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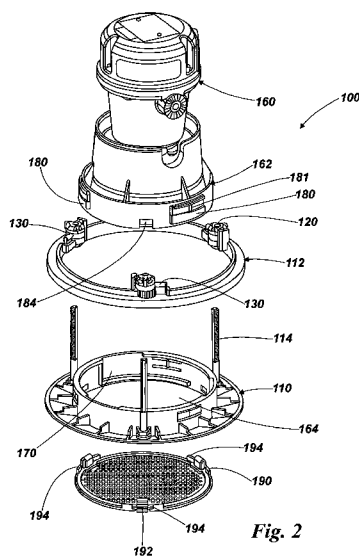


Fig. 2

(57) Abstract: The invention provides a fixing assembly (100) including a first body (110) having a projecting member (114) including first engagement means (116), a second body (120) slideable along at least a portion of said projecting member (114), the second body (120) having second engagement means (124) for engagement with the first engagement means (116), engagement of the first and second engagement means (116, 124) preventing the second body (120) from sliding along the first body projecting member (114), a third body (130) rotatable about the projecting member (114) and locatable between the first and second bodies (110, 120), a fourth body (112), locatable between the first and second bodies (110, 120), wherein the first, second, third and fourth bodies (110, 120, 130, 112) are arrangeable such that rotation of the third body (130) into a clamping position urges the second and fourth bodies (120, 112) to separate.

Support

The present invention relates to support means, e.g. for a speaker or a light, which may be wall, floor, ceiling or otherwise mounted. In particular, the present invention provides support means which is more easily and efficiently fitted to e.g. a ceiling etc., and which is more user friendly during installation.

In modern buildings walls, floors and/or ceilings are often formed of plaster board or other relatively thin planar or laminate structures. It is known that such structures can bear the weight of one or more speakers, lights etc. and often they are coupled to the speaker(s) (or light(s) etc.) by support means. Such support means, modified or otherwise, may also be suitable to support e.g. a speaker (light etc.) in a floor structure or a wall structure.

Conventional support means often comprise a first member and a second member which cooperate to sandwich, e.g. clamp, the weight bearing structure. Conventionally, the second member includes a threaded nut (and possible a washer) for engagement with a long threaded member, such as a

conventional bolt, which extends from the first member and passes through the weight bearing structure such as a ceiling tile, for example. Screwing the nut along the bolt, e.g. by using ones fingers, and ultimately tightening it with e.g. a spanner, clamps the support means to the weight bearing structure. Figs. 1(a) and (b) show a basic schematic of such a conventional support means 1, with a support element 10 having integral threaded bolts 12 which are able to pass through e.g. a ceiling tile 14 into a ceiling space 16 to be engaged with nuts 18. The nuts 18 are rotated to move along the respective bolt, as shown in Fig. 1(a).

The ceiling tile 14 has a bore 20 formed in it, which is preferably of a wider diameter than the lumen 22 of the support element 10. Thus, the speaker can be lowered to rest on the lip 24 present formed between the lumen 22 and the wall of the ceiling tile forming the bore 20.

The weight bearing structure is provided with a lumen in which the speaker, light etc. is to be held in place by being supported by the support means. Any trailing wires or leads coming from the speaker, light etc. can extend through the wall space, floor space or ceiling space, for example.

Conventional support means such as that described above are disadvantageous, in that they require the installing engineer repeatedly to perform numerous time consuming tasks to fix, e.g. clamp, the support means to the weight bearing structure. In particular, as can be seen from Fig. 1, the engineer will often have to extend an arm through the lumen 22 to engage a respective nut with each of the bolts.

Often, this will have to be performed one handed, as the size of the lumen will not permit two hands/arms to pass through. This is undesirable, because it can take a long time to engage a nut to a bolt one-handedly (especially when neither is visible to the user). It can also take a long time to rotate each nut sufficiently along the respective bolt so that each one is positioned to clamp (perhaps softly) the weight bearing structure - i.e. to finger tighten the nut and bolt. It can also be difficult to use a tool such as a spanner one handedly to tighten the nut and bolt arrangement further to clamp the weight bearing structure sufficiently.

The present invention attempts to solve at least the above problems. Thus, in a first aspect, the present invention provides a fixing assembly as set forth in claim 1.

Advantageously, the third body permits an installing engineer (or user) to clamp the fixing assembly, e.g. to a weight bearing structure as previously described, one handedly with greater relative ease - thereby increasing the rate at which the engineer can install the fixing assembly or a plurality of the fixing assemblies - as the engineer need only arrange the fixing assembly and manually rotate the third body e.g. by less than 180° , or less than 135° , or less than 90° , to form a suitable clamp for the fixing assembly.

Preferably, the third body includes a lever arm projecting from it to assist a user, e.g. the engineer, to rotate the third body into the clamping position. Thus, the engineer can so rotate the third body without the need for additional tools, e.g. spanners etc.

Advantageously, the second body, which can be considered to correspond to the nut of a conventional support means, can be slid along at least a portion of the projecting member, thereby reducing the time the installing engineer requires to install the fixing assembly. It is to be noted that the sliding function of the second body is a preferred feature

(i.e. a preferred aspect) of the invention and should not be considered essential to the working of all the aspects of the invention, particularly in view of the advantages described here.

Preferably, the second body is rotatable about the projecting member to bring the respective first and second engagement means into engagement. In conjunction with the slidable feature discussed in the preceding paragraph, this feature advantageously allows the user, e.g. the installing engineer, to rapidly establish the fixing means in place relative to e.g. a weight bearing structure - for example to arrange the fixing means similarly to the finger tightened conventional support means described above.

To allow the second body to slide along the projecting member, the first engagement means preferably includes a series or chain of first teeth formed along at least a portion of the length of the projecting member. A series or chain of second teeth may be formed along at least a respectively different portion of the length of the projecting member.

The respective chains of first and second teeth may be arranged to be diametrically opposite to one another.

One or more blank regions devoid of the or each chain of teeth may be formed axially along the length of the projecting member, the second engagement means being movable along the one or more blank regions such that the second body is slideable along at least a portion of the projecting member.

Preferably, the fixing assembly further includes a fourth body, which is locatable between the first body and the second body, the fourth body having a surface modified to include at least one helical sloping portion for engagement with a correspondingly sloped portion of the third body, whereby interaction of the respective sloping portions upon rotation of the third body into the clamping position urges the first and second bodies to separate.

However, the helical sloping portion for engagement with a correspondingly sloped portion of the third body might instead be located on a surface of the second body which is able to be brought to abut the third body.

Preferably, the fourth body, which is locatable between the first body and the second body, has a surface modified to include at least a pair of helical sloping portions arranged to cooperate with each other and to engage at least a complementary pair of correspondingly sloped portions of the third body, whereby interaction of the respective sloping portions of the third and fourth bodies upon rotation of the third body into the clamping position urges the first and second bodies to separate.

However, the pair of helical sloping portions for engagement with a pair of correspondingly sloped portions of the third body might instead be located on a surface of the second body which is able to be brought in to abutment with the third body.

Preferably the respective helical sloping portions in each pair (of helical sloping portions) on the third body, the fourth body and/or the second body are diametrically opposed to one another. A first helical sloping portion of each pair may start adjacent the end of the other helical sloping portion. A first helical sloping portion of a set of two or more helical sloping portions may start adjacent the end of another helical sloping portion of the same said set.

For the avoidance of doubt, the helical sloping portions are not to be considered to be threaded portions. A helical sloping portion of the e.g. the third body does not interdigitate with two other helical sloping portions, e.g. on the fourth or second body. The helical sloping portions are preferably provided as ramps projecting from a respective surface of the third, fourth and/or second body.

Preferably, the fixing assembly includes ratchet means for releasably locking the third body in the clamping position, thereby helping to prevent the clamp formed by the fixing assembly from being released e.g. over time and/or in response to a shock. However, the user can release the ratchet to loosen the clamp if desirable.

The ratchet means may include teeth formed on the fourth body. The ratchet means may include a locking finger formed on the third body for engagement with teeth formed on the fourth body to releasably lock the third body in the clamping position. The locking finger may be provided on the lever arm. The ratchet means also therefore provide the user with tactile feedback that the third body is rotating suitably. Furthermore, the ratchet action acts as an

indexing means, which can advantageously inform the user, via tactile feedback, about the extent to which the third body has been rotated.

To facilitate even more rapid assembly of the fixing assembly according to the present invention, the second body is preferably coupled to the fourth body. The third body may be coupled to the fourth body. Preferably, the third body is sandwiched between the fourth body and the second body. Such preferred arrangements, individually and collective, mean that the user can be provided with many or all of the components of a fixing assembly according to the present invention for ease of assembly, whilst minimizing the risk(s) of losing any one component.

The fourth body coupled to the second body and/or third body preferably forms a sub-assembly which can be coupled to the first body to sandwich e.g. a weight bearing structure.

The fourth body, e.g. when coupled to the second body, may include means for releasably holding the second body in a sliding arrangement, thereby allowing the second body to slide along at least a portion of the length of the projecting member, when suitably arranged, e.g. in use.

Preferably, the fourth body includes means for releasably locking the second body relative to the projecting member when the first and second engagement means are engaged, the releasable locking means being suitable to prevent the second body from rotating to disengage the first and second engagement means when the third body is rotated into the clamping position.

Preferably, the present invention provides a fixing assembly according to this first aspect wherein the first body includes a plurality of said projecting members, a corresponding plurality of said second bodies and a corresponding plurality of said third bodies. For example, there may be two, three, four or more sets of the projecting member and second and third bodies.

The first body may be annular, having such a plurality of projecting members spaced around the annulus, e.g. equally spaced, and the plurality of second and third bodies may be provided on a single fourth body, e.g. as the above described sub-assembly. Thus, the sub-assembly and the first body may be provided as two separable parts of a fixing assembly according to the present invention. By

reducing the number of parts, loss of any particular part becomes less likely, especially by incorporating the potentially relatively smaller bodies, e.g. the second and third bodies into a sub-assembly by coupling them to a larger body, e.g. the fourth body.

Preferably, the present invention is intended to provide a fixing assembly, e.g. a support means, for a speaker, a light etc. The fixing assembly is intended to support a ceiling speaker or a wall speaker, or even a floor speaker. The fixing assembly is intended to support a ceiling light or a wall light, or even a floor light.

In another aspect of the present invention, a fixing assembly may be provided as a kit of parts, as set forth in the appended claims.

In a further aspect, the present invention provides a method of mounting a fixing assembly as described herein to a structure, as set forth in claim 32. Advantageously, a method of mounting a fixing assembly to a structure according to the present invention can be performed more rapidly and with less difficulty than e.g. conventional

methods of installing the conventional support means described above.

