

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
12 January 2012 (12.01.2012)

(10) International Publication Number
WO 2012/004087 AI

(51) International Patent Classification:
F16B 37/08 (2006.01)

35394 Giessen (DE). **PATRICOT, Nicolas** [FR/FR]; 14 rue de la Peruche, F-78117 Chateaufort (FR).

(21) International Application Number:
PCT/EP2011/059700

(74) Agent: **WITTE, WELLER & PARTNER**; Postfach 10 54 62, 70047 Stuttgart (DE).

(22) International Filing Date:
10 June 2011 (10.06.2011)

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10 2010 027 204.3 6 July 2010 (06.07.2010) DE

(71) Applicant (for all designated States except US):
NEWFREY LLC [US/US]; 1207 Drummond Plaza, Newark, Delaware 19711 (US).

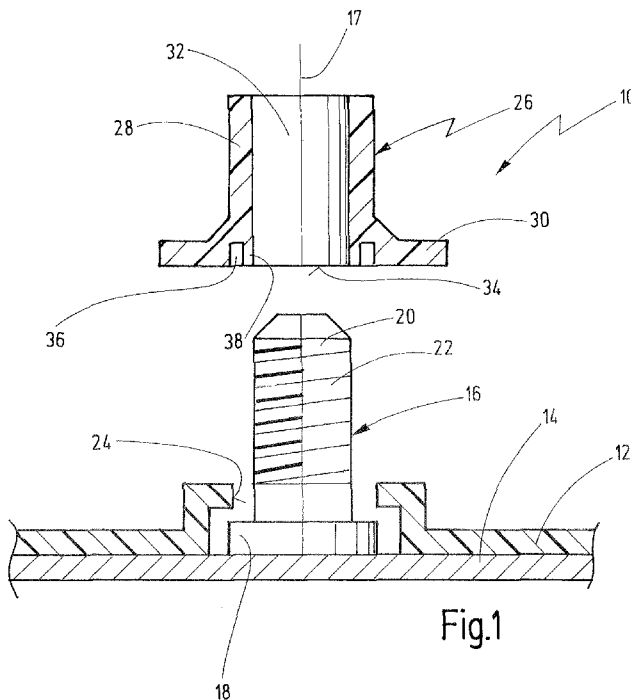
(72) Inventors; and

(75) Inventors/ Applicants (for US only): **DUCORNAIT, Pierre-Yves** [FR/DE]; c/o Emhart Teknologien Tucker GmbH, Max-Eyth-Strasse 1, 35394 Giessen (DE). **SCHMIDT, Michael-Udo** [DE/DE]; c/o Emhart Teknologien Tucker GmbH, Max-Eyth-Strasse 1, 35394 Giessen (DE). **ROSEMANN, Frank** [DE/DE]; c/o Emhart Teknologien Tucker GmbH, Max-Eyth-Strasse 1,

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: NUT, FASTENING ARRANGEMENT AND METHOD OF FASTENING



(57) Abstract: The invention relates to a nut (26) for a fastening arrangement (10) for fixing an item (12) to a structural component (14), the nut (26) having an axially aligned socket (32) for a bolt (16), which can be joined to the structural component (14), and the socket (32) having an opening (34), via which the bolt (16) can be introduced into the socket (32). In the area around the opening (34) the nut (26) has at least one depression (36), which is designed so that a radially elastic holding section (38) is formed between the opening (34) and the depression (36).

W^o 2012/004087 A1

Published:

— with international search report (Art. 21(3))

NUT, FASTENING ARRANGEMENT AND METHOD OF FASTENING

[0001] The present invention relates to a nut for a fastening arrangement for fixing an item to a structural component, the nut having an axially aligned socket for a bolt, which can be joined to the structural component, and the socket having an opening, via which the bolt can be introduced into the socket.

[0002] The present invention further relates to a fastening arrangement for fixing an item to a structural component, comprising a bolt which is joined to the structural component in a longitudinal direction, and a nut which is fixed to the bolt, the nut having a flange section, and the item being fixed between the flange section and the structural component and/or between the flange section and a flange of the bolt.

