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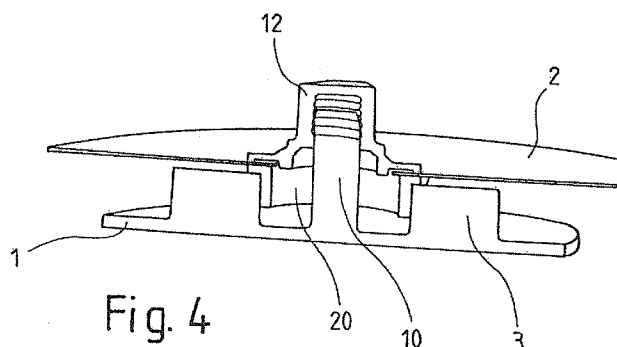
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(54) Title: FASTENING SYSTEM FOR A PROTECTIVE PLATE OF AN OPERATING FLUID CONTAINER



(57) Abstract: The present invention describes a fastening system for fastening a heat-shielding and/or impact-protection plate (2) to an operating fluid container wall (1) with the following features: - the fastening system comprises a cylindrical receiving bolt (10) and a fastening element (12) with an internal thread (14); - the receiving bolt (10) is formed from a first plastic and/or comprises a first plastic at its outer circumference; - the fastening element (12) is formed from a second plastic and/or its internal thread (14) is formed from a second plastic; - a hardness of the second plastic is greater than a hardness of the first plastic; - the fastening element (12) can be screwed onto the receiving bolt (10); and - by screwing the fastening element (12) onto the receiving bolt (10), an external thread is formed on the outer circumference of the receiving bolt (10) by material displacement of the first plastic into gaps between the flanks (16) at the root (18) of the internal thread (14).



Fastening system for a protective plate of an operating fluid container

5 The present invention relates to a fastening system for fastening a heat-shielding and/or impact-protection plate to an operating fluid container, in particular to an operating fluid container wall.

10 Operating fluid containers are, for example, fuel tanks or fluid containers for aqueous urea solution. Fuel tanks in motor vehicles are often arranged in the area of heat-carrying components, in particular in the vicinity of exhaust systems. This leads to a considerable thermal loading of the fuel tank and in
15 extreme cases may lead to its deformation. Furthermore, fuel tanks are often arranged in the area of the underbody of a motor vehicle, so that the fuel tank is in this case exposed to the risk of stone impact.

20 To shield operating fluid containers from excessive heat input and protect them from stone impact, operating fluid containers are often provided with heat-shielding and/or stone-impact-protection plates, which are fastened to the outer wall of the operating
25 fluid container at the locations thereof that are to be protected.

It is known from the prior art to use for fastening these protective plates threaded fastening bolts, which
30 comprise a plastic receptacle and a threaded bolt with a foot, the threaded bolt together with the foot being formed from a metal. For mounting the protective plate on a fuel tank, the threaded fastening bolt is first welded onto the outer skin of the fuel tank, so that
35 the foot of the threaded bolt is in direct contact with the outer skin of the fuel tank, and then the protective plate is fastened to the threaded bolt by means of a metal nut.

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In the event of heat input, for example by way of an exhaust system of the motor vehicle, the threaded bolt heats up and passes the heat on to the contact point with the outer skin of the tank, so that it is also
5 heated up. If the heat transfer by way of the threaded bolt and/or by way of the protective plate takes a long time, there is even the risk of the tank wall being reduced by the heated punch effect, to the extent that the tank wall is penetrated, which leads to leaking of
10 the operating fluid container. Furthermore, heat damage may cause the threaded bolt to come out from the receptacle, so that the protective plate is no longer held without play by the threaded fastening bolt, which in turn may lead to rattling noises of the loose
15 protective plate and even to the protective plate being lost during driving.

The object of the present invention is to provide an improved fastening system, by means of which a heat-
20 shielding and/or impact-protection plate can be fastened to an operating fluid container wall, and which ensures reliable fastening of the heat-shielding and/or impact-protection plate to the operating fluid container wall in spite of heat input, for example by
25 way of an exhaust system.

This object is achieved according to the invention in a way corresponding to the features specified in claim 1. Advantageous configurations of the invention are
30 specified in the subclaims.