Indeed, the conventional support means described above are further disadvantageous, in that they often require e.g. a speaker or a light which they are intended to support to be put into electrical communication e.g. with an electrical power source and/or with signal generator such as an acoustic amplifier, and left in the ceiling/wall/floor space, such that when the support means is installed the speaker/light can be retrieved and supported by the support means.

Indeed, the present inventor has surprisingly found that it is not possible to extract e.g. a speaker or light which is intended to be supported by the conventional support means from the floor/wall/ceiling space via the support means itself. Conventional support means known to the inventor prevent the passage of the body to be supported (e.g. speaker, light etc.) through the support means from one side of the weight bearing structure to the other.

Thus, it is often necessary for an installation engineer to remove the support means to allow a defective supported body

(light, speaker etc.) to be replaced or repaired, unless the supported body can be removed via another path, e.g. by removing adjacent ceiling tiles.

Therefore, in general another aspect of the present invention allows a body to be supported, e.g. a light, speaker etc. to pass through a support means, such as a mounting assembly, completely. Thus, a mounting assembly according to this aspect of the present invention is set forth in claim 36.

Advantageously, the support element may be formed integrally with the body to be held by the mounting assembly. The support element may be formed as a separate element, respectively to couple to such a body and to the mounting element.

The support element may include a first coupling element and the mounting element may include a second coupling element, the first and second coupling elements preferably being capable of interacting to allow the support element and the mounting element to be detachably couplable. The detachable coupling of the support element to the mounting element advantageously results in secure retainment of the body to

be supported yet permits the support element, and associated body to be supported, to be removed from the mounting assembly in either direction, if desired.

In order to provide smooth passage of the support element through the lumen of the mounting element, the second coupling element may include a guide channel formed on a surface of the mounting element at least partly defining said lumen, the first coupling element preferably including a projection for engagement with the guide channel.

Preferably, movement of said projection along the entire length of the guide channel guides the support element through the mounting element lumen.

Preferably, the guide channel is formed to extend around at least a portion of the lumen. In this arrangement, the support element can be supported by a wall at least partly defining the guide channel, such that the support element cannot pass through the lumen of the mounting element by translation alone. This is advantageous for ceiling and floor mounting to prevent the support element sliding, by translation, out of the lumen. It is preferred that at least a portion of the guide channel is formed to extend at

least partway around the lumen in a plane perpendicular to the length axis of the lumen.

Preferably, the guide channel is formed to provide a first and a third guide portion extending generally in the direction of the axis of the lumen, a second guide portion being provided to connect the first and third guide portion, the guide channel allowing the support element to be guided completely through the mounting element via the guide channel, wherein the second guide portion generally extends around a portion of the lumen. It is preferred that at least a portion of the second guide portion is formed to extend at least partway around the lumen in a plane perpendicular to the length axis of the lumen

Preferably, the support element includes a first indexing means and the mounting element includes a second indexing means, the first and second indexing means preferably being capable of interacting to indicate to a user, e.g. by tactile feedback, that the support element and the mounting element are located, with respect to each other, in a first indexing arrangement. Advantageously, this alerts the user to a preferred mutual arrangement of the support element and the mounting element.

The second indexing means preferably includes an indexing projection formed within the guide channel. The first indexing means preferably includes an indexing recess formed to receive the indexing projection. The indexing projection is preferably formed on a biased hinge element to be movable relative to the guide channel. The biased hinge element preferably provides means for reliably locating the indexing projection in the indexing recess and for preventing the indexing projection from being slid out of the indexing recess below a certain threshold force, corresponding to the degree of bias of the hinge.

The guide channel is preferably formed to provide a first and a third guide portion extending generally in the direction of the axis of the lumen, a second guide portion being provided to connect the first and third guide portion, the guide channel allowing the support element to be guided completely through the mounting element via the guide channel, wherein the second guide portion generally extends around a portion of the lumen.

It is preferred that the first and second indexing means interact in the second guide portion, so that a user is

aware that the support means is suitably supported by the second guide portion.

Preferably, the support element and the mounting element each include a respective lock element, which when aligned permit a locking body to detachably couple them together to prevent the support element moving relative to the mounting element. Therefore, in this locked arrangement the support element effectively cannot be removed from the mounting element, increasing the safety of e.g. an overhead ceiling mounting assembly.

Preferably, the alignment of the respective lock elements is achieved at the first indexing arrangement, so that the user is immediately aware, e.g. by tactile feedback, that the appropriate alignment for the locking arrangement is reached.

Preferably, the locking body is provided on a cover member capable of spanning the lumen. The cover member may be a speaker grill for example.

Features of any aspect described here may be combined with the features of any other aspect, except where such features are self-evidently incompatible.

The present invention will now be described by way of non-limiting example with reference to the accompanying figures, in which:

Fig. 1(a) shows a cross-sectional view of a conventional support means, e.g. for a speaker;

Fig. 1(b) shows a plan view of the conventional support means shown in Fig. 1(a);

Fig. 2 shows an embodiment of the present invention in the form of a speaker mounting intended for ceiling mounting a speaker;

Fig. 3 shows an example of a projecting member according to the present invention;

Fig. 4 shows an example of a nut body according to the present invention for complementary engagement with the projecting member shown in Fig.3;

Fig. 5 shows an arrangement according to the present invention;

Fig. 6 shows a portion of an assembly according to the present invention which includes a preferred helical sloping portion;

Fig. 7(a) shows a portion of a sub-assembly according to a preferred aspect of the present invention;

Fig. 7(b) shows a perspective view of a preferred sub-assembly according to an aspect of the present invention;

Figs. 7(c) & (d) show respective perspective views of a preferred tightening member according to an aspect of the present invention;

Fig. 8 shows an assembled assembly according to the present invention;

Fig. 9 shows a preferred guide path according to another aspect of the present invention; and

Fig. 10 shows a portion of an assembly according to another aspect of the present invention.

Fig. 2 shows a mounting suitable for use, and intended for use, as a ceiling speaker mounting which incorporates one or more of the aspects of the present invention. For brevity, reference is made below to a ceiling tile; however the present invention is not limited to use with ceiling tiles - it could be used to mount a speaker or a light etc in a wall or a floor, for example, or in a ceiling by virtue of

another weight bearing structure other than ceiling tile, for example plasterboard. Other locations where a speaker might be needed may also benefit from the present invention. Likewise, the invention should not be considered to be limited to speakers. The present invention can provide benefits for other objects to be mounted e.g. in the ceiling, wall or floor, for example lights, motion/heat sensors, etc.

A mounting 100 according to one or more aspects of the present invention includes a support 110 and a clamping member 112, which mutually cooperate to sandwich e.g. a ceiling tile (not shown) between them. By virtue of the present invention, the support 110 and the clamping member 112 can be made to clamp a body between them, e.g. the ceiling tile. The support 110 includes one or more projecting members 114, in this case three projecting members 114. These members are arranged to be capable of passing through (e.g. one or more) possibly pre-formed hole(s) in the ceiling tile.

Each projecting member 114 includes a set of teeth 116a, and preferably a second set of teeth 116b, arranged along its length e.g. as shown in Fig.3. Between the respective sets

of teeth 116a and 116b, there is preferably a blank portion 118 (e.g. with no teeth), which is preferably flat. Where only one set of teeth 116a is provided a single blank portion 118 (e.g. with no teeth), which is preferably flat, may be provided.

For example, in Fig. 3a there is shown a view along the long axis of a projecting member 114 shown in Fig. 2. As can be seen the projecting member includes respective flat portions 118 provided between two, preferably diametrically opposed, sets of teeth 116a and 116b. In Fig.3b, a cross-section of the member 114 is shown taken in the plane b-b shown in Fig.3a.

The teeth of each set of teeth may be of a triangular profile. The teeth may have a helix angle of zero, thereby meaning that they do not form a portion of a (screw) thread.

Alternatively, the helix angle may be non-zero, meaning that the or each set of teeth may form a respective portion of a thread, wherein each portion is separated from a corresponding other portion by a least one blank portion 118.

Fig.3c shows a view towards the plane c-c, where the solid line defines a peak of each tooth and the dashed line defines the trough between each tooth.

Fig. 3d shows an angled view of the member 114, for clarity.

Turning back to Fig.2, each member 114 may be formed of e.g. metal and may be attached to the support 110, each by a clip fitting. In an alternative embodiment, each member 114 may be formed integrally with the rest of the support 110, e.g. of a plastic material, of metal or of any other suitable material known to the skilled person.

The or each member 114 is arranged to be received by a respective nut type body 120 which is preferably coupled to the support 112, but which may be provided separate to the support 112. The member 114 may be configured to pass through a respective bore or lumen formed in the support 112.

The nut body 120 preferably includes one or more teeth provided in one or more further sets of teeth, where the or each tooth of each further set is arranged to be capable of inter-digitation with teeth of a set of teeth formed on the

projecting member 114. When the respective sets of teeth of the nut body 120 and the projecting member 114 interdigitate, the nut body should be prevented from moving, e.g. sliding, along the length of the projecting member 114.

However, inter-digitaton of the respective sets of teeth preferably only occurs in certain relative arrangements of the nut body 120 and the projecting member 114. In other relative arrangements, the teeth provided on the nut body 120 align with the flat portion(s) 118 of the projecting member 114, and the nut body can therefore by slid up and down at least a length of the projecting member 114. For example, as shown in Fig. 4a, the nut body 120 has a hole 122 through it for receiving the projecting member 114. The hole is preferably modified to include teeth 124. The teeth are arranged such that in Fig.4b, the nut body 120 cannot slide along the projecting member, whereas in Fig. 4c, the nut body 120 cannot slide along the projecting member 114, because of the above described inter-digitation of the teeth 124 and 116a, 116b.

The helix angle of the one or more teeth of each set of teeth provided on the nut body 120 are complementarily arranged with respect to the teeth of the projecting member

114, such that where the helix angle of the teeth on the projecting member is non-zero, the nut body 120 teeth also have a non-zero helix angle (e.g. matching that of the projecting member teeth); likewise, when the helix angle of the projecting member 114 teeth is zero, the nut body 120 teeth also have a zero helix angle.

In use, the support 110 is arranged on one side, e.g. beneath, a ceiling tile and the clamping member 112 is arranged on the other. Each nut body 120 is put in the sliding arrangement relative to a respective projecting member 114 as shown in Fig. 4b, and the support 110 and clamping member can be brought together to sandwich e.g. the ceiling tile between them as the nut bodies 120 slide along each respective member 114.