[0003] Finally the present invention relates to a method of fastening an item to a structural component, particularly for producing a fastening arrangement, comprising steps in which a nut is slipped on to an upper side of a bolt joined to a structural component and the nut is then driven on to the bolt by means of a blow in a longitudinal direction, the item being fixed between a flange section of the nut and the structural component and/or a flange of the bolt.

[0004] Fastening arrangements of the aforementioned type are used in motor vehicle construction, for example. By means of such a fastening arrangement or a plurality of such fastening arrangements it is possible, for example, to attach flat panelling elements to the underbody of a vehicle.

[0005] In doing this a first step is to join a bolt perpendicularly to a surface of the structural component (such as an underbody sheet metal panel) in order to produce a fastening arrangement. This can be done, for example, by means of so-called stud welding, but it can also be accomplished by adhesive bonding methods or thermoplastic welding methods. In the case of stud welding the bolt and the structural component are generally made of a metal material. In the case of adhesive bonding the bolt and the structural component may also be of any other materials. In the case of thermoplastic welding the bolt and the structural component are generally made of plastic.

[0006] In a known method of producing a fastening arrangement of the aforementioned type the bolt joined to the structural component is a threaded bolt having a metric thread. The nut is correspondingly a threaded nut having a corresponding metric internal thread. In order to fasten the item it is placed on the structural component, the bolt protruding through a recess in the item. The nut is then screwed on to the threaded bolt.

[0007] Alternatively, another known method is to drive bolt nuts on to such bolts. If the bolt is made of a metal material, the nut in this case may be made

of a plastic material, for example. In this case the nut is first slipped onto the upper side of the bolt and is then pressed by means of a blow (with a hammer, for example) axially on to the bolt. Here the nut is formed with a coarse screw thread on its inner circumference, for example.

[0008] Although driven assembly makes the actual assembly operation easier, since it obviates the need for a rotating movement of the nut, the quality of the fastening arrangement produced in this way largely depends on whether the nut has previously been correctly slipped on to the upper side of the bolt.

[0009] If the driven nut has a coarse screw thread on its inner circumference, fluctuations can furthermore occur in the holding forces attainable.

[0010] In this context, an object of the invention is to specify an improved nut, an improved fastening arrangement and an improved method of fastening.

[0011] In the case of the nut specified in the introductory part, this object is achieved in that in the area around the opening the nut has at least one depression, which is designed so that a radially elastic holding section is formed between the opening and the depression.

[0012] In the case of the fastening arrangement specified in the introductory part the object is achieved in that the nut is a nut according to the invention.

[0013] In the case of the method specified in the introductory part this object is achieved in that, in the area of the opening through which the bolt enters the nut, the nut has an elastic holding section, which serves to hold the nut in the time between slipping the nut on to the bolt and driving the nut on to the bolt.

[0014] Designing such a nut with an elastic holding section in the edge area of the opening means that prior to final assembly the nut can be securely pre-

assembled with relatively high pre-assembly holding forces. Such a nut is generally advantageous if it has a metric internal thread and is screwed on to a threaded bolt in a final assembly step.

[0015] This type of pre-assembly is particularly advantageous, however, if the nut is then finally assembled by means of an axial blow. The elastic holding device in this case ensures a precise positioning of the nut in relation to the bolt. Furthermore, the nut cannot accidentally fall off between pre-assembly and final assembly.

[0016] The elastic holding device is furthermore also capable of yielding elastically as the nut is driven home, so that the holding device can also help to increase the holding forces after performing the final assembly step. This applies in particular if the bolt is embodied as a threaded bolt (with metric thread or coarse screw thread).

[0017] The object is therefore achieved in full.

[0018] According to a preferred embodiment the depression is embodied as an annular depression around the opening.

[0019] Here the radially elastic holding section is embodied as a thin shank stub, which can yield elastically, radially outwards into the depression and after slipping the nut on can exert radial holding forces acting inwards on the bolt.

[0020] However, the depression can also be designed so that the radially elastic holding section has one or more radially elastic retaining tongues distributed in a circumferential direction. In this case the depression is preferably connected on specific sections of the circumference to the opening or a section of the socket.

