

Description

TECHNICAL FIELD

[0001] The present disclosure relates to an adjustable floor support system for supporting a raised floor construction relative to an underlying support surface, where the adjustable floor support system comprises an elongated floor joist extending in a first direction, at least one level adjustment screw and at least one connection plug. The at least one level adjustment screw is attachable to the at least one connection plug, and the at least one connection plug is attachable to the floor joist.

BACKGROUND

[0002] When building floors on uneven underlying load-bearing support surfaces, such as for example a concrete surface, or when there is a need for ventilating a floor, it is often desired to build the floor at a distance above the underlying support surface. Such raised floor constructions could for example involve a system of floor joists on which the floor is built, where the floor joists are spaced apart in relation to the underlying support surface. To create the distance between the raised floor construction and the underlying support surface, level adjustment screws attached to the floor joists may be used. The floor joists may be provided with means to which the level adjustment screws are attached and the lower part of the level adjustment screws are anchored to the underlying support surface. The height of the floor joist in relation to the underlying support surface can be adjusted by rotating the level adjustment screws.

[0003] A floor construction of the above mentioned type is disclosed in WO 2010/140946 A1, where the joists are made of wood material and have vertical drill holes with joist sleeves for the screws and where the screws are anchored to an underlying load-bearing support surface with fastening means in the form of nails, screws or plugs. A problem with these floor constructions is that the work with assembling the joist sleeves and the screws to the joists surface is very time consuming, since holes need to be drilled in the joists and thereafter the joist sleeves are mounted into the joists. When the joist sleeves are in place, the screws can be attached to the joist sleeves. Other problems with this construction is that the floor joists made of solid wood are heavy and sometimes bent or curved in shape and therefore not providing a dimensionally stable support for the floor construction.

[0004] US 8,397,443 B2 discloses a bar system for a floor construction, where the system is provided with a plurality of profiled bars or joists and a level adjustment mechanism. The bars are enclosing the level adjustment mechanisms, which level adjustment mechanisms include level adjustable projections adapted to project from the bars against a support structure. However, the floor construction described in US 8,397,443 B2 is a complex, heavy and expensive construction.

[0005] There is thus a need for an improved adjustable floor support system, with a structure that is dimensionally stable, low in cost, simple and fast to assemble, and further is lightweight in construction.

SUMMARY

[0006] An object of the present disclosure is to provide an adjustable floor support system, where the previously mentioned problems are avoided. This object is at least partly achieved by the features of the independent claim. The dependent claims contain further developments of the adjustable floor support system.

[0007] The disclosure concerns an adjustable floor support system for supporting a raised floor construction relative to an underlying support surface, the adjustable floor support system comprising an elongated floor joist extending in a first direction, at least one level adjustment screw and at least one connection plug. The at least one level adjustment screw is attachable to the at least one connection plug, and the at least one connection plug is attachable to the floor joist. The floor joist has a hollow configuration with an upper wall, a lower wall and two side walls arranged between the upper wall and the lower wall, where the upper wall has at least one upper plug opening and the lower wall has at least one corresponding lower plug opening. At least one connection plug is attachable to the floor joist by an upper plug end connecting to the at least one upper plug opening of the floor joist and a lower plug end connecting to the at least one corresponding lower plug opening of the floor joist. Advantages with these features are that through the hollow configuration of the floor joist, the floor support system is dimensionally stable and lightweight in construction. Further, the floor joists are simple to manufacture making the system with floor joists, connection plugs and level adjustment screws low in cost and also simple and fast to assemble.

[0008] According to an aspect of the disclosure, the at least one level adjustment screw is extending in a second direction when attached to the floor joist with the connection plug, where the second direction is essentially orthogonal to the first direction. This gives the system a structure that is easy to assemble, fast to install, and simple to adjust with the level adjustment screws aligned with the same angle in relation to the extension of the floor joists.

[0009] According to another aspect of the disclosure, the at least one level adjustment screw is rotatably attachable to the at least one connection plug, so that the at least one level adjustment screw is displaced in the second direction when being attached to and rotated in relation to the at least one connection plug about an axis extending in the second direction. These features make the floor support system simple to assemble and adjust. The rotational movement of the level adjustment screws is easily achieved for a fast and precise adjustment of the floor joists in relation to the underlying support sur-

face.

[0010] According to a further aspect of the disclosure, the at least one upper plug opening of the floor joist is encompassed by an inwardly projecting support flange extending from the upper wall, where the support flange has a lower support surface. An advantage with this feature is that the floor joist construction is stabilised through the support flange. Further, the flange is supporting the connection plug in a simple and efficient way when attached to the floor joist.

[0011] According to an aspect of the disclosure, the upper plug end of the at least one connection plug has an upper support surface, where the upper support surface is interacting with the lower support surface of the support flange when the at least one connection plug is attached to the floor joist. The interaction between the upper support surface and the lower support surface provides a secure connection between the connection plug and the floor joist.

[0012] According to another aspect of the disclosure, the at least one connection plug has one or more outwardly projecting flexible attachment members for attaching the at least one connection plug to the floor joist. The one or more flexible attachment members make the floor support system easy to assemble and also attach the connection plugs to the floor joist in a simple and reliable way.

[0013] According to a further aspect of the disclosure, the at least one lower plug opening of the floor joist has one or more plug opening recesses adapted for cooperating with a lower end part of the one or more flexible attachment members, so that the at least one connection plug is prevented from rotating about an axis extending in the second direction when being attached to the floor joist. An advantage with these features is that the connection plugs are securely connected to the floor joists in a way so that they do not rotate when adjusting the level adjustment screws in relation to the floor joist.

[0014] According to another aspect of the disclosure, the one or more flexible attachment members 16 and the one or more plug opening recesses 15 are connecting the level connection plug 3 to the floor joist 4 so that they can withstand a specific separation force of at least 0.10 kN in a direction along the second axis Y.

[0015] According to an aspect of the disclosure, the at least one level adjustment screw has an elongated tubular shape with an outer surface having a first threaded area, and the at least one connection plug has a tubular shape with an inner plug surface having a second threaded area, where the first threaded area is adapted to interact with the second threaded area. The interaction between the threaded areas provides an efficient adjustment of the floor support system.

[0016] According to another aspect of the disclosure, the side walls of the floor joist have one or more reinforcement grooves extending along the floor joist in the first direction. The reinforcement grooves give the floor joist a strong construction even if using a thin construction

material for a lightweight construction.

[0017] According to an aspect of the disclosure, the at least one level adjustment screw is made of a plastic material or a fibre reinforced plastic material, such as for example glass fibre reinforced polypropylene (PPH) or a glass fibre reinforced polyamide (PA). The function of the level adjustment screw is to carry high loads from the floor construction. The use of a plastic material or a fibre reinforced plastic material, such as glass fibre reinforced polypropylene (PPH) or a glass fibre reinforced polyamide (PA), will give a lightweight and durable construction with high load bearing capability.

[0018] According to an aspect of the disclosure, the at least one connection plug is made of a plastic material, such as for example polyoxymethylene (POM), or a fibre reinforced plastic material. An advantage with these features is that the connection plug is easy to manufacture with high strength.

[0019] According to an aspect of the disclosure, the floor joist is made of metal, such as for example steel or aluminium, or a composite material. Advantages with these features are that the floor support system can be made lightweight in construction with a dimensionally stable construction, especially when compared to floor joist systems made of solid wood, which are heavy and sometimes bent or curved in shape.

BRIEF DESCRIPTION OF DRAWINGS

[0020] The disclosure will be described in greater detail in the following, with reference to the attached drawings, in which

Fig. 1a-b show schematically, in perspective views, a section of a floor support system according to the disclosure,

Fig. 2a-b show schematically a view from above and a view from below of a section of a floor joist according to the disclosure,

Fig. 3a-d show schematically, a view from above, a view from below, a side-view and a cross-section of a connection plug according to the disclosure,

Fig. 4a-c show schematically, a side-view, a cross-sectional side view and a view from above of a level adjustment screw according to the disclosure,

Fig. 5 shows schematically, a cross-section of a floor support system according to the disclosure.