When the support 110 and the clamping member 112 are suitably arranged, each nut body 120 can be rotated to the non-sliding position to hold the clamping member 112 in position relative to the support 110.

At this stage the assembly 100 can be described as softly clamping e.g. the ceiling tile, something similar, say, to finger tightening a conventional nut and bolt when using the

conventional assembly described above. However, advantageously, the present assembly allows this stage to be reached with ease and more quickly than a conventional assembly. An assembly 100 according to the present invention is intended to be able to be clamped to a ceiling tile or other ceiling body, a wall panel or a floor panel having a thickness of between 0.5mm and 50mm.

Preferably, the nut body 120 includes a lug 126 for interaction with a lock 128 provided e.g. on the clamping member 112. Preferably, the lock 128 includes a recess 129 for receiving the lug when the nut body 120 is in the non-sliding position, i.e. when the respective sets of teeth inter-digitate as described above. The lug 126 and lock 128, e.g. a recess 129, may be provided in the reverse arrangement. The engagement of the lug 126 and recess 129 helps to prevent accidental rotation of the nut body 120 into the sliding position. This feature is especially desirable where the assembly 100 is intended for use as a ceiling support, thereby helping to prevent the assembly from falling from the ceiling and causing injury.

According to an aspect of the present invention a tightening member 130 is provided e.g. as shown in Fig. 5. The

tightening member 130 is preferably provided between a tightening portion of the clamping member 112 and the nut body 120. Rotation of the tightening member 130 urges the clamping member 112 and the nut body apart. As the nut body 120, arranged in the non-sliding position, is in a fixed distance relationship with the support 110, the clamping member 112 and support 110 are urged to clamp e.g. the ceiling tile more firmly.

Rotation of the tightening member 130 may be performed by virtue of a lever arm 132, projecting from the tightening member.

Preferably, the tightening member 130 includes a main finger 134 for interaction with a series of sub-fingers 136 e.g. provided on the clamping member 112. The main finger 134 and the sub-fingers 136 preferably combine to provide a ratchet mechanism helping to prevent the tightening member from accidentally slipping back (disadvantageously) to loosen the clamp on e.g. the ceiling tile.

Preferably, the main finger 134 is provided on the lever arm 132. Preferably, the sub-fingers have a sawtooth profile.

The main finger 134 is preferably engageable with a locking element 134' preferably formed on the clamping member 112, so that when engaged the tightening member 130 is releasably locked in (e.g. a starting) position from which it can be moved to effect said clamping.

The tightening member 130 preferably includes at least one, preferably more, preferably two, tightening surface (each) formed to provide a helical ramp formed around the axis of rotation. Preferably, the tightening portion of the clamping member 112 includes one or more corresponding tightening surfaces for interaction with a respective tightening surface of the tightening member.

For example, as shown in Fig. 6, the clamping member 112 may include two helical ramps 140a, 140b. The tightening member 130 according to this embodiment would include two complementary helical ramps 142a, 142b. Rotation of the tightening member about its axis would result in axial displacement (e.g. along the axis of rotation) of the tightening member relative to the clamping member 112 as the respective pairs (140a, 142a and 140b, 142b) of helical ramps interact.

Therefore, according to an aspect of the present invention, the assembly 100 can be installed e.g. in a ceiling, without the need for tools, and one handedly. Furthermore, the clamping force generatable by rotation of the tightening member 130 can be varied simply by providing lever arms 132 of different lengths, because the moment required to rotate the tightening member to achieve a given clamping force along the axis of rotation is proportional to the length of the lever arm 130.

Where a helical surface or ramp is referred to, it is meant that at any given point the surface (e.g. of the ramp) is 'angled' in relation to a given datum, and the angled surface is formed around an axis of rotation. So, it can be said that the surface follows a helical path around the axis of rotation. This gives the surface a helical form rather than just an angled form.

The helical form of the respective helical ramps allows the whole surface of each ramp of both bodies to remain in contact during axial rotation. This is advantageous e.g. to help stop slipping between the bodies, and e.g. to help distribute any load and thereby to improve the wear resistance of the ramps.

In the preferred embodiment, there are two positions where the angled surfaces start (e.g. 180° apart - diametrically opposed) around the axis of rotation as shown in Fig. 6, because this approach can provide a steeper helix angle meaning that the extent of axial translation is greater for a given angle of rotation.

This is advantageous because a relatively small angle of rotation provides a relatively large axial displacement of the nut to take up any clearance and to provide sufficient clamping force on e.g. the ceiling tile.

Preferably, the helical ramps 140a, 140b are provided integrally on the clamping member 112.

Preferably, as shown in Figs. 7(a)-(d), the tightening member 130 preferably includes one or more coupling elements 144, preferably 3 or 4 coupling elements, for engagement with the clamping member 112 to couple the tightening member 130 to the clamping member 112. Preferably, the coupling elements 144 may include one or more barbed projections 144 for engaging a complementary portion of the clamping member 112 in order to make decoupling of the tightening member 130

more difficult than the coupling (other arrangements of coupling element may be provided to perform this function). The or each element 144 may line a bore in the clamping member 112 for receiving the projecting member 114.

Preferably, the tightening member 130 is freely rotatable despite being couple to the clamping member 112 and/or the nut body 120.

Preferably, the nut body 120 is coupled to the tightening member 130. The nut body 120 may include first coupling means for engaging complementary second coupling means provided by the tightening member 130. Preferably, the nut body 120 is freely rotatable despite being coupled to the tightening member 130.

For example, as shown in Fig. 7(a), the nut may include a lip 148, e.g. a circumferential lip, for example an inwardly radially projecting (preferably circumferential) lip, for receipt by e.g. a complementary recess form 150 in the tightening member (see Figs. 7(a)-(d)). Alternatively, or additionally, the tightening member 130 may include a radially projecting, preferably circumferential, projection

154 for receipt by a complementary recess 156 provided by the nut body 120.

The nut body 120 is preferably unaffected by rotation of the tightening member 130. For example, when the nut body 120 is locked into the non-sliding position, rotation of the tightening member preferably should not be capable of unlocking the nut body 120, e.g. rotating it into the sliding position.

By coupling the nut body 120 to the tightening member 130 which is in turn coupled to the clamping member 112, the number of parts needed to install the assembly 100 is minimized, thereby reducing the chance that a user may lose an important component part.

Fig. 8 shows an assembly 100 embodying one or more aspects of the present invention. In the embodiment shown, the assembly may include a speaker 160 supportable by a holding body 162, which is receivable into the lumen 164 of the support 110.

Preferably, the support 110 includes a pathway 170 as shown in Fig. 2 for receiving a guide projection 180 provided on the holding body 162.

In Fig. 9 it is shown that the pathway 170 guides the guide projection in a general Z-shape such that the holding body 162 can pass completely through the support 110.

Preferably, indexing means 171 may be provided in the pathway 170, preferably in a (e.g. middle) portion of the pathway which travels around at least a portion of the perimeter, e.g. circumference, of the lumen 164 of the support 110. A complementary indexing means 181 is preferably provided on the support body 162 - which support body 162 may be formed integrally with the housing of e.g. the speaker, light etc. which it supports.

The respective indexing means 171, 181 advantageously inform the user as to when the support 110 and the support body 162 are appropriately arranged in the indexed arrangement to support e.g. the speaker or light.

Preferably, the respective indexing means provide tactile feedback to the user that the support 110 and the support body 162 are in the indexed arrangement.

As shown in Fig. 10 in sectional view, the pathway 170 around a portion of the perimeter of the lumen 164 defined by the support 110 preferably includes a hinge member 172, which preferably incorporates the indexing means 171. The support body 162 preferably includes the indexing means 181 on the projection 180. In a preferred embodiment the hinge member 172 is resiliently deformable to urge the respective indexing means 171, 181 into the indexing arrangement.

Preferably, the indexing means 171 is a projection to be received by the indexing means 181. However, the reverse arrangement is also acceptable. Preferably, the hinge member 172 is formed to include the indexing means 171.

Preferably, an assembly 100 according to the present invention includes a locking means for preventing the support body 162 from moving (rotating or translating) within the lumen 164 of the support 110. For example, a grill 190 may include one or more locking lugs 192 for engaging a respective recess 184 formed in the support body

162. Furthermore, the grill 190 may include one or more aligning means 194 for engagement with complementary aligning means formed e.g. in the support 110.

Therefore, when the locking lugs 192 engage a respective recess 184 and when the aligning means 194 engage a respective aligning means e.g. in the support 110, the support body 162 is prevented from rotating relative to the support 110. Furthermore, as the support body is held in the support 110 by virtue of the guide projection 180 and the pathway 170, the support 162 is prevented from moving in relative to the support 110.

Preferably, the or each locking lug 192 is only receivable by the respective recess 184 when the support 110 and the support body 162 are in the indexing arrangement.

Naturally, the pathway 170, the indexing means 171, the hinge member 172, the complementary aligning means (not shown), the lumen 164 could also be provided by the clamping member 112 rather than the support 110.

Claims

1. A fixing assembly including:

a first body having a projecting member including first engagement means;

a second body slideable along at least a portion of said projecting member, the second body having second engagement means for engagement with the first engagement means, engagement of the first and second engagement means preventing the second body from sliding along the first body projecting member;

a third body rotatable about the projecting member and locatable between the first and second bodies;

wherein the first, second and third bodies are arrangeable such that rotation of the third body into a clamping position urges the first and second bodies to separate.

2. A fixing assembly according to claim 1,

wherein said rotation of the third body into the clamping position urges the first and second bodies to separate in respective directions along the axis of projection of the projecting member.

3. A fixing assembly according to claim 1 or claim 2, further comprising a fourth body, locatable between the first body and the second body, the fourth body having a surface modified to include at least one helical sloping portion for engagement with a correspondingly sloped portion of the third body, whereby interaction of the respective sloping portions of the third body and the fourth body upon rotation of the third body into the clamping position urges the first and second bodies to separate.

4. A fixing assembly according to any one of claims 1 to 3, further including ratchet means for releasably locking the third body in the clamping position.

5. A fixing assembly according to claim 4, wherein the ratchet means includes teeth formed on the fourth body, and a locking finger formed on the third body to engage the teeth to releasably lock the third body in the clamping position.

6. A fixing assembly according to claim 5, wherein the locking finger is formed on the third body to engage the teeth to releasably lock the third body in a plurality of positions including the clamping position.

7. A fixing assembly according to any one of the preceding claims, wherein the second body is rotatable about the projecting member to bring the respective first and second engagement means into engagement.