[0021] It is furthermore advantageous overall if the holding section comprises a lug projecting radially inwards.

[0022] This reduces the inside diameter of the holding section in relation to the inside diameter of the socket. In other words the holding section is radially expanded by the lug bearing against the bolt. The lug here preferably makes the inside diameter of the holding section smaller than the outside diameter of the bolt, particularly a section of the bolt on which the nut is pre-assembled.

[0023] The lug on the inner circumference of the holding section may be a single lug. However, a plurality of individual lugs distributed over the circumference may also be provided on the inner circumference of the holding section.

[0024] It is particularly preferred if the lug is a continuous annular lug running over the circumference of the holding section.

[0025] According to a further embodiment the nut has an introduction taper, which leads into the opening.

[0026] This measure makes it easier to slip the nut on to the bolt for the purpose of pre-assembly. The introduction taper here has a large diameter in the area of the underside of the nut, which tapers down to the diameter of the opening of the socket. In this case the larger diameter may be at least twice the diameter of the opening.

[0027] It is especially preferred here if the depression is located in the area of the introduction taper.

[0028] The holding section here preferably also has a conically tapering shape at its end pointing away from the socket.

[0029] This makes it even easier to introduce the bolt into the nut for the purpose of pre-assembly.

[0030] It is furthermore advantageous overall if the socket is of circular cross section.

[0031] This allows the holding force achieved by the final assembly to be set to a predetermined value with no fluctuations. It is especially preferred here if the socket on its circumference (and/or the nut on its inner circumference) is of substantially smooth design, that is to say without internal thread.

[0032] It is furthermore advantageous overall if the socket extends axially right through the nut and if an inspection section extending in a transverse direction thereto, which is destroyed when the bolt is introduced, is formed in the socket.

[0033] It can happen, particularly in the so-called driven assembly, that the nut is not driven far enough onto the bolt in an axial direction. In this case the inspection section would not be destroyed. Since the socket passes right through in an axial direction, the inspection section can be inspected after performing the final assembly step, in order to establish whether the nut has been driven far enough on to the bolt.

[0034] The inspection section may take the form of a continuous film over the cross-sectional area of the socket, for example, but it may also be formed by a narrow cross web or the like.

[0035] It is especially preferred here if the diameter of the socket, in a section on the side of the inspection section remote from the opening, is larger than the diameter of the socket in a section on the side of the inspection section facing the opening.

[0036] This serves to improve the fracturing properties of the inspection section.

[0037] In the case of the fastening arrangement according to the invention it is particularly advantageous if the bolt is a threaded bolt having a longitudinal groove formed in the threaded area.

[0038] Such a threaded bolt may be embodied as a metric bolt having a so-called paint groove, for example.

[0039] For the purpose of anticorrosion protection the bolts, especially in motor vehicle engineering, are joined to the vehicle body in the untreated state (particularly in stud welding). The bolt is then painted together with the structural component to which it is fastened.

[0040] When screwing a nut on to such a threaded bolt, such a paint groove can ensure that the paint applied does not interfere with the thread engagement.

[0041] When driving a nut on to such a bolt it is particularly advantageous if the socket for the bolt is of circular cross section. In this case uniformly high holding forces result irrespective of the relative rotational position between the bolt and the nut.

[0042] It goes without saying that the aforementioned features and those yet to be explained below can be used not only in the particular combination specified but also in other combinations or individually without departing from the scope of the present invention.

[0043] Exemplary embodiments of the invention are represented in the drawing and will be explained in more detail in the following description. In the drawings:

Fig. 1 shows a schematic representation of a first embodiment of a fastening arrangement according to the invention;

Fig. 2 shows a schematic representation of an alternative embodiment of a nut according to the invention;

Fig. 3 shows a partially sectional view of a further embodiment of a nut according to the invention; and

Fig. 4 shows a further alternative embodiment of a fastening arrangement according to the invention.