The fastening system according to the invention for fastening a heat-shielding and/or impact-protection plate to a container wall of an operating fluid
35 container comprises a cylindrical receiving bolt and a fastening element with an internal thread. In this case, the receiving bolt is formed from a first plastic and/or comprises a first plastic at its outer

circumference, and the fastening element is formed from a second plastic and/or its internal thread is formed from a second plastic. The fastening element can be screwed onto the receiving bolt. A hardness of the
5 second plastic is greater than a hardness of the first plastic, so that, by screwing the fastening element onto the receiving bolt, an external thread is formed on the outer circumference of the receiving bolt by material displacement of the first plastic into gaps
10 between the flanks at the root of the internal thread.

Since both the receiving bolt and the fastening element are respectively formed from plastic, the fastening of the receiving bolt to the container wall of the
15 operating fluid container is not reduced or loosened by heat input on/in the receiving bolt. Furthermore, the plastics from which the fastening element and the receiving bolt are formed have a lower thermal conductivity than metal, so that the root of the
20 receiving bolt, which is preferably connected to the container wall with a material bond, is heated up to a lesser extent when there is heat input.

Furthermore, the connection between the fastening
25 element and the receiving bolt is particularly stable, since the external thread of the receiving bolt, which is formed by screwing the fastening element onto the receiving bolt, is not formed by cutting but by displacement of material of the first plastic into gaps
30 between the flanks at the root of the internal thread. In the region of the thread flanks, the material of which the receiving bolt consists is thereby compacted in such a way that the thread produced can withstand extreme static and dynamic loads. In this case, the
35 material displacement on the receiving bolt is permanent, so that the screw connection can be undone again. As in the case of conventionally produced threads, the screw connection can be reused.

The internal thread of the fastening element comprises thread flanks with a front flank angle and a rear flank angle. The front flank angle is preferably between 15° and 25°, most preferably between 15° and 20°, and the rear flank angle is preferably between 25° and 40°, most preferably between 30° and 40°. With the front flank angle of the thread flank, the material of the cap nut, that is to say the second plastic, presses itself into the softer material of the receiving bolt, that is to say into the first plastic.

The first plastic, from which the receiving bolt and/or the outer circumference of the receiving bolt is/are formed, may comprise for example LDPE (low-density polyethylene) with a Shore hardness of 40 to 50, or HDPE (high-density polyethylene) with a Shore hardness of 50 to 70, or polypropylene with a Shore hardness of 65 to 75. The second plastic, from which the fastening element and/or its internal thread is/are formed, may comprise for example polyamide with a Shore hardness of 75 to 85, preferably 80, or glass-fiber reinforced PA 66 (polyamide) with a Shore hardness of 80 to 90, preferably 85, or glass-fiber reinforced PPS (polyphenylene sulfide) with a Shore hardness of 85 to 95, preferably 91.

Furthermore, the fastening system according to the invention offers the advantage that the external thread is produced on the receiving bolt in a non-cutting manner by screwing on of the fastening element.

A further advantage of the fastening system according to the invention is also that the fastening system has fewer individual parts than the fastening systems that are known from the prior art.

In a fitted state, the heat-shielding and/or impact-protection plate is positioned between the operating fluid container wall and the fastening element. The receiving bolt is connected to the operating fluid container wall with a material bond, for example by welding, on the operating fluid container wall. Alternatively, the receiving bolt may, however, also be formed integrally on the operating fluid container wall and be produced together with the operating fluid container wall, for example in an injection-molding process.

The operating fluid container may for example be formed as a fuel tank or a container for aqueous urea solution.

In addition to the hardness, the strength of the second plastic is preferably also greater than the strength of the first plastic.

Furthermore, a heat resistance of the second plastic is preferably greater than a heat resistance of the first plastic. The heat resistance of the second plastic in this case lies above the likely heat transmission of the heat-shielding and/or impact-protection plate.

The fastening element is preferably formed as a cap nut. The closed embodiment of the fastening element as a cap nut has the effect that the receiving bolt is protected in a further improved manner from the effect of heat.

The receiving bolt is preferably embodied in a conically tapering manner in the region of its free end, so that the diameter of the receiving bolt is greater in the region of its fastening base than in the region of its free end.