8. A fixing assembly according to claim 7, wherein the first engagement means includes a chain of first teeth formed along at least a portion of the length of the projecting member.

9. A fixing assembly according to claim 8, wherein the first engagement means further includes a chain of second teeth formed along at least a further portion of the length of the projecting member.

10. A fixing assembly according to claim 9, wherein the respective chains of first and second teeth are formed on opposite faces of the projecting member.

11. A fixing assembly according to claim 9 or 10, wherein the respective chains of first and second teeth are formed to be diametrically opposed.

12. A fixing assembly according to claim 9, 10 or 11, further including one or more blank regions devoid of the or each chain of teeth formed axially along at least a portion of the length of the projecting member, the second engagement means being receivable in the one or more blank regions such that the second body is slideable along at least a portion of the projecting member.

13. A fixing assembly according to any one of claims 3 to 12, wherein the second body is coupled to the fourth body.

14. A fixing assembly according to claim 13, wherein the fourth body includes means for releasably locking the second body relative to the projecting member when the first and second engagement means are engaged.

15. A fixing assembly according to any one of claims 3 to 14, wherein the third body is coupled to the fourth body.

16. A fixing assembly according to claim 15, wherein the third body is sandwiched between fourth body and the second body.

17. A fixing assembly according to claim 13, wherein the fourth body includes means for releasably holding the second body in a sliding arrangement, allowing the second body to slide along at least a portion of the length of the projecting member.

18. A fixing assembly according to claim 13 or 17, wherein the fourth body includes means for releasably holding the second body in an engagement arrangement, where the first and second engagement means engage.

19. A fixing assembly according to any one of claims 8 to 12, wherein the second engagement means includes one or more digits for engagement with said discontinuous thread.

20. A fixing assembly according to claim 19, wherein the or each digit is a portion of a complementary thread corresponding to said discontinuous thread.

21. A fixing assembly according to claim 20, wherein said complementary thread is a helical thread.

22. A fixing assembly according to any one of the preceding claims,

wherein in use a fifth body to which the fixing assembly is to be fixed is clamped between the first and second bodies when the third body is rotated to the clamping position.

23. A fixing assembly according to any one of the preceding claims, wherein the first body includes a plurality of said projecting members, a corresponding plurality of said second bodies and a corresponding plurality of said third bodies.

24. A speaker mounting assembly incorporating the fixing assembly of any one of the preceding claims.

25. A ceiling speaker mounting assembly incorporating the fixing assembly of any one of claims 1 to 23.

26. A wall speaker mounting assembly incorporating the fixing assembly of any one of claims 1 to 23.

27. A fixing assembly substantially as herein described with reference to, and as shown in, the accompanying figures.

28. A speaker mounting assembly substantially as herein described with reference to, and as shown in, the accompanying figures.

29. A ceiling speaker mounting assembly substantially as herein described with reference to, and as shown in, the accompanying figures.

30. A kit of parts including a first body, a second body and a third body which when arranged suitably form a fixing assembly according to any one of claims 1 to 23.

31. A kit of parts including a first body, a second body, a third body and a fourth body which when arranged suitably form a fixing assembly according to claim 3 and to any one of claims 4 to 23 as dependent on claim 3.

32. A method of mounting a fixing assembly to a structure, the fixing assembly having:

- a first body having a projecting member including first engagement means;

- a second body slideable along at least a portion of said projecting member, the second body having second engagement means for engagement with the first engagement

means, engagement of the first and second engagement means preventing the second body from sliding along the first body projecting member;

a third body rotatable about the projecting member and locatable between the first and second bodies;

wherein the first, second and third bodies are arrangeable such that rotation of the third body into a clamping position urges the first and second bodies to separate; the method including the steps of:

- (i) positioning the structure and the third body between the first body and the second body;
- (ii) sliding the second body along the projecting member to sandwich the structure and the third body between the first body and the second body;
- (iii) rotating the second body so as to engage the respective first and second engagement means;
- (iv) rotating the third body into the clamping position to urge the first and second bodies to separate and thereby to cause the fixing assembly to clamp the structure.

33. A method according to claim 32, wherein the fixing assembly further comprises a fourth body, locatable between

the first body and the second body, the fourth body having a surface modified to include at least one helical sloping portion for engagement with a correspondingly sloped portion of the third body, whereby interaction of the respective sloping portions of the third body and the fourth body upon rotation of the third body into the clamping position urges the first and second bodies to separate; wherein

step (i) of the method includes positioning the structure between the first body and the fourth body; wherein

step (ii) includes sliding the second body along the projecting member to sandwich the structure between the first body and the fourth body, and to sandwich the third body between the fourth body and the second body; and wherein

step (iv) includes rotating the third body into the clamping position to urge the first and second bodies to separate and thereby to cause the fixing assembly to clamp the structure between the first and fourth bodies.

34. A method according to claim 32 or 33 wherein the structure is a ceiling structure or a wall structure.

35. A method substantially as described herein with reference to the accompanying figures.

36. A mounting assembly comprising:

a support element suitable for holding a body in the mounting assembly;

and a mounting element having a lumen for accepting the support element, the mounting assembly being configured to allow the support element to pass completely through it via the lumen;

wherein the support element and the mounting assembly are detachably couplable to be held in place relative to one another when at least a portion of the support element is in the lumen.

37. A mounting assembly according to claim 36,

wherein the support element includes a first coupling element and the mounting element includes a second coupling element, the first and second coupling elements being capable of interacting to allow the support element and the mounting element to be detachably couplable.

38. A mounting assembly according to claim 37,

wherein the second coupling element includes a guide channel formed on a surface of the mounting element at least partly defining said lumen, the first coupling element including a projection for engagement with the guide channel.

39. A mounting assembly according to claim 38,

wherein movement of said projection along the entire length of the guide channel guides the support element through the mounting element lumen.

40. A mounting assembly according to claim 38 or claim 39

wherein the guide channel is formed to extend around at least a portion of the lumen.

41. A mounting assembly according to any one of claims 38 to 40

wherein the support element includes a first indexing means and the mounting element includes a second indexing means, the first and second indexing means being capable of interacting to indicate to a user that the support element and the mounting element are located, with respect to each other, in a first indexing arrangement.

42. A mounting assembly according to claim 41
wherein the first coupling means includes the first indexing means.
43. A mounting assembly according to claim 41 or claim 42
wherein the second coupling means includes the second indexing means.
44. A mounting assembly according to claim 43
wherein the second indexing means includes an indexing projection formed within the guide channel.
45. A mounting assembly according to claim 44
wherein the first indexing means includes an indexing recess formed in the first projection, and formed to receive the indexing projection.
46. A mounting assembly according to claim 44 or claim 45,
wherein the indexing projection is formed on a hinge to be movable relative to the guide channel.
47. A mounting assembly according to any one of claims 38 to 46

wherein the guide channel is formed to provide a first, and a third guide portion extending generally in the direction of the axis of the lumen, a second guide portion being provided to connect the first and third guide portion, the guide channel allowing the support element to be guided completely through the mounting element via the guide channel, wherein the second guide portion generally extends around a portion of the lumen.

48. A mounting assembly according to claim 47 as dependent on any one of claims 41 to 46

wherein the first and second indexing means interact in the second guide portion.

49. A mounting assembly according to any one of claims 1 to 48 wherein the support element and the mounting element each include a respective lock element, which when aligned permit a locking body to detachably couple them together to prevent the support element moving relative to the mounting element.

50. A mounting assembly according to claim 47 as dependent on any one of claims 41 to 46 and 48 wherein the alignment of the respective lock elements is achieved at the first indexing arrangement.

51. A mounting assembly according to any one of claims 48 to 50 wherein the locking body is provided on a cover member capable of spanning the lumen.

52. A speaker support including a mounting assembly according to any one of the preceding claims.

53. A mounting assembly substantially as described herein with reference to, and as shown in, the attached figures.

54. A speaker mounting assembly substantially as described herein with reference to, and as shown in, the attached figures.

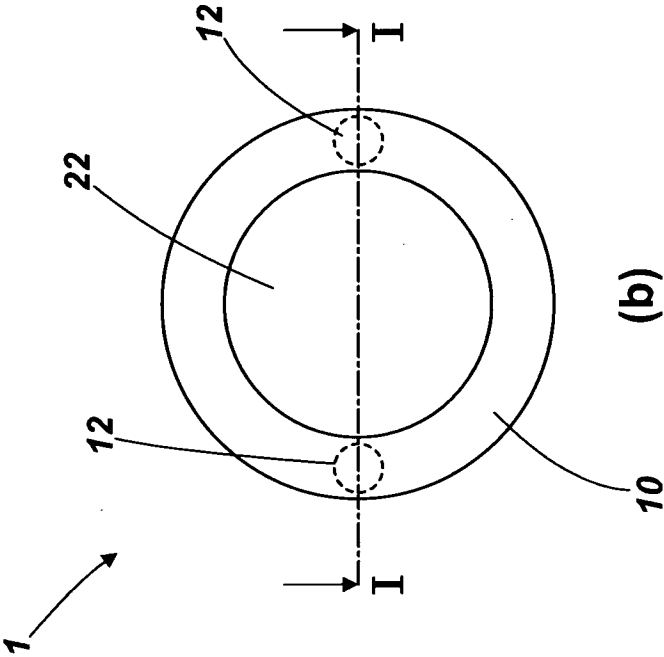
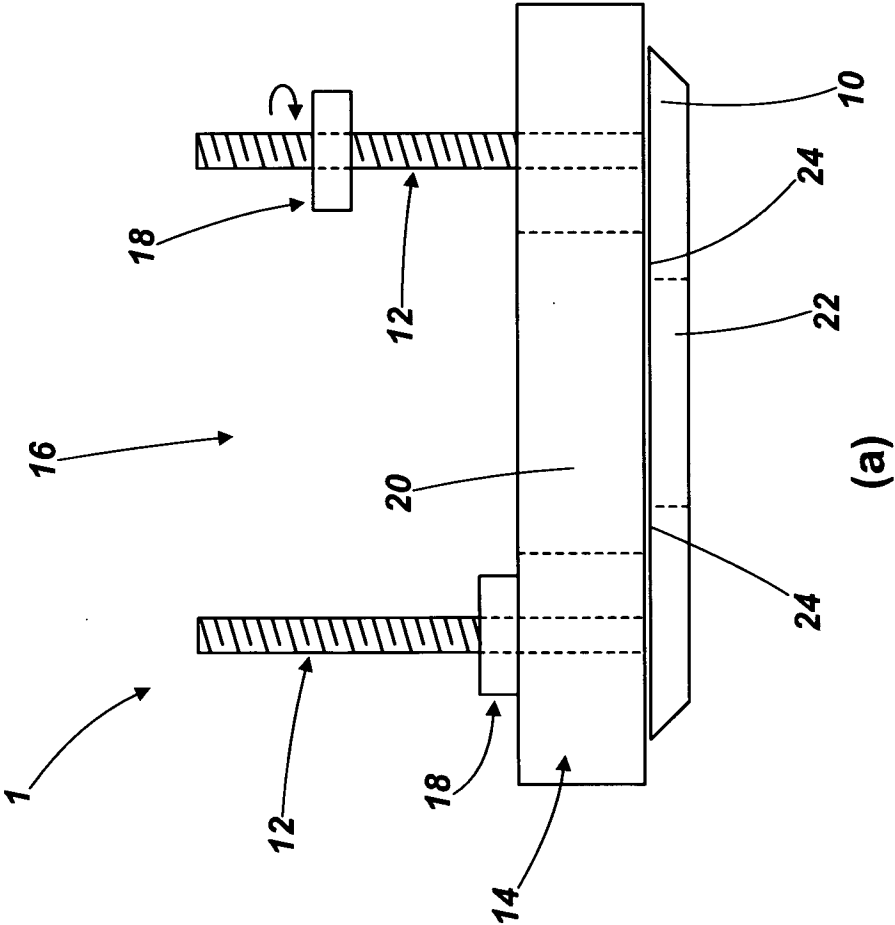


