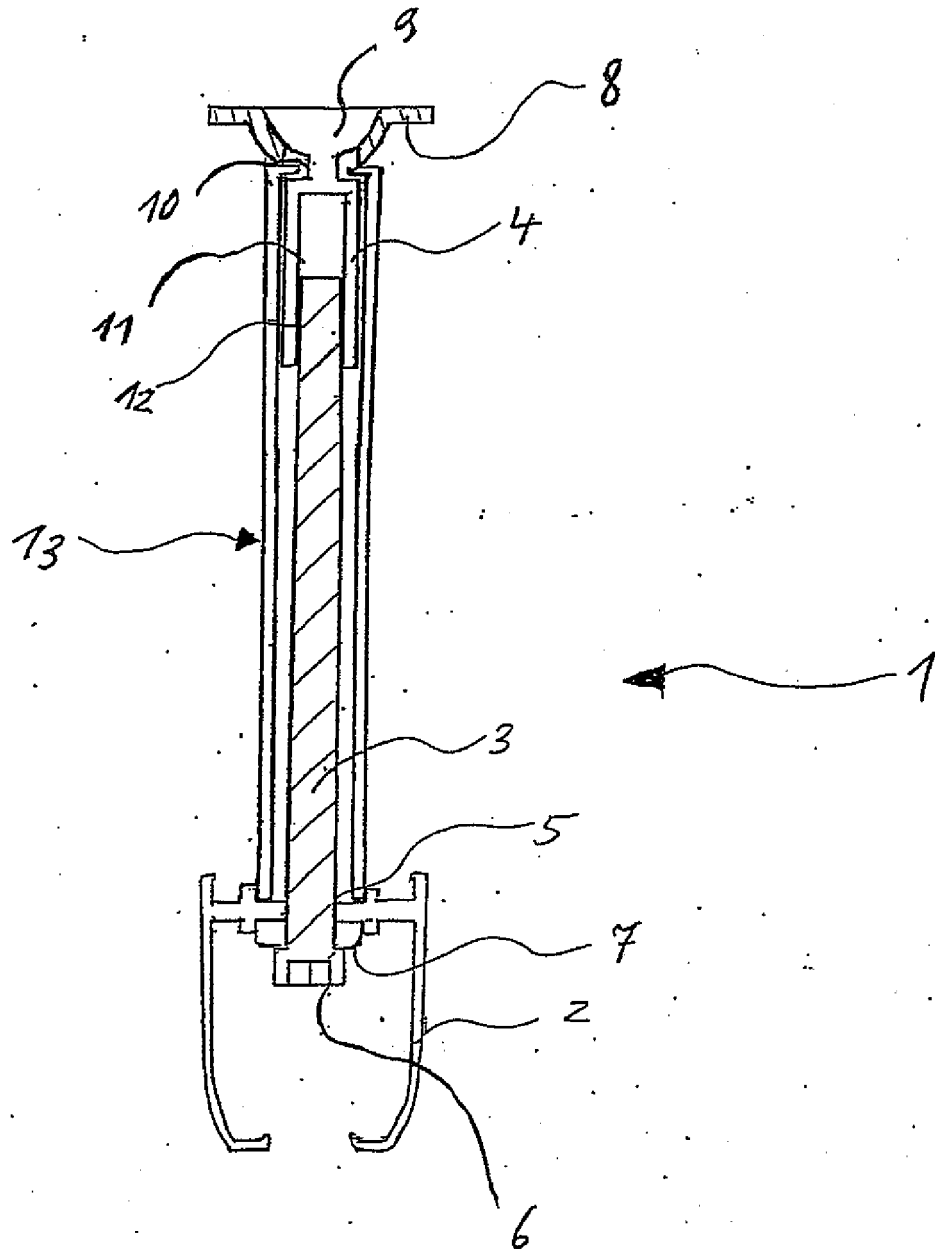


Fig. 2a

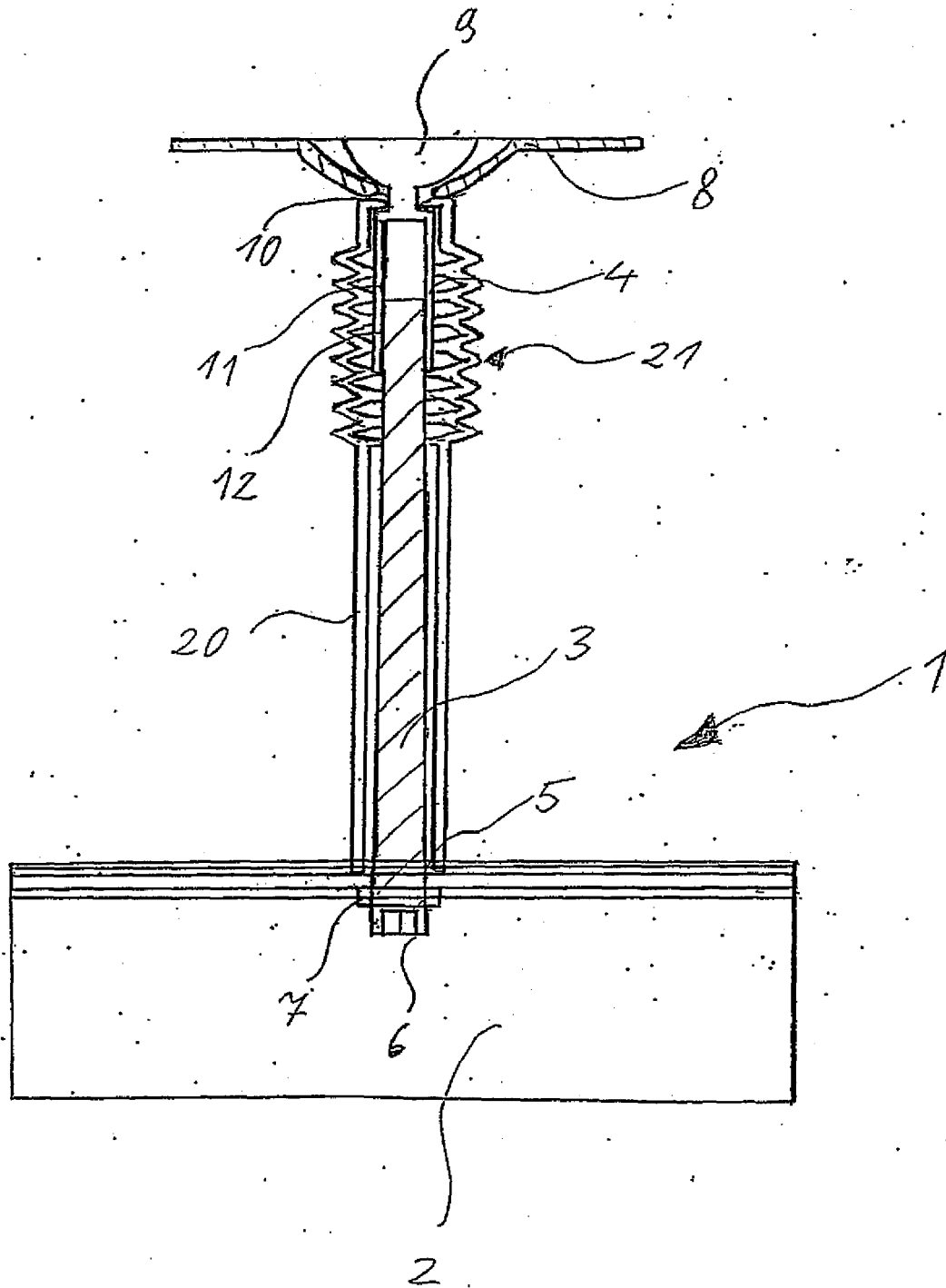
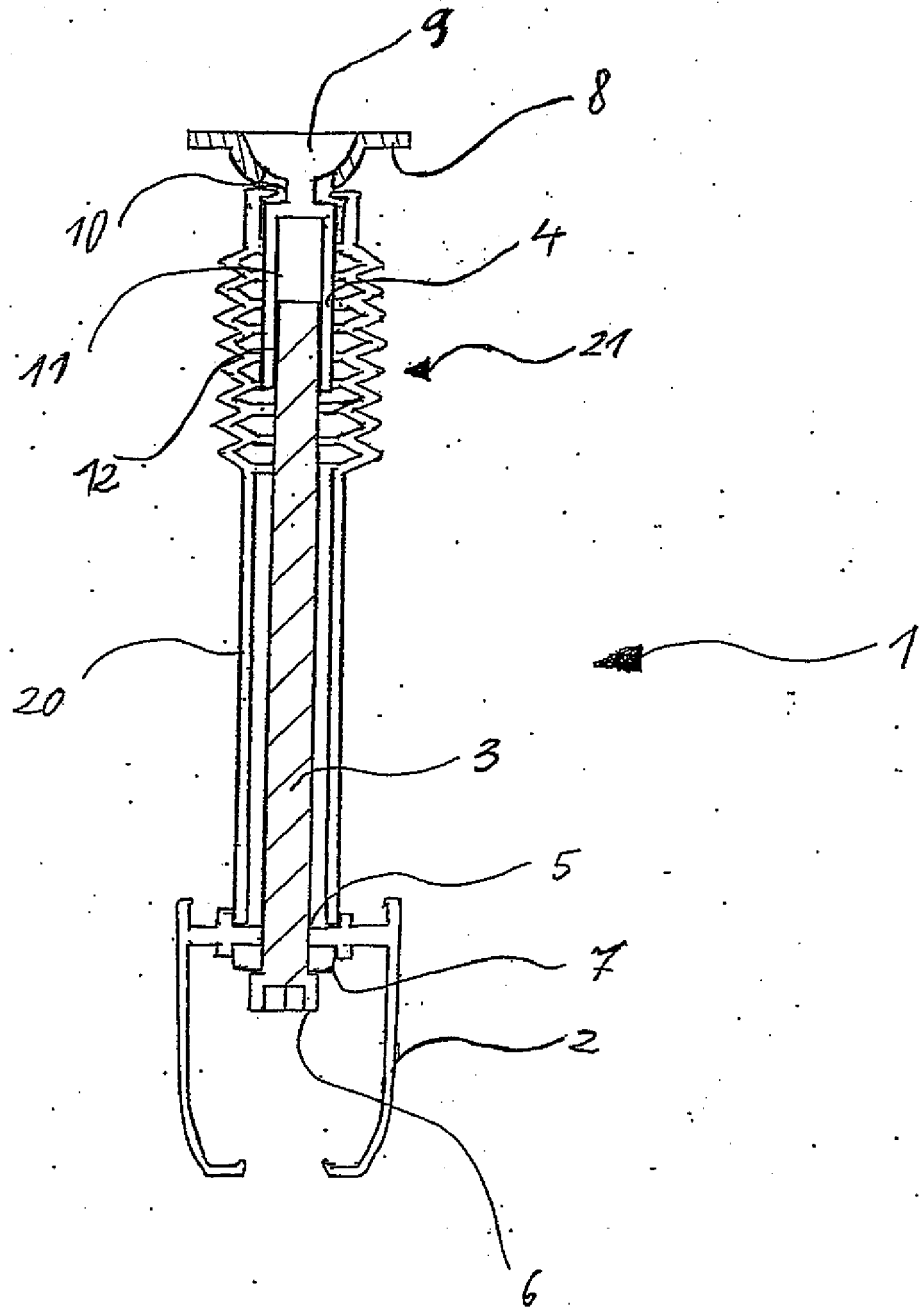


Fig. 2b





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 07 10 9307

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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		1 October 2007	Bielsa, David
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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