Fig. 6 shows schematically, a cross-section of a part of the floor support system according to the disclosure.

DESCRIPTION OF EXAMPLE EMBODIMENTS

[0021] Various aspects of the disclosure will hereinafter be described in conjunction with the appended drawings to illustrate and not to limit the disclosure, wherein like designations denote like elements, and variations of the described aspects are not restricted to the specifically shown embodiments, but are applicable on other variations of the disclosure.

[0022] In the figures, an adjustable floor support system 1 according to the disclosure is shown, where the adjustable floor support system 1 comprises an elongated floor joist 4 extending in a first direction X, at least one level adjustment screw 2 and at least one connection plug 3. The at least one level adjustment screw 2 is attachable to the at least one connection plug 3, and the at least one connection plug 3 is attachable to the floor joist 4. The at least one connection plug 3 has one or more outwardly projecting flexible attachment members 16 for attaching the at least one connection plug 3 to the floor joist 4.

[0023] Figures 1 a and 1 b schematically show an adjustable floor support system 1 for supporting a raised floor construction relative to an underlying load-bearing support surface 22. In figures 1 a and 1 b a section of the floor joist 4 is shown and the floor joist section 4 has two level adjustment screws 2 engaged to two connection plugs 3. As a non-limiting example, the floor joist 4 may have a length of up to 6000 mm in the first direction X and be provided with several connection plugs 3 and level adjustment screws 2, depending on the design. The number of connection plugs 3 and level adjustment screws 2 attached to the floor joist 4 can thus vary depending on the floor construction.

[0024] When building a flooring construction, a number of elongated floor joists 4 having the same or different lengths are in a known way used to arrange a floor joist framework structure that supports floor covering materials, such as for example a subfloor panel structure and floor planks or a floor decking material. Other suitable covering materials may also be used depending on the floor construction.

[0025] The support surface 22 could be any type of surface on which the raised floor construction should be built, such as for example a concrete surface, a wooden surface or even an outdoor ground surface.

[0026] A raised floor construction is built at a distance above the support surface 22, and this type of floor construction is commonly used when building floor constructions on uneven underlying support surfaces or when there is a need for ventilating a floor structure. Raised floor constructions may involve a system of floor joists 4 on which the floor is built, where the floor joists 4 are spaced apart in relation to the underlying support surface 22. To create the distance between the floor joists 4 and the underlying support surface 22, a suitable number of spaced apart level adjustment screws 2 are used for each floor joist.

[0027] As shown in figures 1a-b and 5, the floor joist 4 has a hollow configuration with an upper wall 5, a lower wall 6 and two side walls 7 arranged between the upper wall 5 and the lower wall 6. This provides a lightweight and stable floor joist construction. As shown in the figures, the floor joist 4 may have an essentially rectangular cross-sectional shape, but other suitable cross-sectional shapes are also possible. The lower wall 6 is facing the support surface 22 and the upper wall 5 is providing a surface on which the floor covering material is supported.

[0028] The floor joist 4 may be made of any suitable material, such as steel, aluminium or other metals, composite materials or wooden materials. Specifically, the floor joist 4 is made of a metal sheet material, for example a thin steel sheet material that is folded from a steel blank or a rolled steel sheet into its desired configuration and thereafter welded along the length in the first direction X to achieve a strong construction. The produced floor joist 4 may either be manufactured into a desired length or cut into suitable lengths. As a non-limiting example, in order to achieve a lightweight construction a steel sheet material with a thickness of 0.5-4.0 mm may be used.

[0029] The section of the floor joist 4 shown in figures 1a-b has two connection plugs 3 that are releasably connected to the floor joist 4. The upper wall 5 of the floor joist 4 has at least one upper plug opening 8 and the lower wall 6 has at least one corresponding lower plug opening 9. When the level adjustment screws 2 are attached to the floor joist 4 with the connection plugs 3, the level adjustment screws 2 are extending in a second direction Y, where the second direction Y is essentially orthogonal to the first direction X. As an alternative, the level adjustment screws 2 may also extend in a direction that is non-orthogonal to the first direction X if suitable for the design of the floor support system 1.

[0030] The distances D between the connection plugs 3 with engaged level adjustment screws 2 in the first direction X when attached to the floor joist 4, as shown in figure 1a, may be varied depending on the type of floor construction. The heavier load the floor joist 4 should carry, the shorter distances D between the level adjustment screws 2 may be needed in order to secure a stable and safe floor construction. The type of floor joist construction used could also impact the distance needed between the level adjustment screws 2. A strong floor joist construction made for example from a thicker sheet metal material may be designed with longer distances D than a weaker floor joist construction. As a non-limiting example, the distances D in the first direction X between the connection plugs 3 with level adjustment screws 2 when attached to the floor joist 4 may be in the range of about 200-1000 mm. The floor joist 4 may be designed so that the distances D between the connection plugs 3 in the first direction X are equal. It is also possible to have different distances between the connection plugs. As a non-limiting example, the floor joist 4 may be provided with several upper plug openings 8 and corresponding lower plug openings 9 with a distance of 200 mm between

pairs of upper and lower plug openings along the floor joist 4 in the first direction X. With such an arrangement connection plugs 3 with level adjustment screws 2 may be attached to the floor joist 4 at a distance D of for example 200 mm, 400 mm, 600 mm, 800 mm, or 1000 mm. There is thus no need to attach connection plugs 3 with level adjustment screws 2 to all upper plug openings 8 and corresponding lower plug openings 9 provided in the floor joist 4, if desired.

[0031] The connection plugs 3 are attachable to the floor joist 4 by an upper plug end 10 connecting to the upper plug opening 8 of the floor joist 4 and a lower plug end 11 connecting to the corresponding lower plug opening 9 of the floor joist 4. When the section of the floor joist 4 is viewed from above or from below as shown in figures 2a and 2b, the upper plug opening 8 and the corresponding lower plug opening 9 of the floor joist 4 are aligned in the second direction Y so that the connection plugs 3 can be attached to the floor joist 4 in a position so that the attachment screws 2 are extending essentially in the second direction Y. The level adjustment screws 2 may also be arranged at another angle in relation to the extension of the floor joist 4 if suitable.

[0032] As shown in figures 5 and 6, the upper plug openings 8 of the floor joists 4 have a specific shape that interacts with the upper plug ends 10 of the connection plugs 3. Each upper plug opening 8 is encompassed by an inwardly projecting support flange 12 that is extending from the upper wall 5 of the floor joist 4 into the inner hollow part of the floor joist 4. The support flange 12 has at its lower point a lower support surface 13, which according to this embodiment has a circular shape, as shown in figures 2a-b. The support flange 12 gives the floor joist 4 a more stable construction, since the projection downwards is stabilizing the floor joist 4 where the upper plug opening 8 is arranged.

[0033] Also, the lower plug openings 9 of the floor joists 4 have a specific shape that interacts with the lower plug ends 11 of the connection plugs 3. Each lower plug opening 9 has one or more plug opening recesses 15. In the embodiment shown, the plug opening 9 has two plug opening recesses formed on each side of the lower plug opening, as shown in figure 2b, which are adapted for cooperating with lower end parts 17 of the flexible attachment members 16 of the connection plug 3, so that the connection plugs 3 are prevented from rotating about an axis extending in the second direction Y when being attached to the floor joist 4. The plug opening recesses 15 are simply formed as two oppositely arranged rectangular-like recesses forming parts of the lower plug openings 9. The lower plug openings 9 are essentially circular in shape with the exception of the plug opening recesses 15, as shown in figures 1b and 2b.

[0034] When manufacturing the floor joists 4 from a metal sheet material, the upper plug openings 8 with the support flange 12 and the lower plug openings 9 with the plug opening recesses 15, may be formed through a punching operation, where the openings are punched

out from the metal sheet before it is formed into its desired hollow beam-like configuration.