Fig. 1
(PRIOR ART)



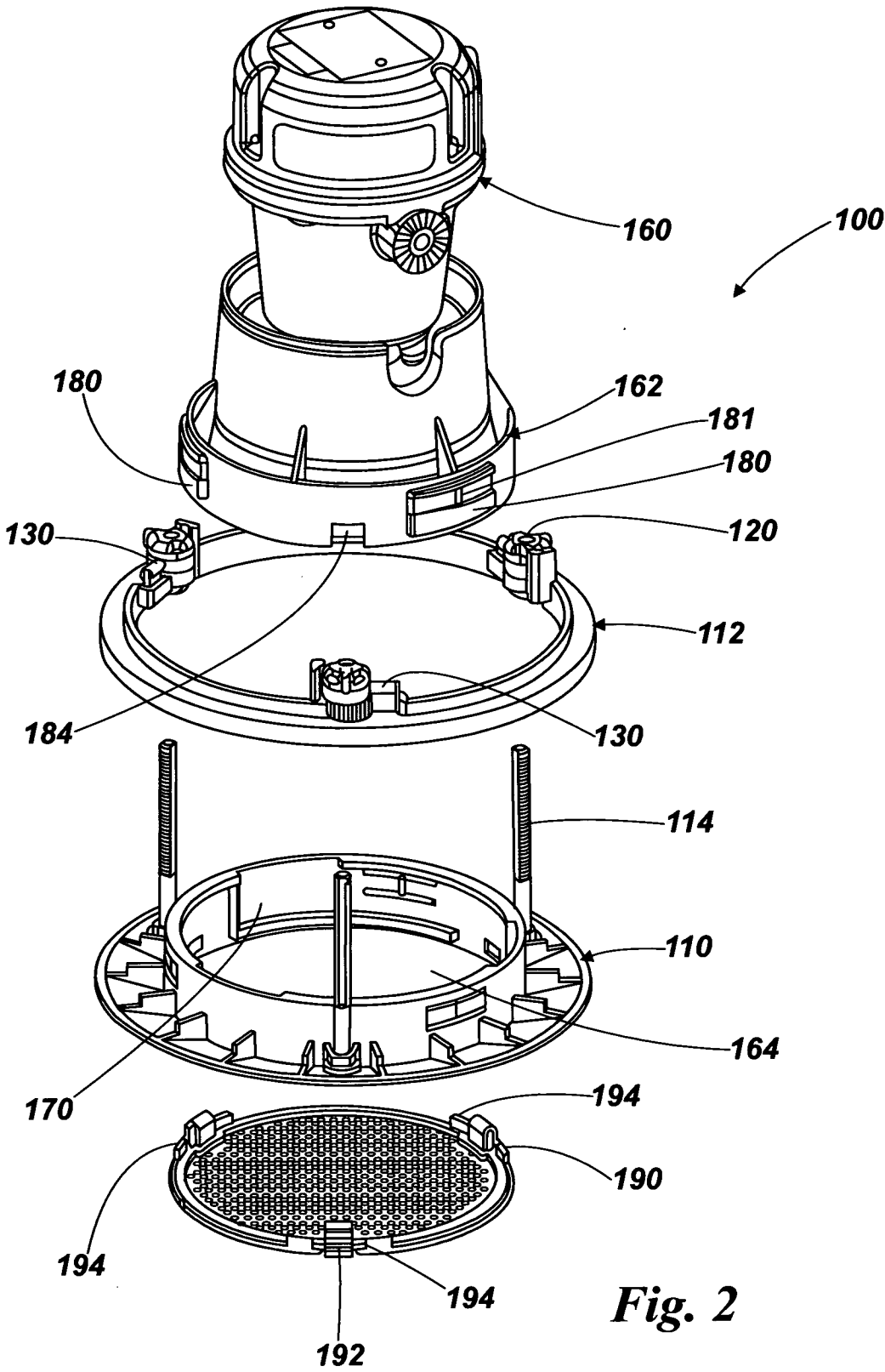
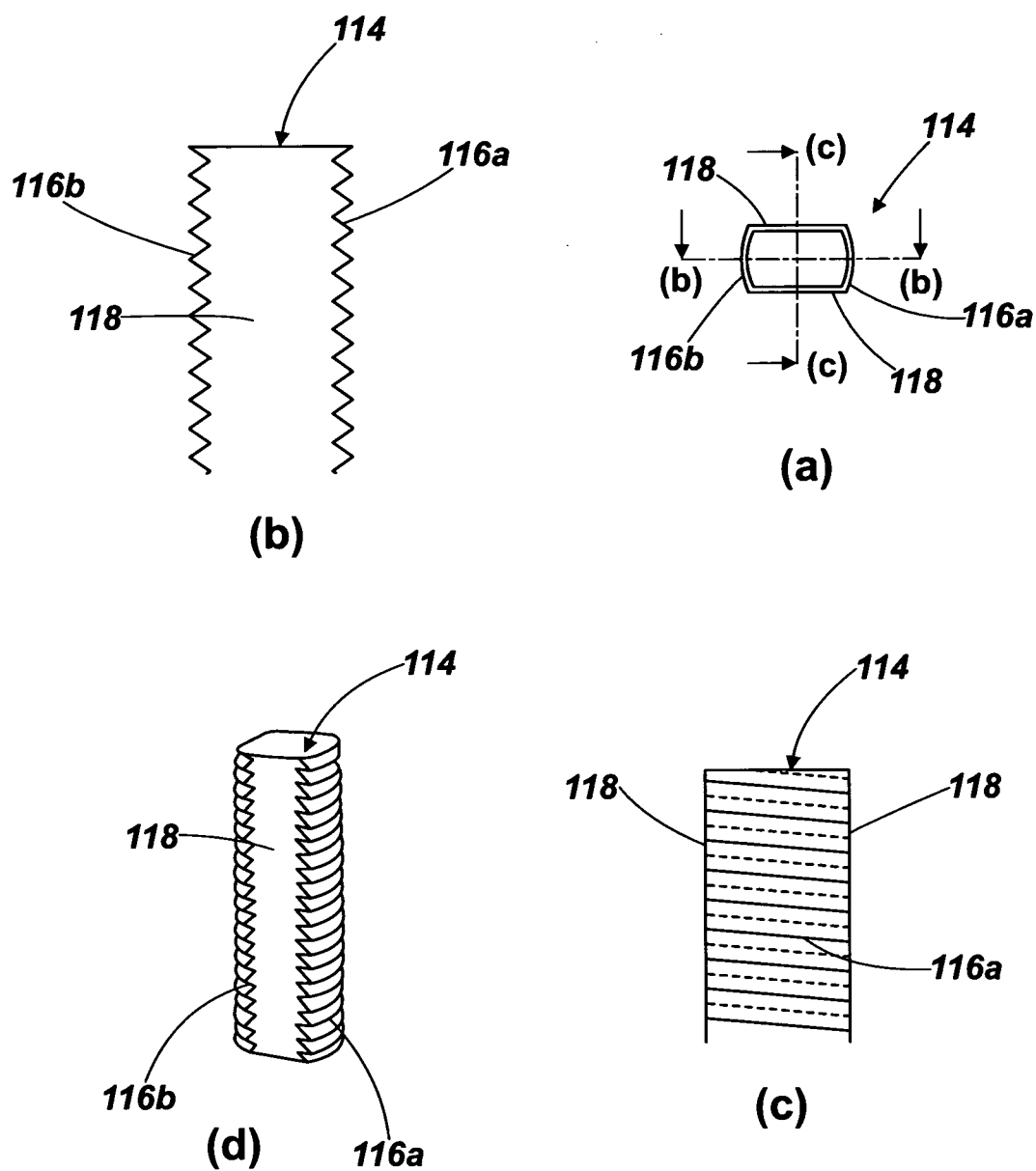
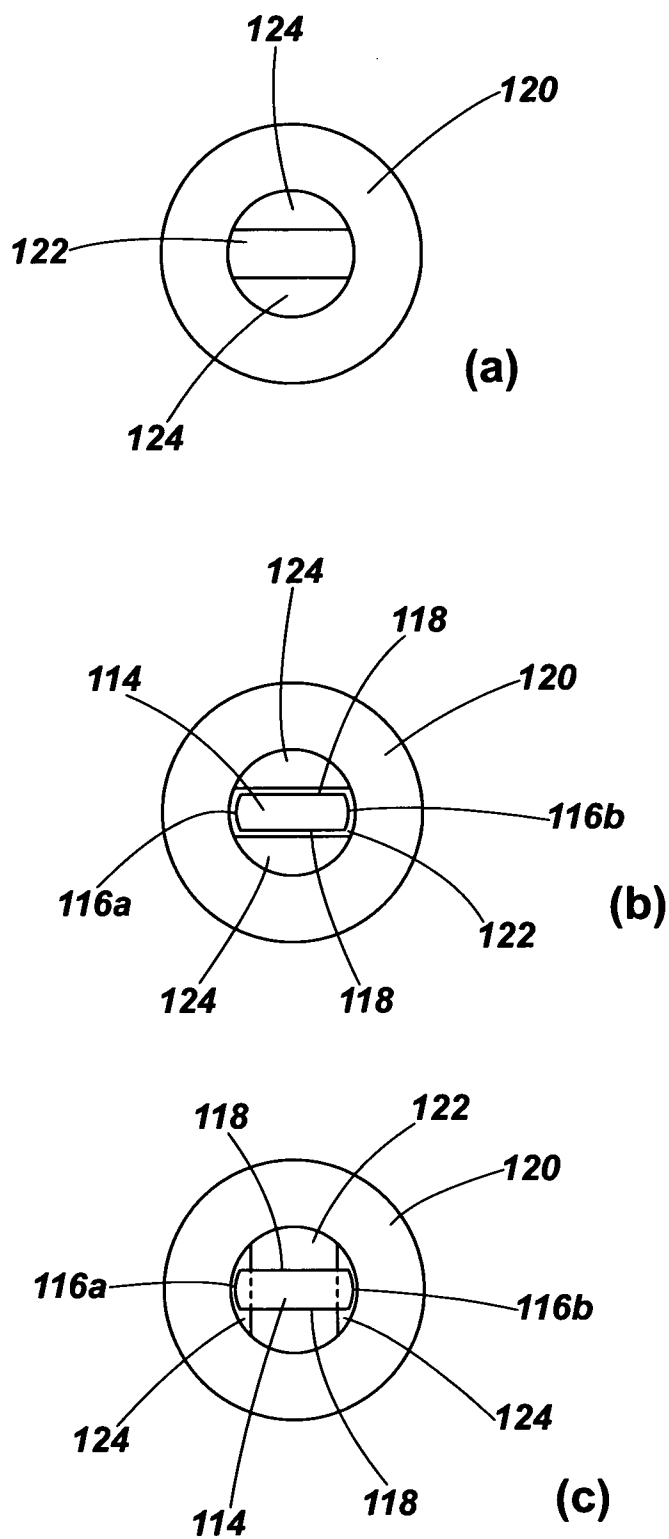