[0044] In Fig. 1 a fastening arrangement is denoted generally by 10. The fastening arrangement 10 serves for fixing an item 12, such as a flat item, in particular an underbody panel, to a structural component 14, such as a vehicle sheet metal plate.

[0045] The fastening arrangement comprises a bolt 16, which is joined perpendicularly in a longitudinal direction 17 to a surface of the structural component 14, for example by so-called stud-welding.

[0046] The bolt 16 comprises a flange 18, the underside of which is joined to the upper side of the structural component 14. The bolt 16 further comprises a shank 20, which extends from the flange 18 in the longitudinal direction 17 and the diameter of which is smaller than that of the flange 18.

[0047] A threaded section 22 may be formed on the shank 20.

[0048] The item 12 has a recess 24 and is arranged on the upper side of the structural component 14 in such a way that at least a part of the shank 20 of the bolt 16 extends through the recess 24 and beyond the upper side of the item 12.

[0049] The fastening arrangement 10 further comprises a nut 26. The nut 26 is integrally made from plastic and comprises a shank section 26 and a flange section 30, which has a larger diameter than the shank section 28.

[0050] The nut 26 furthermore has a socket 32 for the bolt 16, the socket being embodied as a socket of circular cross section passing all the way through in a longitudinal direction 17.

[0051] The shank 20 of the bolt 16 and the socket 32 are preferably of circular cross section, but may also be polygonal.

[0052] The socket 32 has an opening 34, via which the bolt 16 is introduced into the socket 32.

[0053] Also provided around the opening 34 is an annular depression 36, which extends from the underside of the flange section 30 and is formed in the manner of a blind depression.

[0054] The depression 36 is preferably concentric with the opening 34. A holding section 38 in the form of a short shank stub, which is capable of yielding elastically in a radial direction into the depression 36, is thereby formed between the opening 34 and the depression 36.

[0055] Here, the inside diameter of the holding section 38 may be somewhat smaller than the inside diameter of the socket 32.

[0056] When the nut 26 is fitted to the bolt 16, the holding section 38 can exert a radial contact pressure on the bolt 16.

[0057] The inner circumference of the socket 32 is preferably smooth, and the nut 26 is preferably designed for driven assembly.

[0058] In Fig. 1 the nut 26 is shown separated from the bolt. For driven assembly the nut 26 is first slipped onto an upper side of the bolt 16. The holding section 38 here serves for fixing such a pre-assembly position. A blow is then applied to the upper side of the nut 26, so that this is driven in a longitudinal direction 17 on to the bolt 16. The outside diameter of the flange section 30 is greater than the diameter of the recess 24, so that the item 12 is fixed between the flange section 30 and the upper side of the structural component 14. Fig. 1 shows that the item 12 is separated at a distance from the flange 18 of the bolt 16. A part of the item surrounding the recess 24 may also rest on the upper side of the flange 18, however, so that the item is fixed between the underside of the flange section 30 and the upper side of the flange 18.

[0059] The following Figs. 2 to 4 show further embodiments of fastening arrangements and nuts according to the invention. These correspond generally in their construction and working principle to the fastening arrangement 10 and the nut 26 in Fig. 1. The same elements are therefore provided with the same reference numerals. It is essentially the differences that are explained below.

[0060] Fig. 2 first shows that the holding section 38 has a lug 40 in the form of a circumferential annular lug on its inner circumference. The inside diameter of the holding section 38 with the lug 40 formed thereon is then smaller than the diameter of the socket 32. This ensures, when introducing the bolt 16, that the holding section 38 is deflected elastically in a radial direction. The radial thickness of the lug 40 is here preferably approximately equal to the radial thickness of the depression 36. As a result the holding section 38 is able to yield elastically in a radial

direction into the annular depression 36. After slipping on to the bolt 16 the holding section 38 can exert a radial contact pressure on the bolt 16.

[0061] Fig. 2 further shows that the nut 26 has an introduction taper 42 between the underside 30 and the opening 34, which makes it easier to slip the nut 26 on to the upper side of the bolt 16. The depression 36 in this case is formed in the area of the introduction taper 42.