[0035] To further strengthen the floor joist construction, the side walls 7 of the floor joist 4 may be provided with one or more reinforcement grooves 23 extending along the floor joist 4 in the first direction X. It is possible to only provide one of the side walls with one or more reinforcement grooves 23 and also the upper wall 5 and the lower wall 6 may be provided with reinforcement grooves 23. In the embodiment shown, the side walls 7 are each provided with two reinforcement grooves 23. The reinforcement grooves 23 may be arranged as inwardly or outwardly arranged protrusions in the material forming the floor joist 4, which protrusions are extending along the floor joist 4 in the first direction X. In figures 1a-b and 5, the reinforcement grooves are formed as inwardly arranged protrusions.

[0036] Figures 4a and 3b, show the level adjustment screw 2 more in detail. The level adjustment screw 2 has an elongated tubular shape with a length extending in the second direction Y when attached to the floor joist 4 with the connection plug 3. The level attachment screw 2 has a lower screw end 24a and an upper screw end 24b. The level adjustment screw 2 has further an outer surface 18 with threads forming a first threaded area 19, arranged so that the main part of the outer surface 18 along the length of the level adjustment screw 2 is threaded. The level adjustment screw may be designed with a non-threaded area 25 at the lower screw end 24a. The non-threaded area 16 at the lower screw end 24a only extends a small distance along the total length of the level adjustment screw 2 in the second direction Y and may as an option be used for attaching the level adjustment screw to a support device such as for example a foot that provides a good support towards the support surface 22. In figures 5 and 6, the level adjustment screw 2 is shown without a non-threaded area.

[0037] The first threaded area 19 of the level adjustment screw 2 is adapted to interact with the floor joist 4 via the connection plug 3 so that the height of the floor joist 4 in relation to the underlying support surface 22 can be adjusted. The height of the floor joist 4 in relation to the support surface 22 can be adjusted by rotating the level adjustment screws 2 in relation to the floor joist 4. The connection plugs 3 may have a second threaded area 21 with threads that are matching the threads of the first threaded area 19 of the level adjustment screw 2. The first threaded area 19 of the level adjustment screw 2 at the upper screw end 24b is attachable to the second threaded area 21 of the connection plug 3.

[0038] When attaching the level adjustment screw 2 to the floor joist 4, the upper screw end 24b is screwed into the second threaded area 21 of the connection plug 3 from the side where the lower plug end 11 is located. In this way, depending on how far the level adjustment screw 2 is screwed into the floor joist 4, the length of the level adjustment screw 2 extending out from the floor joist 4 can be varied and adapted to a certain height level for

the floor joist 4 in relation to the support surface 22. This means that the length of the level adjustment screw 2, in the second direction Y, extending out from the floor joist 4 can be adjusted by rotating the level adjustment screw 2 in relation to the floor joist 4 and connection plug 3. The more the level adjustment screw 2 is screwed into the floor joist 4, the shorter distance between the floor joist 4 and the support surface 22.

[0039] Thus, the level adjustment screw 2 is rotatably attachable to the at least one connection plug 3, so that the at least one level adjustment screw 2 is displaced in the second direction Y when being attached to and rotated in relation to the at least one connection plug 3 about an axis extending in the second direction Y.

[0040] The level adjustment screws 2 may be manufactured in an assortment with different lengths, so that shorter level adjustment screws 2 are used when there is a need for shorter distances between the underlying support surface 22 and the floor joists 4 and longer level adjustment screws 2 for longer distances. If the support surface 22 has a non-planar top surface with large variations, different lengths on the level adjustment screws 2 may be used in order to secure a level top surface of the floor joists 4. As an alternative, if the level adjustment screws 2 are screwed far into the floor joists 4 so that the upper screw ends 24b extend above the upper surface of the floor joists 4, the part of the level adjustment screws extending above the upper surface of the floor joist 4 may be cut in order to secure an even top surface of the floor joist construction.

[0041] As an alternative, when attaching the level adjustment screw 2 to the floor joist 4, the lower screw end 24b may be screwed into the second threaded area 21 of the connection plug 3 from the side where the upper plug end 12 is located.

[0042] Once inserted into the floor joists 4, the level adjustment screws 2 are possible to remove from the floor joists 4 by simply unscrewing them from the second threaded area 21 of the connection plugs 3 if needed. After removal, the level adjustment screws 2 may again be screwed into the connection plugs 3.

[0043] The dimensions of the level adjustment screws 2 may be varied depending on the floor construction. As a non-limiting example, the level adjustment screws 2 may have a diameter of 20-40 mm and the total length may vary between 50-500 mm. The level adjustment screws may have a tubular-like configuration with a hollow interior 28 as shown in figures 4a-c. The tubular-like configuration is used to achieve a lightweight and material saving construction. The lower end 2a of the level adjustment screw 2 has a lower surface 26, which lower surface 26 may be made planar in order to interact with the support surface 22.

[0044] At the lower surface 26, an attachment opening 27 may be provided so that the lower screw end 24a of the level attachment screw 2 in a known way can be anchored directly to the underlying support surface 22 with a suitable fastening means, such as for example a

screw, a nail or other suitable attachment means. The type of fastening means used should be chosen to match the material of the underlying support surface 22. For a concrete support surface 22, a concrete screw or a concrete nail may for example be a suitable fastening means. As an example when using a concrete screw for anchoring the level adjustment screw 2 to the support surface 22, the concrete screw is inserted into the hollow interior 28 of the level attachment screw 2 so that the end of the concrete screw first enters the attachment opening 27 and then further enters a pre-drilled hole in the underlying support surface 22 so that the concrete screw can be screwed into the pre-drilled hole.

[0045] In figure 4c the level adjustment screw 2 is shown in a view from above. The level adjustment screw 2 has an essentially circular outer periphery with threads arranged on the first threaded area 19 of the outer surface 18. The hollow interior of the tube-like configuration is forming a recess, which in the upper screw end 24b may accommodate a tool for adjusting the height of the floor joist 4 in relation to the support surface 22. As shown in figures 1 a and 4c, the cross-section of the hollow interior when viewed from above is hexagonal so that a hexagonal socket 29 for an Allen wrench is formed. The level adjustment screw 2 may instead be designed with an upper screw end 24b of another configuration for other types of tools, for example with other shapes of the socket. Further, the level adjustment screw may 2 as an alternative be made with a non-hollow or partly hollow interior.

[0046] The level adjustment screw 2 can be made of any suitable material, such as for example plastic materials, metals or composite materials. Also combinations of different materials may be used. Specifically, the level adjustment screw 2 may be made of a plastic material or a fibre reinforced plastic material, such as for example glass fibre reinforced polypropylene (PPH) or a glass fibre reinforced polyamide (PA). To manufacture the level adjustment screw 2 an injection moulding process may be used.

[0047] Figures 3a-d, 5 and 6 show a connection plug according to the disclosure. The connection plug in the embodiment shown 3 has a tubular shaped body provided with two outwardly projecting flexible attachment members 16 for attaching the connection plug 3 to the floor joist 4. The tubular shaped connection plug 3 has an inner plug surface 20a and an outer plug surface 20b. When viewed from above, as seen in figures 3a-b, the inner plug surface 20a and the outer plug surface 20b of the connection plug 3 has circular cross-sectional shapes. The inner plug surface 20a is provided with threads, which form the second threaded area 21. The threads of the second threaded area 21 are adapted to interact with the threads of the first threaded area 19 arranged on the level adjustment screw 2, as shown in detail in figure 5.

[0048] The flexible attachment members 16 are projecting radially outwards and downwards from the outer

plug surface 20b. As shown in figures 3c-d the flexible attachment members 16 are projecting from the mid-section of the outer plug surface 20b, but other suitable arrangements for the flexible attachment members 16 are also possible. To secure that the connection plug 3 and the floor joist 4 are securely attached to each other and not separated from each other in the direction along the second axis Y, each of the flexible attachment members 16 are arranged to engage one of the plug opening recesses 15 arranged at the lower plug opening 9 of the floor joist 4. As shown in figures 1b and 2b, the floor joist 4 has two plug opening recesses 15 that are interacting with the two flexible attachment members 16. In this way, the flexible attachment members 16 and the plug opening recesses 15 are adapted to prevent separation of the connection plug 3 from the floor joist 4 in a direction away from each other along the second axis Y.