Fig. 2

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**Fig. 3**

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**Fig. 4**

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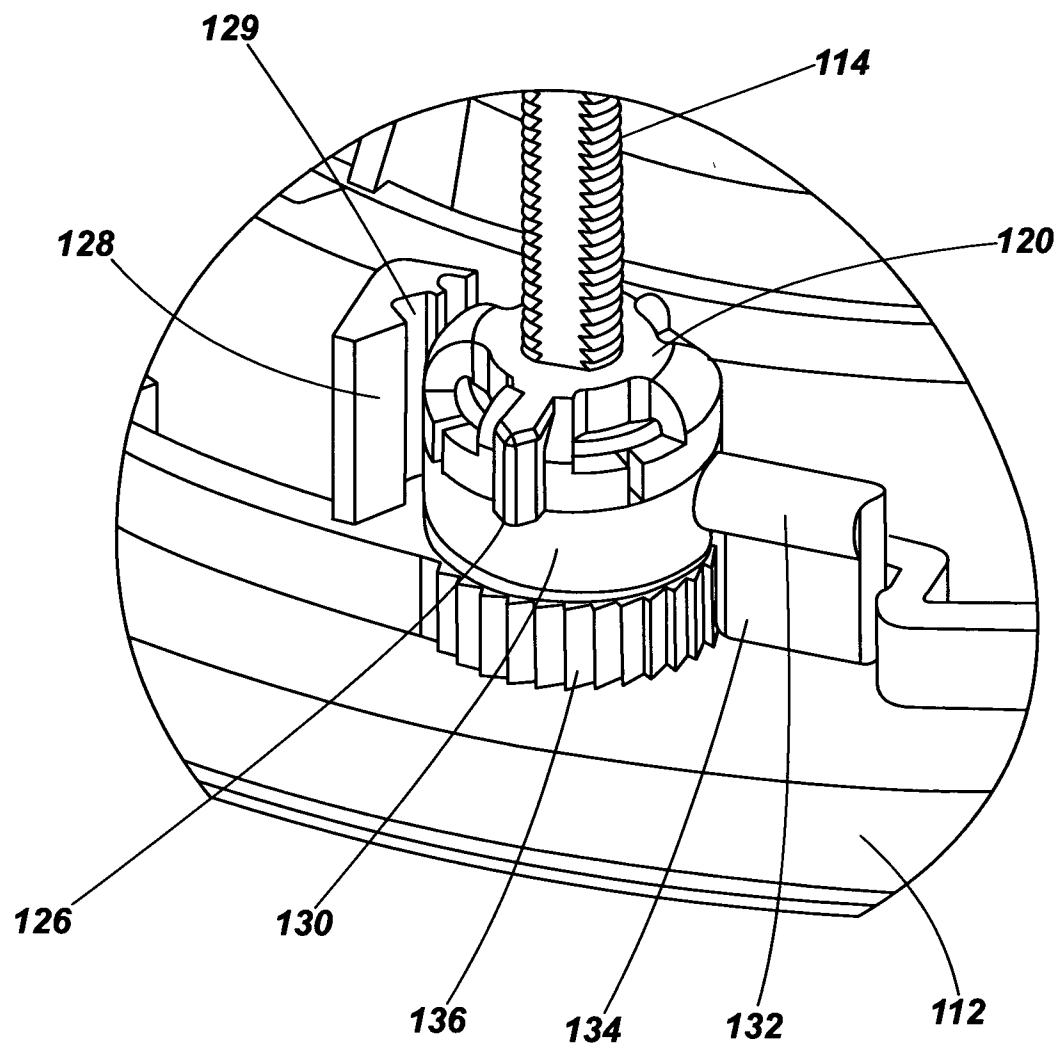