[0062] Fig. 3 shows a further alternative embodiment of a nut 26, which in terms of its construction and working principle corresponds generally to the nut 26 in Fig. 2. It can also be seen from the nut 26 in Fig. 3 that the nut has reinforcing ribs 44 in the area of the introduction taper 42.

[0063] Fig. 4 shows a further embodiment of a fastening arrangement 10.

[0064] It can be seen from this that the shank 20 of the bolt 16 has a threaded section with a paint groove 46 running approximately axially and helically.

[0065] The nut 26 in Fig. 4 furthermore has an inspection section 48 in the form of a thin film extending transversely to the socket 32. The axial arrangement of the inspection section 48 here is selected so that this is destroyed when the nut 26 is correctly fitted on the bolt 16. Fig. 4 shows that the nut 26 has not been driven far enough on to the bolt 16, so that the underside of the flange section 30 is separated by a distance from the upper side of the item 12.

[0066] In order to improve the fracture properties of the inspection section 48, the diameter 52 of the socket 32 on the side of the inspection section 48 remote from the opening 34 is greater than the diameter 50 of the socket 32 in a section on the side of the inspection section facing the opening 34.

[0067] It can further be seen from Fig. 4 that the item 12 may also be of multi-piece design. Here the item 12 comprises a lower layer 12b and an upper layer 12a.

Patent claims

1. Nut (26) for a fastening arrangement (10) for fixing an item (12) to a structural component (14), the nut (26) having an axially aligned socket (32) for a bolt (16), which can be joined to the structural component (14), and the socket (32) having an opening (34), via which the bolt (16) can be introduced into the socket (32), wherein in the area around the opening (34) the nut (26) has at least one depression (36), which is designed so that a radially elastic holding section (38) is formed between the opening (34) and the depression (36).
2. Nut according to Claim 1, wherein the depression (36) is embodied as an annular depression around the opening (34).
3. Nut according to Claim 1 or 2, wherein the holding section (38) comprises a lug (40) projecting radially inwards.
4. Nut according to one of Claims 1 to 3, wherein the nut (26) has an introduction taper (42), which leads into the opening (34).
5. Nut according to one of Claims 1 to 4, wherein the depression (36) is located in the area of the introduction taper (42).
6. Nut according to one of Claims 1 to 5, wherein the socket (32) is of circular cross section.
7. Nut according to one of Claims 1 to 6, wherein the socket (32) extends axially right through the nut (26) and wherein an inspection section (48) extending in a transverse direction thereto, which is destroyed when the bolt (16) is introduced, is formed in the socket (32).

8. Nut according to Claim 7, wherein the diameter (52) of the socket (32), in a section on the side of the inspection section (48) remote from the opening (34), is larger than the diameter (50) of the socket (32) in a section on the side of the inspection section (48) facing the opening (34).
9. Nut according to one of Claims 1 to 8, wherein the nut (26) is integrally formed from plastic.
10. Fastening arrangement (10) for fixing an item (12) to a structural component (14), comprising a bolt (16) which is joined to the structural component (14) in a longitudinal direction (17), and a nut (26) which is fixed to the bolt (16), the nut (26) having a flange section (30), the item (12) being fixed between the flange section (30) and the structural component (14) and/or a flange (18) of the bolt (16), wherein the nut (26) is a nut according to one of Claims 1 to 9.
11. Fastening arrangement according to Claim 10, wherein the bolt (16) is a threaded bolt having a longitudinal groove (46) formed in the threaded area.
12. Method of fastening an item (12) to a structural component (14), particularly for producing a fastening arrangement (10) according to Claim 10 or 11, comprising steps in which a nut (26) is slipped on to an upper side of a bolt (16) joined to a structural component (14) and the nut (26) is then driven on to the bolt (16) by means of a blow in a longitudinal direction (17), the item (12) being fixed between a flange section (30) of the nut and the structural component (14) and/or a flange (18) of the bolt (16), wherein in the area of an opening (34), through which the bolt (16) enters the nut, the nut (26) has an elastic holding section (38), which serves to hold the nut (26) in the time between slipping the nut on to the bolt (16) and driving the nut (26) on to the bolt (16).