[0049] The plug opening recesses 15 are adapted for cooperating with a lower end part 17 of the flexible attachment members 16, so that the at least one connection plug 3 is prevented from rotating about the axis extending in the second direction Y when being attached to the floor joist 4. The lower end part 17 has a lower surface that is in direct contact with the plug opening recess 15 when the connection plug is attached to the floor joist 4. The lower end part 17 engages the plug opening recess 15 so that the connection plug 3 is locked in position in the second direction Y within the floor joist 4, as shown in figure 6. As further can be seen in figure 6, the lower end part 17 extends above a part of the upper side of the lower wall 6 at the plug opening recess 15 to achieve the locking effect of the connection plug 3 in relation to the floor joist 4. Since the flexible attachment members 16 are projecting radially outwards from the outer surface 18, they prevent rotation of the connection plug 3 when attached to the floor joist 4 and interacting with the plug opening recesses 15.

[0050] The upper plug end 10 of the connection plug 3 is provided with an upper support surface 14. The upper support surface 14 is arranged at the upper end of the connection plug 3 and is forming a part of a collar-like plug recess 30 arranged above the second threaded area 21. The plug recess 30 at the upper end of the connection plug 3, as shown in figures 3d, 5 and 6 has a slightly larger diameter than the diameter of the second threaded area. In this way, the recess interacts with the support flange 12 of the floor joist 4, so that the upper support surface 14 is in direct contact with the lower support surface 13 of the support flange 12 when the connection plug 3 is attached to the floor joist 4. When the connection plug 3 is attached to the floor joist 4, the upper part of the plug recess 30 is encompassing the lower part of the support flange 12. The support flange 12 thus has a slightly smaller diameter than the plug recess 30, which also prevents the connection plug 3 from escaping through the upper plug opening 8. With this construction, the upper plug end 10 is connected to and interacting with the support flange 12 of the floor joist 4 so that the

support flange 12 is positioning the upper plug end 10 in relation to the floor joist 4 and holds the upper plug end 10 in place in relation to the floor joist 4.

[0051] When attaching the connection plug 3 to the floor joist 4, the upper plug end 10 of the connection plug 3 is pushed into the lower plug opening 9 of the floor joist 4. The flexible attachment members 16 are formed so that they can flex radially inwards when the connection plug 3 is pushed into the lower plug opening 9 with the flexible attachment members 16 aligned with the plug opening recesses 15, and flex back again to their initial position when the connection plug 3 is fully inserted into the floor joist 4.

[0052] When the connection plug 3 is pushed into the lower plug opening 9 of the floor joist 4, the edges of the plug opening recesses 15 are pushing the flexible attachment members 16 in a direction radially inwards in relation to the second axis Y. When the level adjustment screw 2 is pushed further into the lower plug opening 9, the plug recess 30 is interacting with the support flange 12 of the floor joist 4 so that the connection plug is aligned in the correct position along the second axis Y. Once the connection plug 3 is pushed into its correct position within the floor joist 4, the flexible attachment members 16 are flexing back into their initial position so that the lower end parts 17 are in engagement with the plug opening recesses 15, as shown in figure 6. When the flexible attachment members 16 and the plug opening recesses 15 are interacting, the connection plug 3 is prevented from being separated from the floor joist 4. The lower end parts 17 are thus locking the lower plug end 11 of the connection plug 3 to the floor joist 4, and the plug recess 30 with the upper support surface 14 is engaging the connection plug 3 to the lower support surface 13 of the support flange 12, so that the connection plug 3 is locked into position within the floor joist 4 and being prevented from being disconnected from the floor joist in a direction along the second axis Y. Further, when the connection plug 3 and the floor joist 4 are connected to each other, the connection plug, as described above, is prevented from rotating about the second axis Y in relation to the floor joist 4, which is necessary when engaging the level adjustment screw 2 to the connection plug 3 and when adjusting the level connection screw 2 in relation to the floor joist 4. The lower plug end 11 is designed to fit the lower plug opening 9 so that there is only a small play between the outer plug surface 20b of the lower plug end 11 and the edge of the lower plug opening 9. In the same way, the upper plug end 10 is designed to fit the upper plug opening 8 so that there is only a small play between the plug recess 30 and the support flange 12 when connected.

[0053] If needed, in order to separate the connection plug 3 from the floor joist 4, tools may for example be used to force the flexible attachment members 16 in a direction radially inwards so that they are no longer engaging the plug opening recesses 15. Thereafter, the connection plug 3 is disengaged from the floor joist 4 by

pulling the connection plug 3 through the lower plug opening 9 in a direction along the second axis Y away from the floor joist 4.

[0054] As an alternative, the connection plug 3 may instead be provided with one, three or even more flexible attachment members 16, and the floor joist 4 may be provided with a suitable number of plug opening recesses 15. If only one flexible attachment member 16 is used, only one plug opening recess 15 is needed. If three or more flexible attachment members 16 are used, a corresponding number of plug opening recesses 15 are arranged at the lower plug opening 9. If two or more flexible attachment members 16 are used, they may be different in design, shape and size as long as they are connected to and interacting with corresponding plug opening recesses 15. Also the plug opening recesses 15 may be of different shape than the described, as long as they interact with the flexible attachment members 16 in an efficient way.

[0055] To secure that the connection plug 3 is firmly connected to the floor joist 4, the floor support system 1 may be designed so that the flexible attachment members 16 and the plug opening recesses 15 are engaging the level connection plug 3 and the floor joist 4 in a way so that they can withstand a specific separation force in a direction along the second axis Y. The size and design of the flexible attachment members 16 with lower end parts 17 and the design of the plug opening recesses 15 may be chosen so that this specific level of separation force can be met. In this way, the flexible attachment members 16 and the plug opening recesses 15 are connecting the connection plug 3 to the floor joist 4 so that they can withstand a specific separation force in a direction along the longitudinal axis X. To meet a high construction standard of the floor system, the floor support system 1 may be designed to withstand a specific separation force in a direction along the second axis Y of at least 0.10 kN. In this way a stable and reliable construction is achieved. Tests have shown that the specific separation force of at least 0.10 kN firmly connects the connection plug 3 to the floor joist 4, providing a reliable connection.

[0056] The connection plug 3 may be made of any suitable material, such as for example plastic materials, metals or composite materials. Also combinations of different materials may be used. Specifically, the connection plug 3 is made of a plastic material, such as for example polyoxymethylene (POM), or a fibre reinforced plastic material. The connection plug 3 may be manufactured through an injection moulding process, and may have other suitable shapes than the described tubular shape as long as the connection plug provides the same function.

[0057] It will be appreciated that the above description is merely exemplary in nature and is not intended to limit the present disclosure, its application or uses. While specific examples have been described in the specification and illustrated in the drawings, it will be understood by those of ordinary skill in the art that various changes may

be made and equivalents may be substituted for elements thereof without departing from the scope of the present disclosure as defined in the claims. Furthermore, modifications may be made to adapt a particular situation or material to the teachings of the present disclosure without departing from the essential scope thereof. Therefore, it is intended that the present disclosure not be limited to the particular examples illustrated by the drawings and described in the specification as the best mode presently contemplated for carrying out the teachings of the present disclosure, but that the scope of the present disclosure will include any embodiments falling within the foregoing description and the appended claims. Reference signs mentioned in the claims should not be seen as limiting the extent of the matter protected by the claims, and their sole function is to make claims easier to understand.