Fig. 5

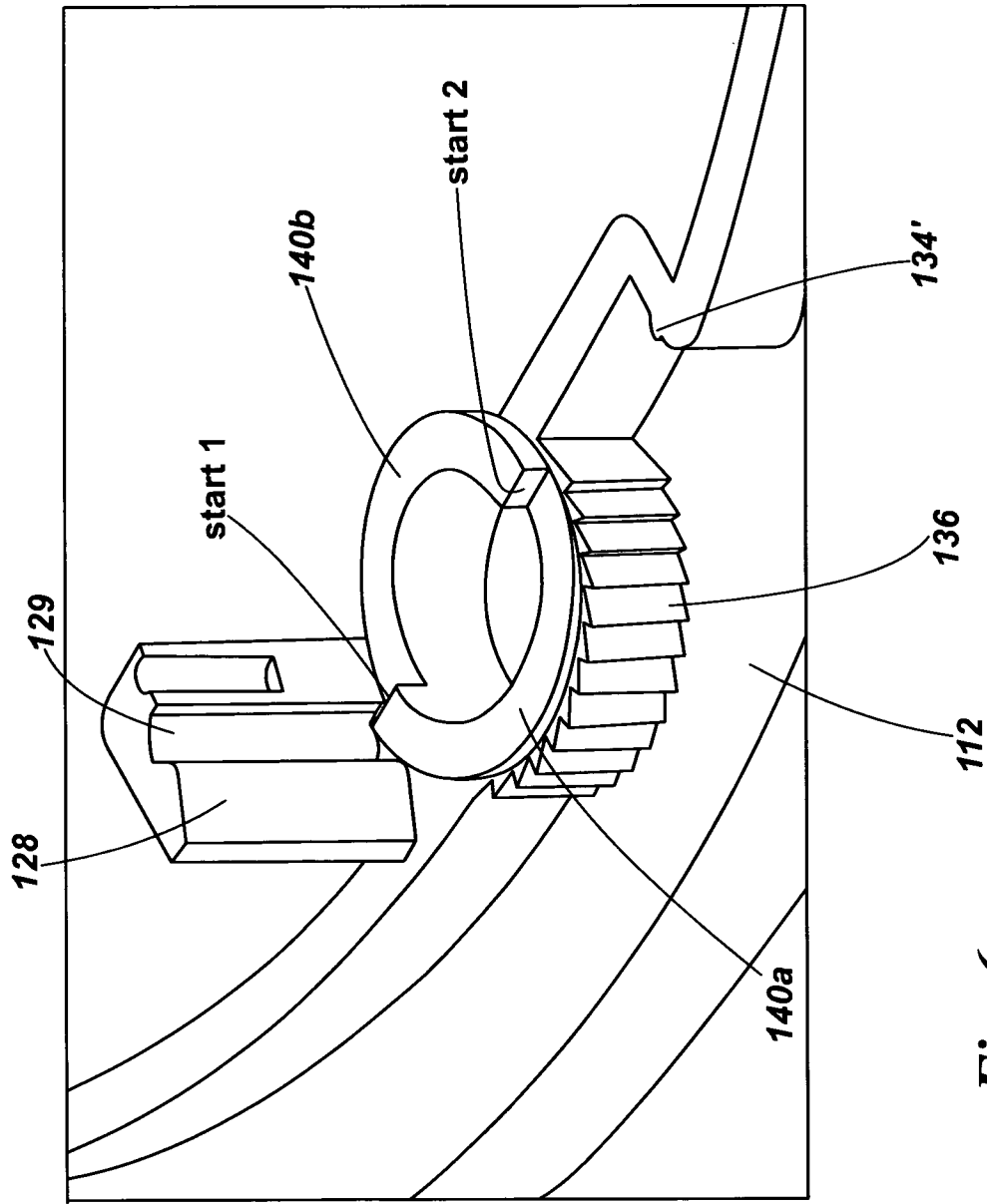


Fig. 6

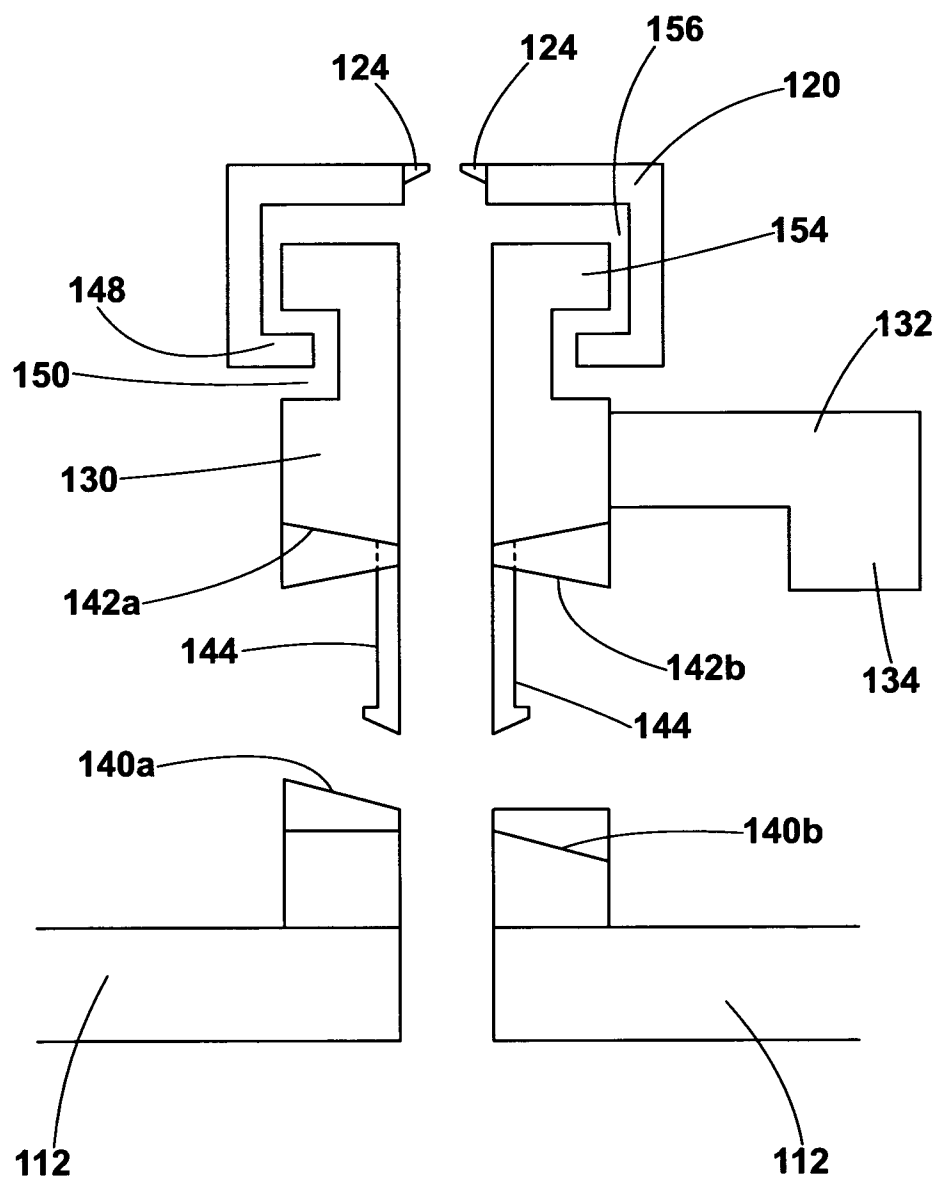


Fig. 7(a)

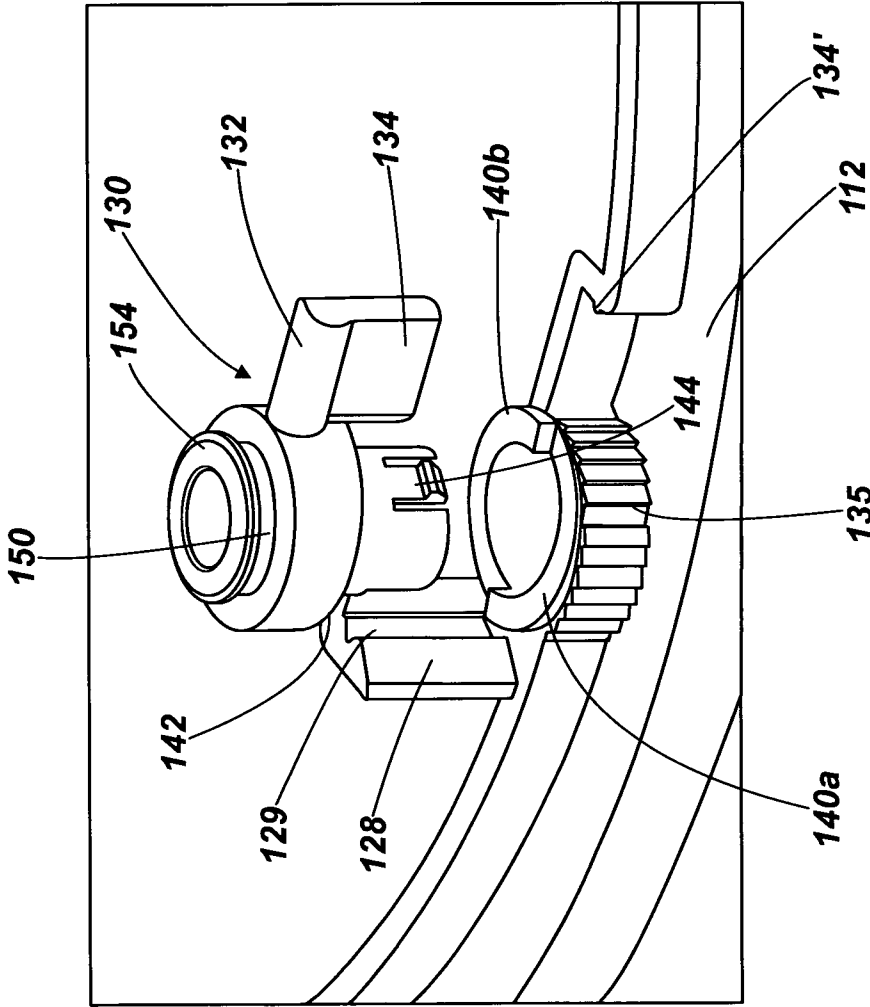
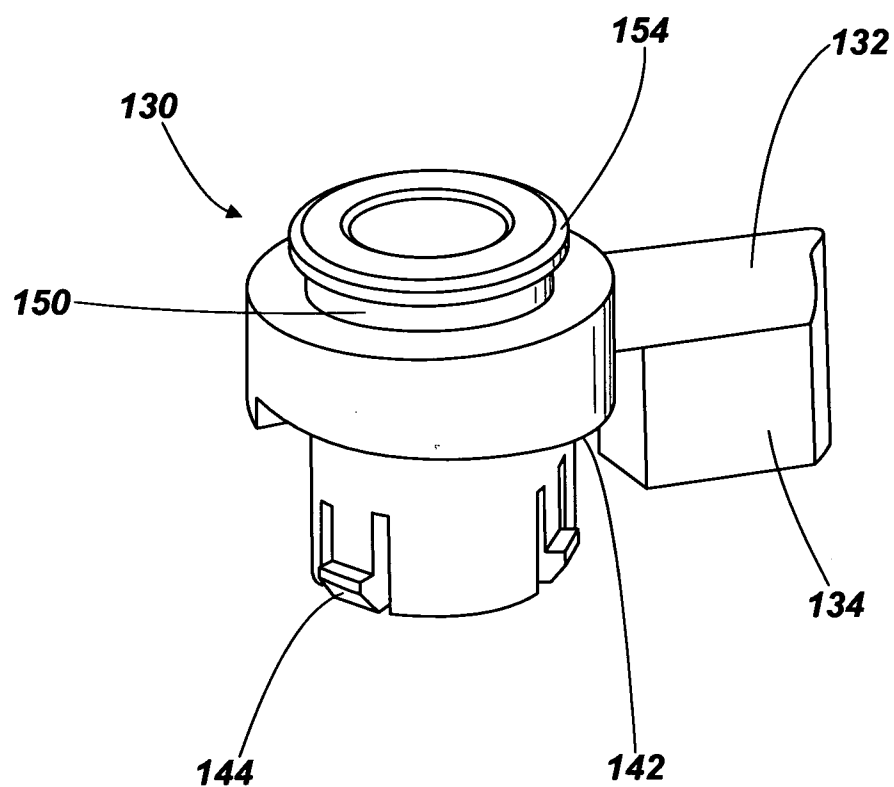
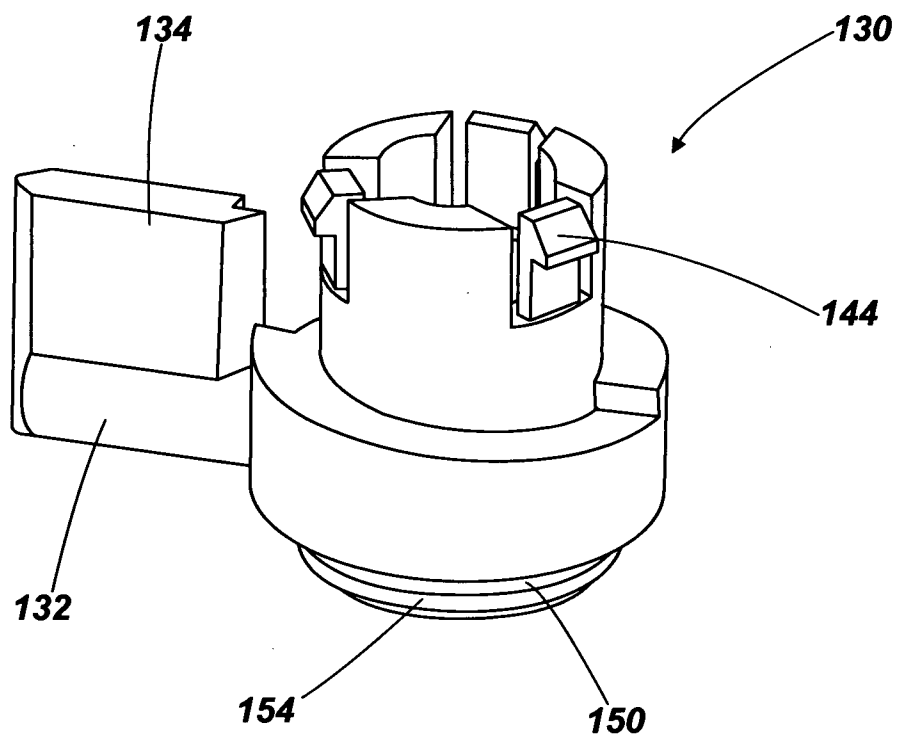
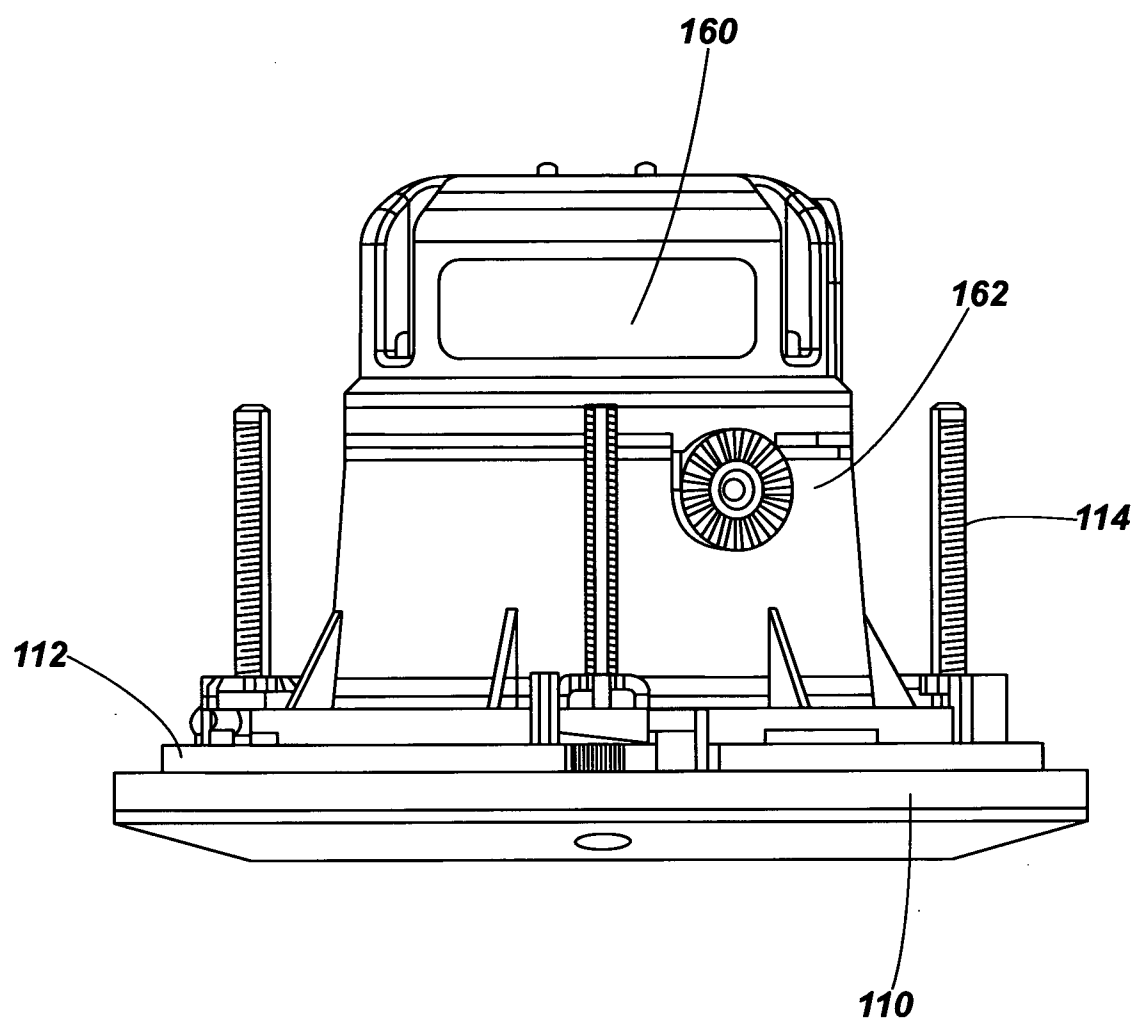