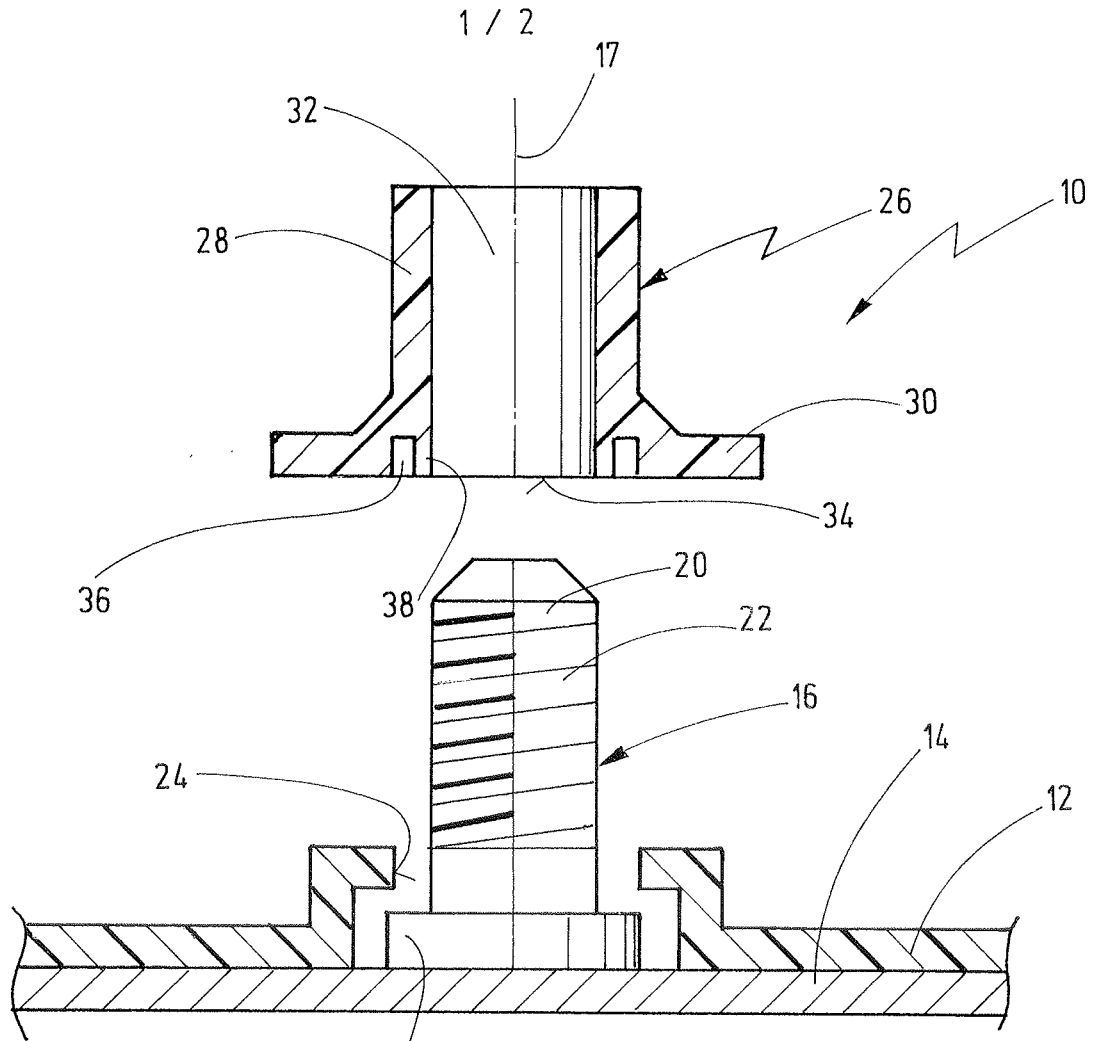


Fig.1

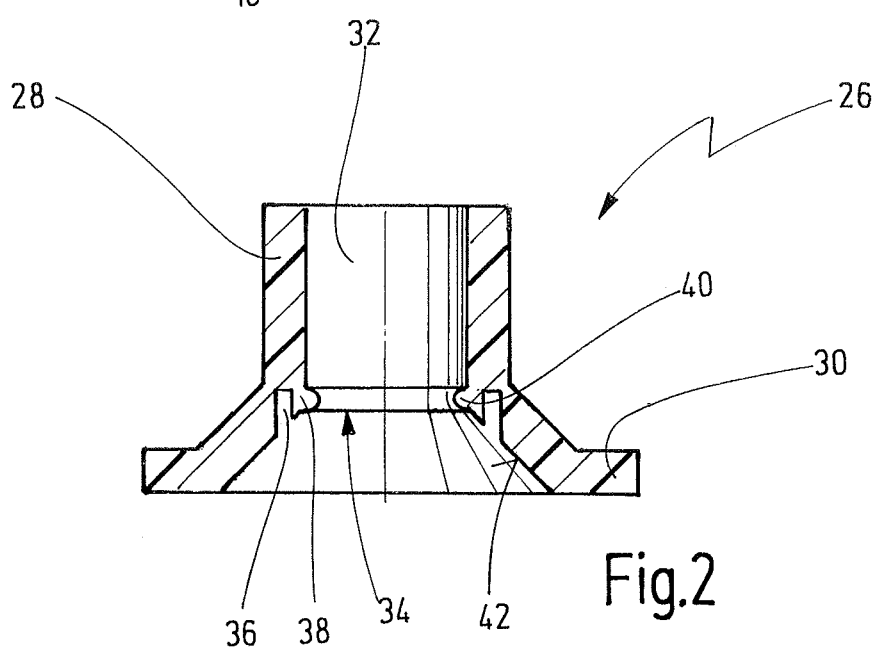


Fig.2

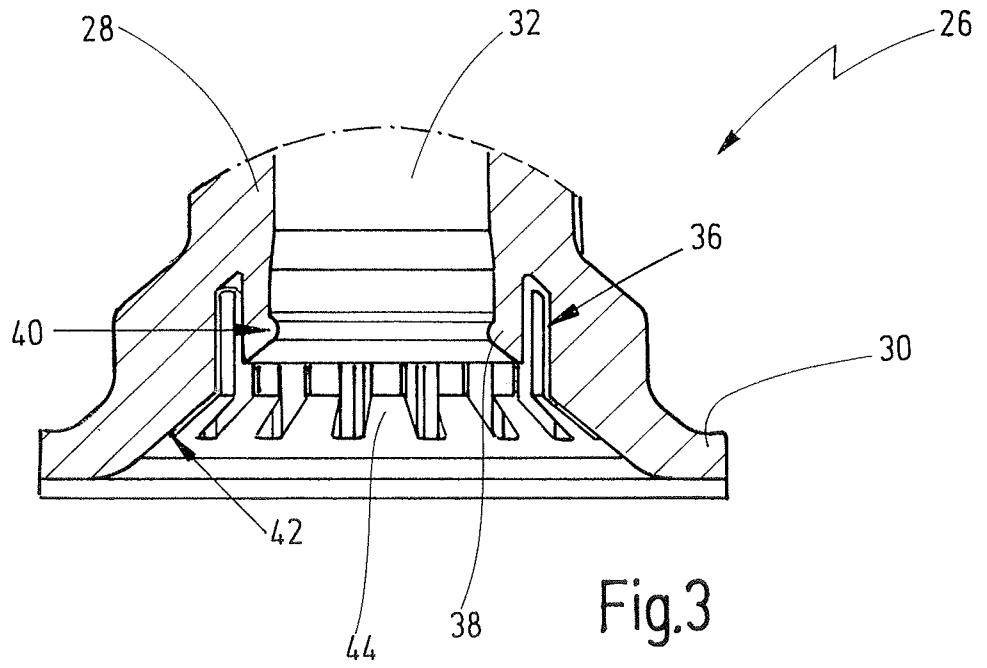


Fig.3

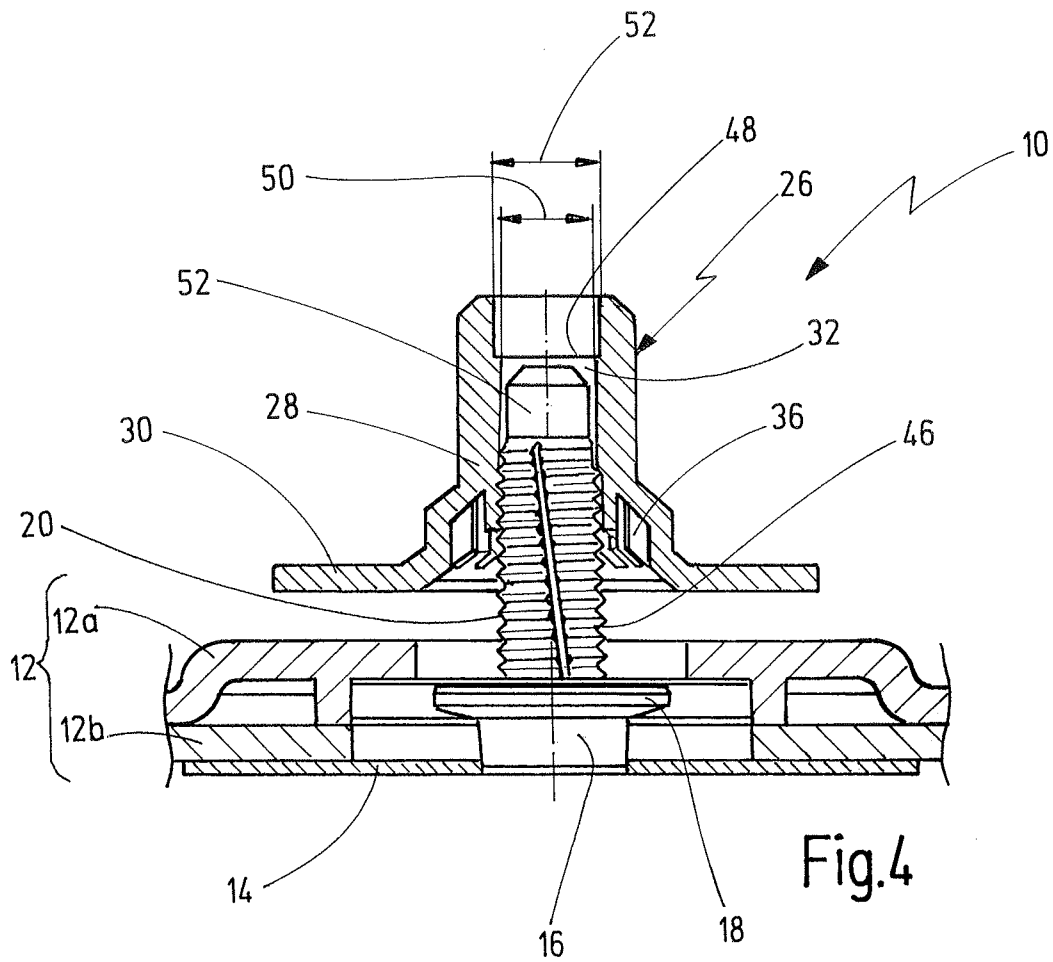


Fig.4

INTERNATIONAL SEARCH REPORT

International application No PCT/EP2011/059700
--

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16B37/08
 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)
F16B

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	US 4 299 520 A (IWATA YUKICHI) 10 November 1981 (1981-11-10)	12
A	figures	1
A	-----	
	US 5 098 242 A (SCHATY HARALD [DE]) 24 March 1992 (1992-03-24)	1
	figures	

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"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</p> <p>"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.</p> <p>"&" document member of the same patent family</p>
--	--

Date of the actual completion of the international search 13 September 2011	Date of mailing of the international search report 21/09/2011
---	---

Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Pi rog, Pawel
--	--

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2011/059700

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4299520	A 10-11-1981	DE 3000208 A1 JP 55097514 A	24-07-1980 24-07-1980

US 5098242	A 24-03-1992	NONE	