REFERENCE SIGNS

[0058]

- 1: Floor support system
- 2: Level adjustment screw
- 3: Connection plug
- 4: Floor joist
- 5: Upper wall
- 6: Lower wall
- 7: Side walls
- 8: Upper plug opening
- 9: Lower plug opening
- 10: Upper plug end
- 11: Lower plug end
- 12: Support flange
- 13: Lower support surface
- 14: Upper support surface
- 15: Plug opening recesses
- 16: Flexible attachment members
- 17: Lower end part
- 18: Outer surface
- 19: First threaded area
- 20a: Inner plug surface
- 20b: Outer plug surface
- 21: Second threaded area
- 22: Support surface
- 23: Reinforcement grooves
- 24a: Lower screw end
- 24b: Upper screw end
- 25: Non-threaded area
- 26: Lower surface
- 27: Attachment opening
- 28: Hollow interior
- 29: Hexagonal socket
- 30: Plug recess

Claims

1. An adjustable floor support system (1) for supporting a raised floor construction relative to an underlying support surface (22), the adjustable floor support system (1) comprising an elongated floor joist (4) extending in a first direction (X), at least one level adjustment screw (2) and at least one connection plug (3);

wherein the at least one level adjustment screw (2) is attachable to the at least one connection plug (3), and the at least one connection plug (3) is attachable to the floor joist (4);

characterized in that the floor joist (4) has a hollow configuration with an upper wall (5), a lower wall (6) and two side walls (7) arranged between the upper wall (5) and the lower wall (6), where the upper wall (5) has at least one upper plug opening (8) and the lower wall (6) has at least one corresponding lower plug opening (9);

wherein the at least one connection plug (3) is attachable to the floor joist (4) by an upper plug end (10) connecting to the at least one upper plug opening (8) of the floor joist (4) and a lower plug end (11) connecting to the at least one corresponding lower plug opening (9) of the floor joist (4).
2. An adjustable floor support system (1) according to claim 1,

characterized in that the at least one level adjustment screw (2) is extending in a second direction (Y) when attached to the floor joist (4) with the connection plug (3), where the second direction (Y) is essentially orthogonal to the first direction (X).
3. An adjustable floor support system (1) according to claim 2,

characterized in that the at least one level adjustment screw (2) is rotatably attachable to the at least one connection plug (3), so that the at least one level adjustment screw (2) is displaced in the second direction (Y) when being attached to and rotated in relation to the at least one connection plug (3) about an axis extending in the second direction (Y).
4. An adjustable floor support system (1) according to any of the preceding claims,

characterized in that the at least one upper plug opening (8) of the floor joist (4) is encompassed by an inwardly projecting support flange (12) extending from the upper wall (5), where the support flange (12) has a lower support surface (13).
5. An adjustable floor support system (1) according to claim 4,

characterized in that the upper plug end (10) of the at least one connection plug (3) has an upper support surface (14), where the upper support surface (14) is interacting with the lower support surface (13) of the support flange (12) when the at least one connection plug (3) is attached to the floor joist (4).
6. An adjustable floor support system (1) according to any of the preceding claims,

characterized in that the at least one connection plug (3) has one or more outwardly projecting flexible attachment members (16) for attaching the at least one connection plug (3) to the floor joist (4).
7. An adjustable floor support system (1) according to claim 6,

characterized in that the at least one lower plug opening (9) of the floor joist (4) has one or more plug opening recesses (15) adapted for cooperating with a lower end part (17) of the one or more flexible attachment members (16), so that the at least one connection plug (3) is prevented from rotating about an axis extending in the second direction (Y) when being attached to the floor joist (4).
8. An adjustable floor support system (1) according to claim 7,

characterized in that the one or more flexible attachment members 16 and the one or more plug opening recesses 15 are connecting the level connection plug 3 to the floor joist 4 so that they can withstand a specific separation force of at least 0.10 kN in a direction along the second axis Y.
9. An adjustable floor support system (1) according to any of the preceding claims,

characterized in that the at least one level adjustment screw (2) has an elongated tubular shape with an outer surface (18) having a first threaded area (19), and the at least one connection plug (3) has a tubular shape with an inner plug surface (20a) having a second threaded area (21), where the first threaded area (19) is adapted to interact with the second threaded area (21).
10. An adjustable floor support system (1) according to any of the preceding claims,

characterized in that the side walls (7) of the floor joist (4) have one or more reinforcement grooves (23) extending along the floor joist (4) in the first direction (X).
11. An adjustable floor support system (1) according to any of the preceding claims,

characterized in that the at least one level adjustment screw (2) is made of a plastic material or a fibre reinforced plastic material, such as for example glass fibre reinforced polypropylene (PPH) or a glass fibre

reinforced polyamide (PA).

12. An adjustable floor support system (1) according to any of the preceding claims, characterized in that the at least one connection plug (3) is made of a plastic material, such as for example polyoxymethylene (POM), or a fibre reinforced plastic material. 5
13. An adjustable floor support system (1) according to any of the preceding claims, **characterized in that** the floor joist (4) is made of metal, such as for example steel or aluminium, or a composite material. 10

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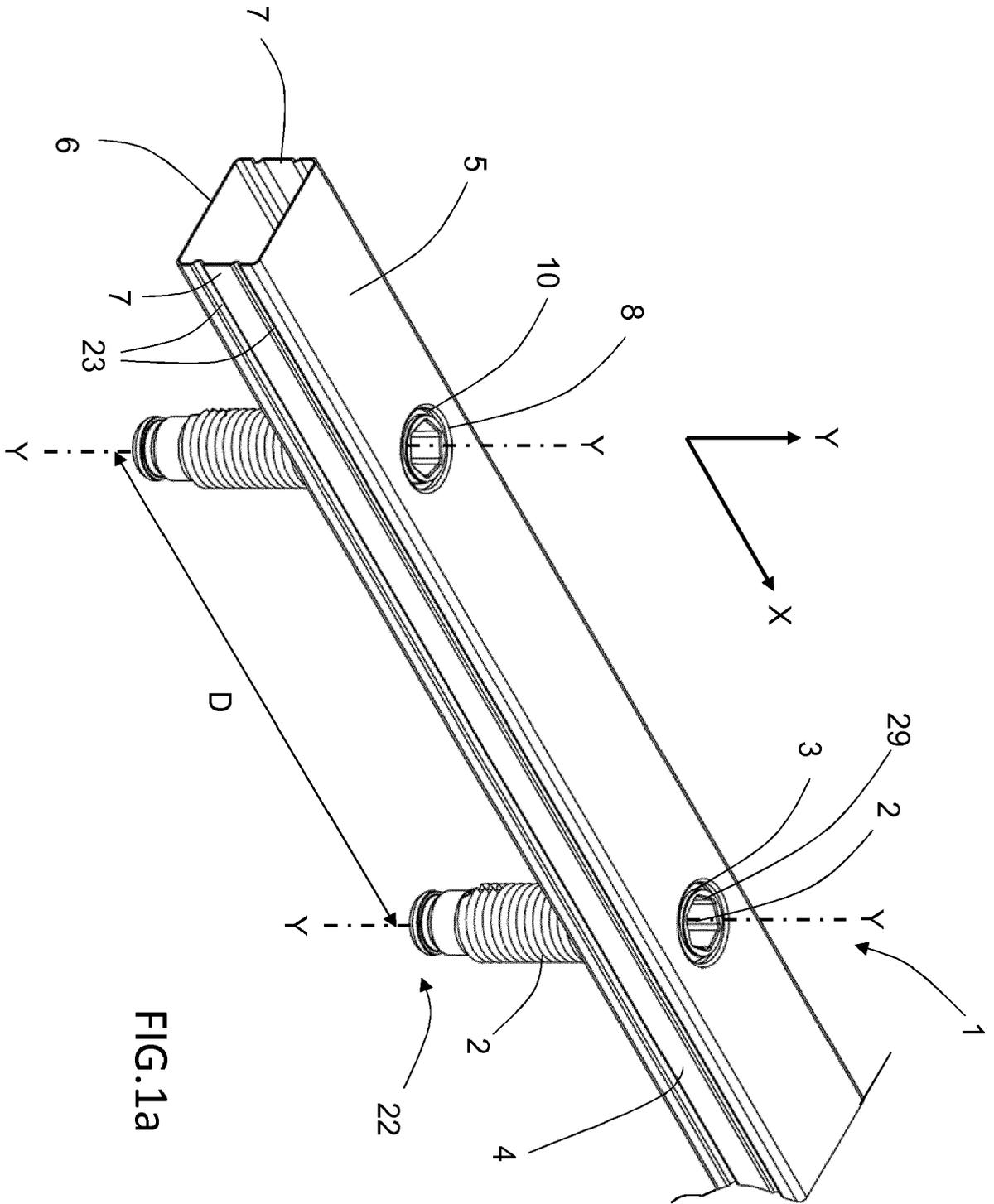