Fig. 7(b)

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*Fig. 7(c)*

10/13***Fig. 7(d)***

11/13*Fig. 8*

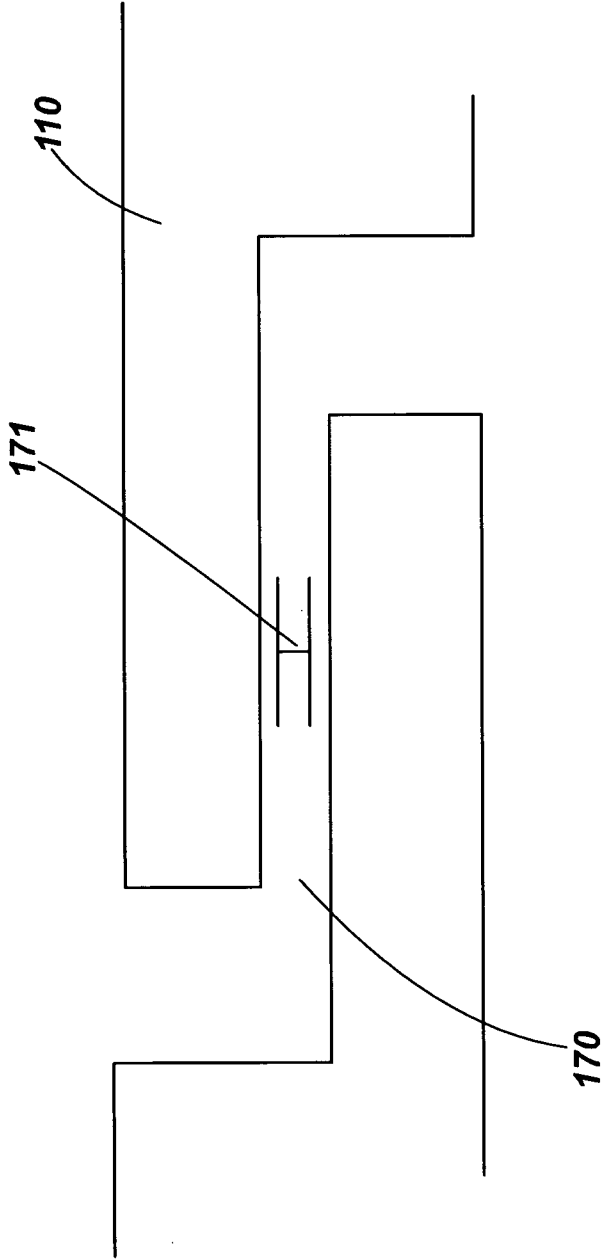
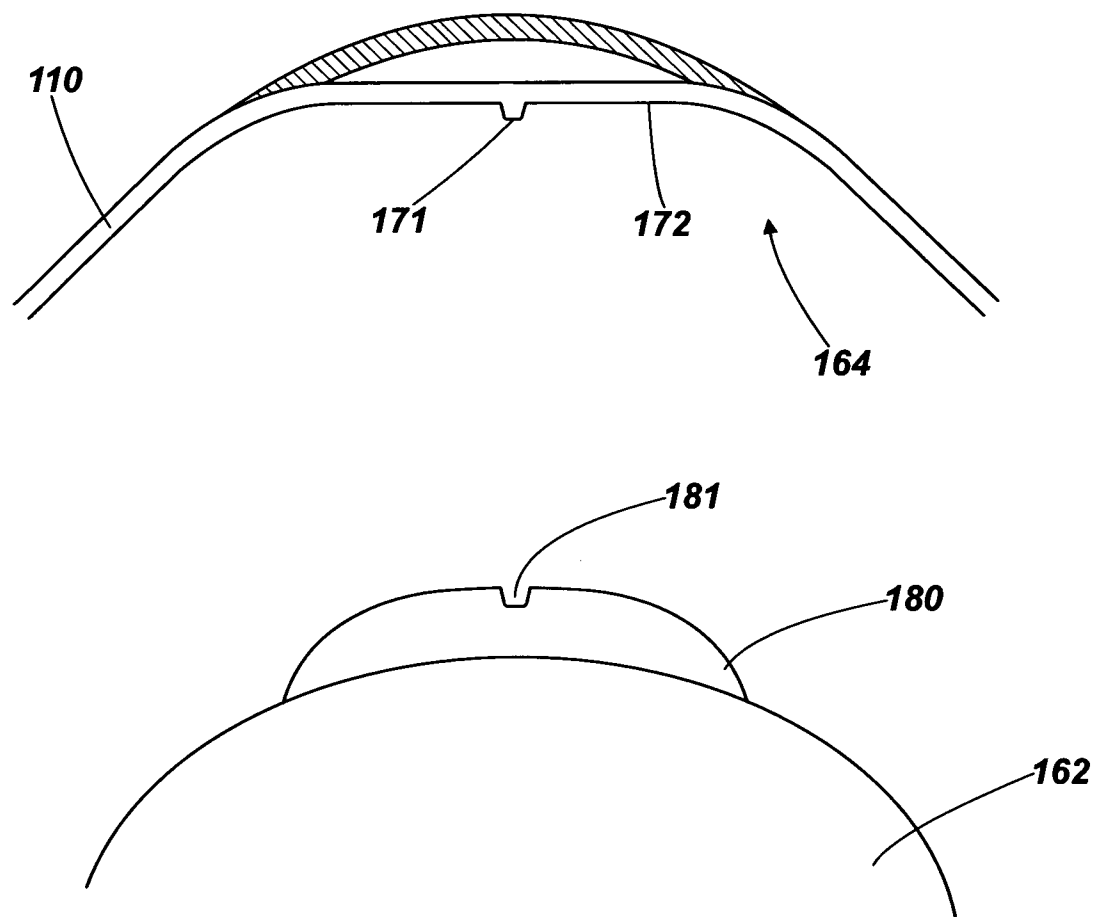


Fig. 9

13/13*Fig. 10*

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2009/002701

A. CLASSIFICATION OF SUBJECT MATTER

INV. H04R1/02 F21V21/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04R F21V

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 563 870 A2 (SCHWAB SANITAER PLASTIC GMBH [DE]) 6 October 1993 (1993-10-06)	1-12,16, 19-23, 27,30-35
Y	column 6, line 29 - column 8, line 40; figures 1-5	14,17, 18, 24-26, 28,29
A	-----	13,15
Y	US 2005/220569 A1 (DRYER JOSEPH E [US]) 6 October 2005 (2005-10-06) paragraph [0018] - paragraph [0022]; figure 1	14,17,18
Y	DE 31 21 700 A1 (SINN DIETER) 16 December 1982 (1982-12-16) the whole document	24-26, 28,29
	----- -/-	

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

27 April 2010

Date of mailing of the international search report

06/05/2010

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
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Authorized officer

Fobel, Oliver

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2009/002701

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 675 531 A (LEHMAN KENNETH G) 11 July 1972 (1972-07-11) the whole document -----	1-35
X	US 4 821 161 A (KOONTZ WILLIAM D [US]) 11 April 1989 (1989-04-11) column 2, lines 52-62 column 5, lines 12-18; figures 1,3 -----	36,52-54
X	US 5 075 831 A (STRINGER RALPH S [US] ET AL) 24 December 1991 (1991-12-24) column 2, line 64 - column 3, line 60 column 4, line 49 - column 5, line 40; figure 2 -----	36-38, 49,52-54

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2009/002701

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-35

How to fix or clamp a mounting element to a structure

2. claims: 36-54

How to mount a support element to a mounting element

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2009/002701

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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