FIG. 1a

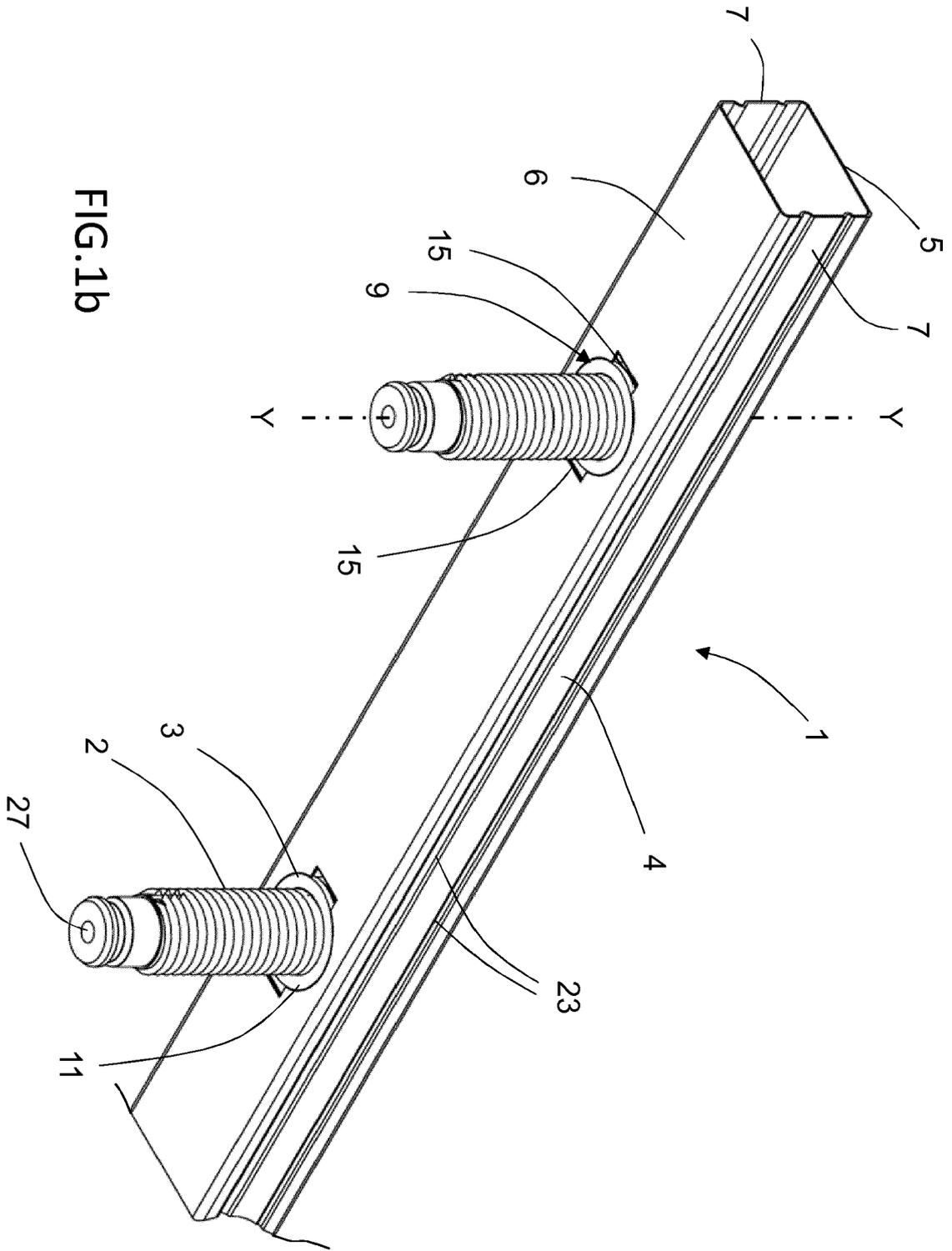


FIG. 1b

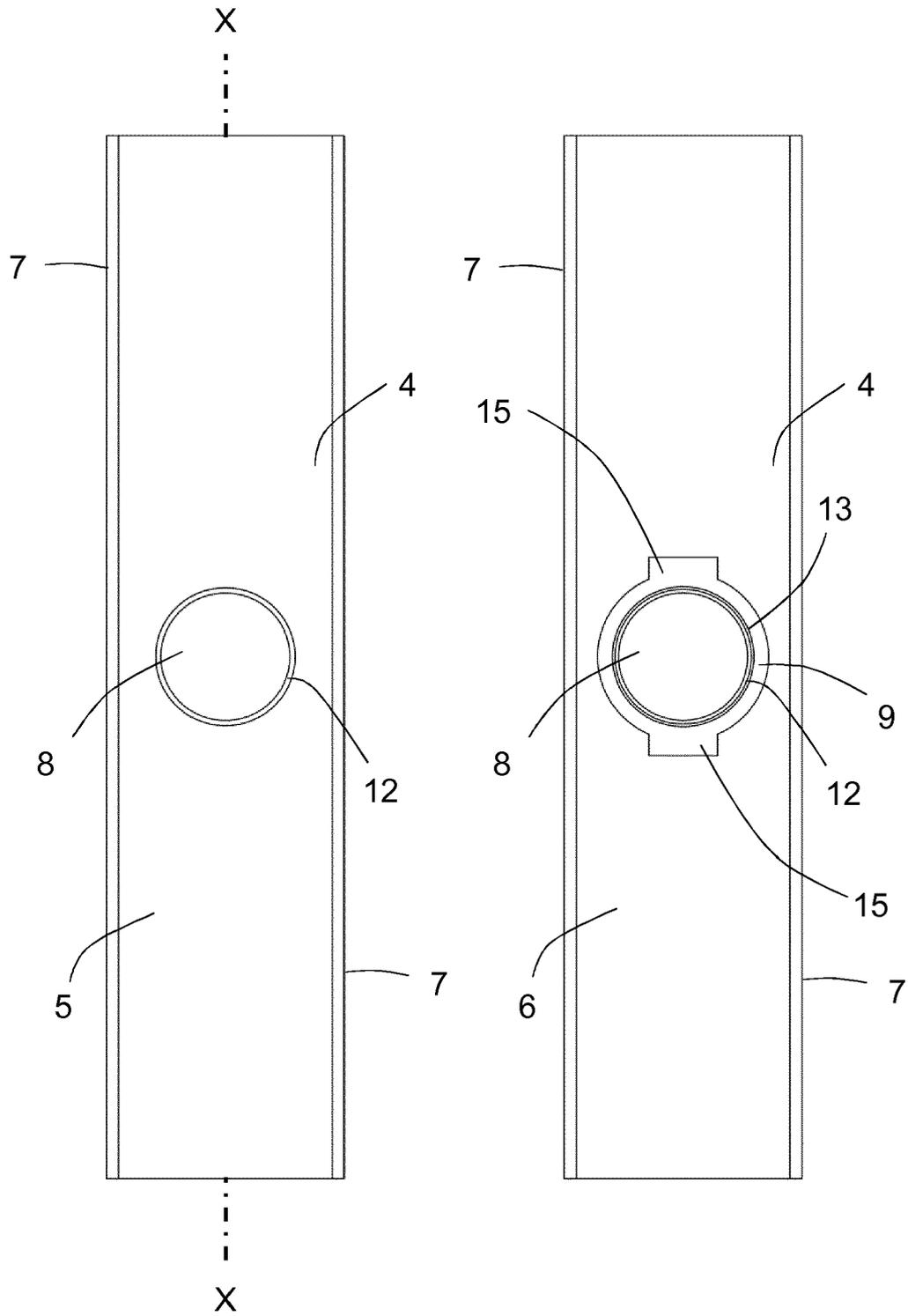


FIG.2a

FIG.2b

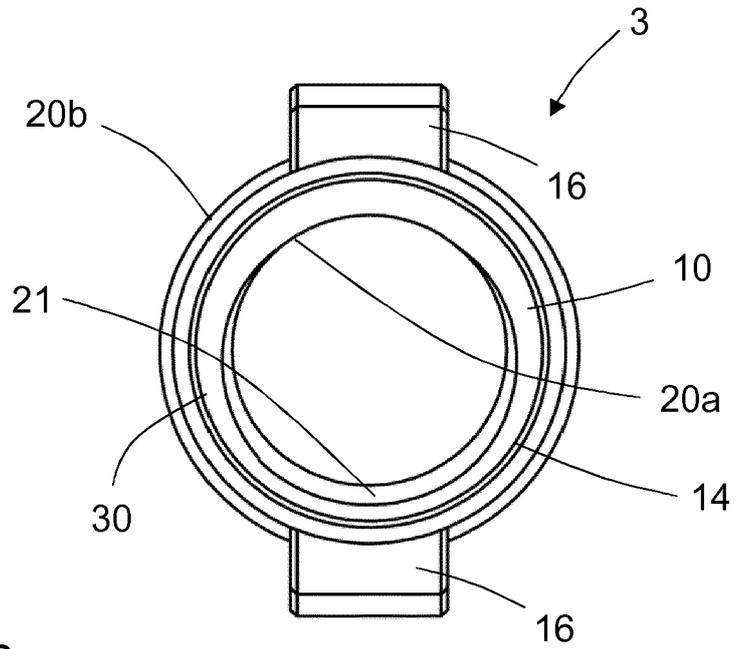


FIG.3a

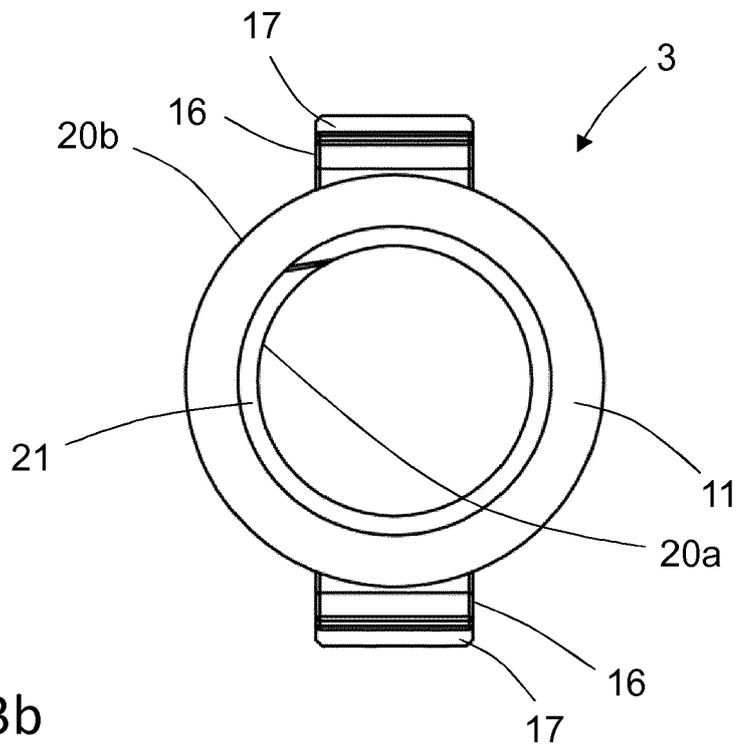


FIG.3b

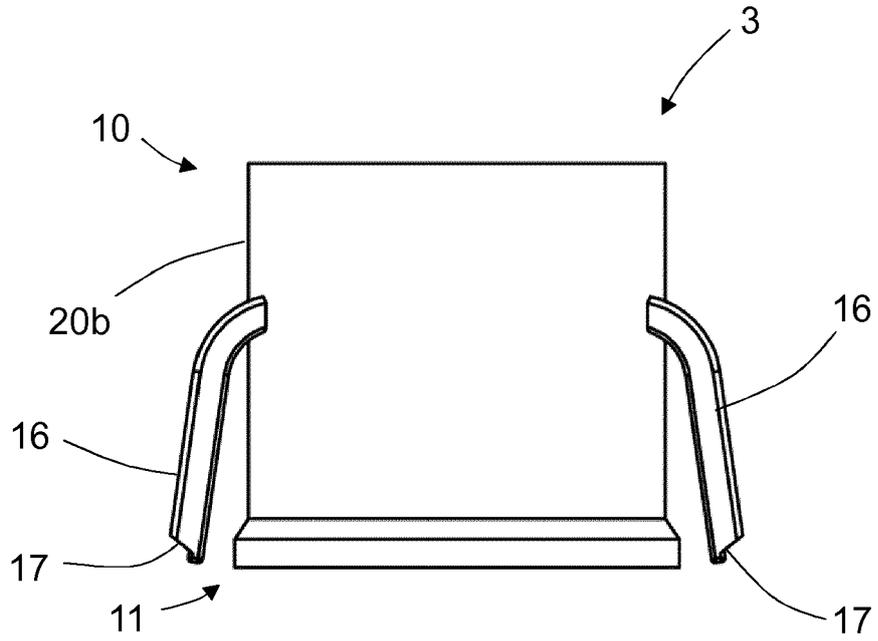


FIG. 3c

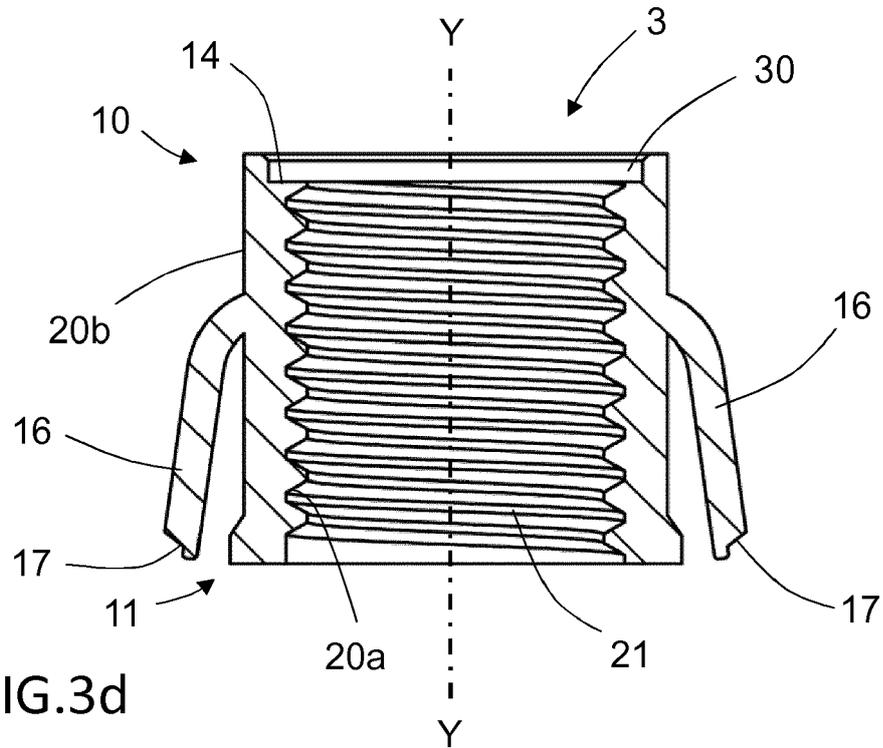
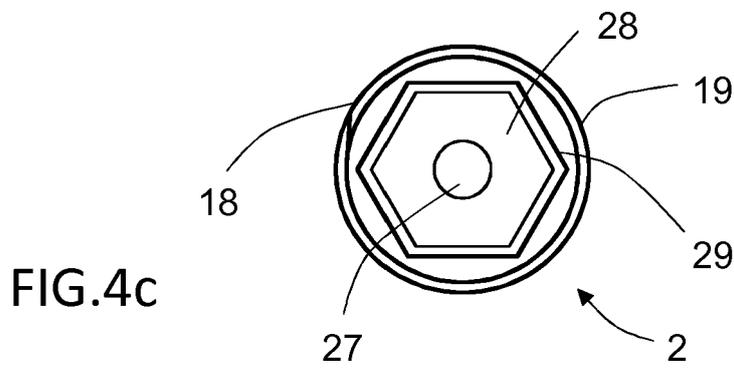
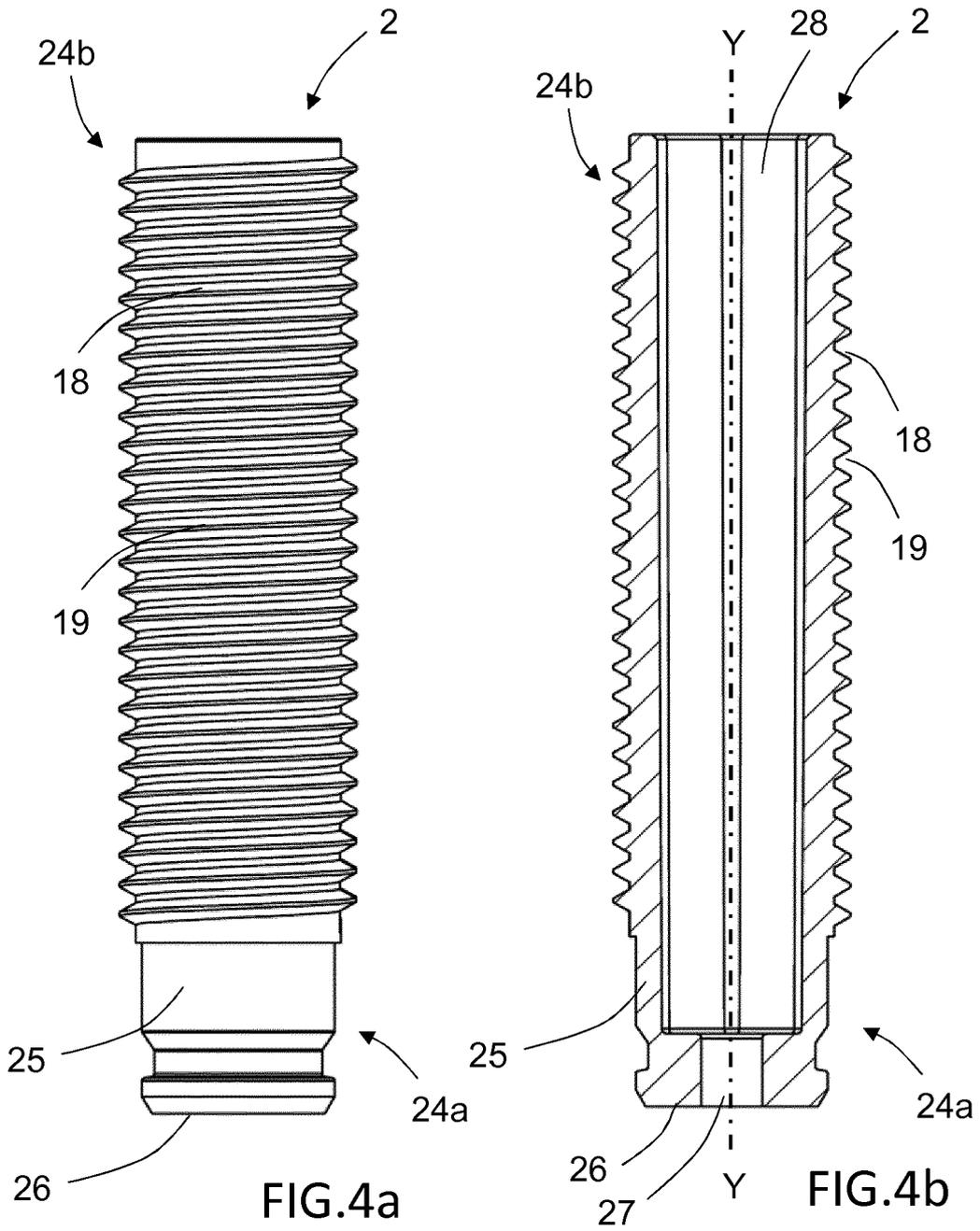


FIG. 3d



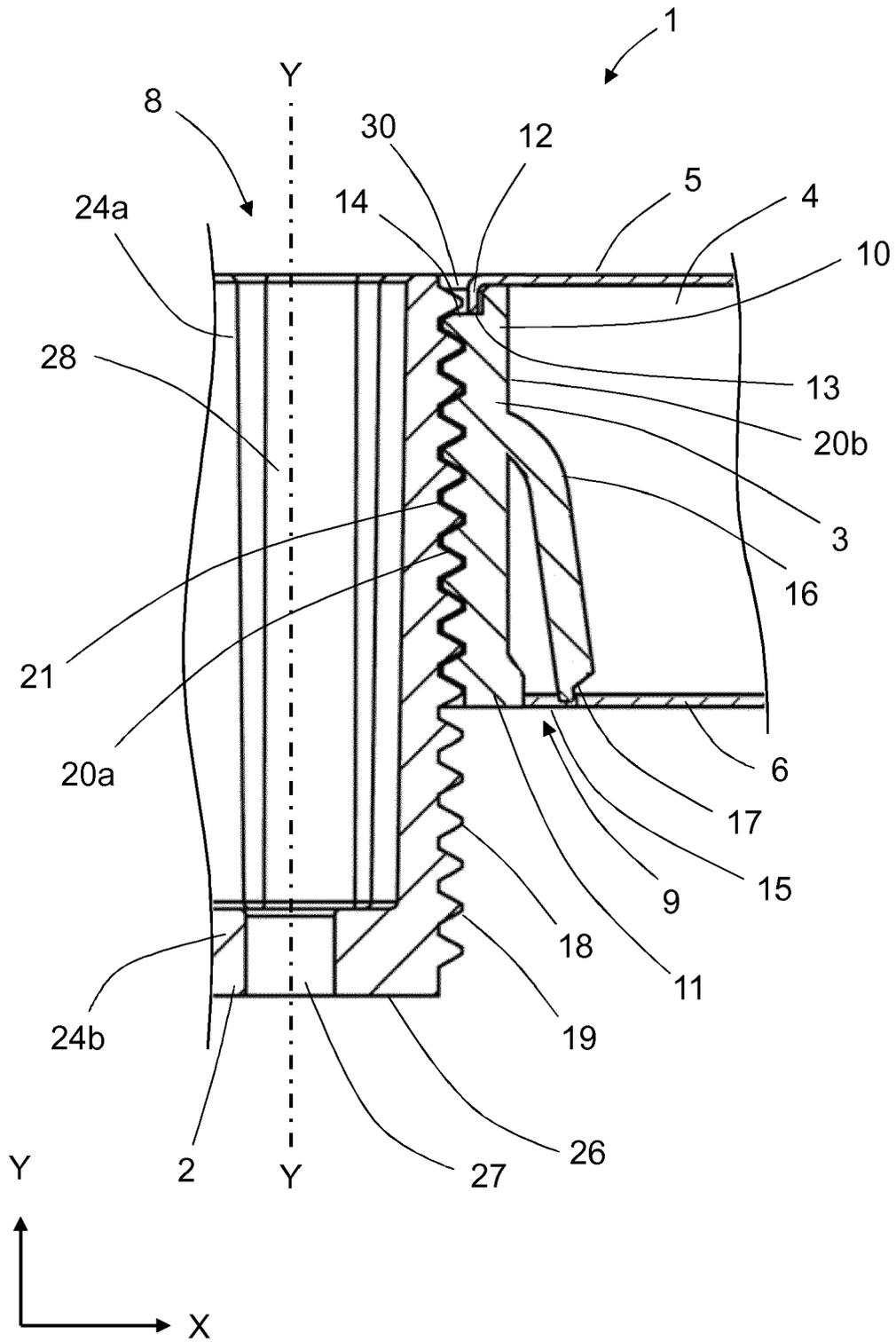


FIG.6



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Place of search Munich		Date of completion of the search 22 December 2017	Examiner Arsac England, Sally
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