Furthermore, the internal thread of the fastening element is also conically formed and, in the installed position, an internal thread diameter is greater in the region of the side facing the operating fluid container wall than in the region of the side facing away from the operating fluid container wall. It is advantageous in the case of this embodiment that, when the fastening element is screwed onto the receiving bolt, the fastening element is centered on it. Furthermore, a force that is necessary for the displacement of the first plastic into the gaps between the flanks at the root of the internal thread increases as the fastening element is progressively screwed onto the receiving bolt. Furthermore, on account of the conical configuration of the internal thread, as the fastening element is progressively screwed onto the receiving bolt, the displacement of the first plastic is driven on by the internal thread, so that, as the screwing on progresses, more material of the receiving bolt is displaced into gaps between the flanks at the root of the internal thread.

The fastening system advantageously also comprises a supporting device, which in the installed position can be arranged between the heat-shielding and/or impact-protection plate and the operating fluid container wall, it being possible for the heat-shielding and/or impact-protection plate to be pressed onto the supporting device by means of the fastening element.

By providing the supporting device, the distance between the heat-shielding and/or impact-protection plate and the operating fluid container wall can be increased, so that the thermal insulating effect of the heat-shielding and/or impact-protection plate is further increased. The supporting device may in this case be formed for example in the form of a supporting bush or in the form of supporting webs, which extend

radially away from the receiving bolt. Furthermore, the supporting device may be formed separately and be connected to the operating fluid container wall by a welding process for example, or alternatively the supporting device may be formed with the operating fluid container in a joint injection-molding process.

In a preferred embodiment, the supporting device is formed from or comprises an elastomer and/or a thermoplastic elastomer. Given an appropriate choice of material for the supporting device, vibrations of the heat-shielding and/or impact-protection plate during driving can be damped particularly effectively.

The supporting device is preferably formed as a two-component structural part and comprises a first plastic for damping vibrations of the heat-shielding and/or impact-protection plate and a second plastic for reducing the heat transfer to the fuel tank wall. Given an appropriate form of the supporting device, the advantages of vibration damping for the protective plate and of the low heat transfer to the operating fluid container wall can be combined with one another.

An operating fluid container according to the invention with a heat-shielding and/or impact-protection plate is characterized in that the operating fluid container comprises a fastening system according to the invention, the receiving bolt that is connected to the operating fluid container wall protruding through a fastening opening in the heat-shielding and/or impact-protection plate, which is arranged between the operating fluid container wall and the fastening element. The fastening element is in this case screwed on the receiving bolt and is in direct contact with the heat-shielding and/or impact-protection plate. Consequently, the heat-shielding and/or impact-protection plate is fastened to the operating fluid

container by means of the fastening system according to the invention.

5 The receiving bolt is in this case preferably welded on the operating fluid container wall. A corresponding operating fluid container can be produced for example by way of a blow-molding process.

10 The receiving bolt may preferably also be injection-molded on the operating fluid container wall. A corresponding operating fluid container may be produced by way of an injection-molding process, for example together with the receiving bolt, so that the operating fluid container can be produced with the receiving bolt
15 in a joint production process.

Further advantages, details and features of the invention emerge below from the exemplary embodiments explained. Specifically:

20 Figure 1 shows a schematic cross-sectional representation of the connection of a fastening bolt to a fuel tank wall according to the prior art;

25 Figure 2a shows a cross-sectional representation of a fastening element in the form of a cap nut of a fastening system according to the invention;

30 Figure 2b shows an enlargement of the region that is shown encircled in Figure 2a and shows a contact region between a receiving bolt and the cap nut to illustrate the material displacement of the receiving bolt;
35

Figure 2c shows a three-dimensional representation of the cap nut that is represented in Figure 2a;

Figure 3 shows a cross-sectional representation through an operating fluid container according to the invention in the region of an operating fluid container wall;

Figure 4 shows a three-dimensional representation of a further embodiment of an operating fluid container according to the invention in section;

Figure 5 shows a cross-sectional representation of a further embodiment of an operating fluid container according to the invention with a modified fastening element;

Figure 6a shows a three-dimensional representation of a supporting device together with a receiving bolt of the fastening system according to the invention;

Figure 6b shows an alternative embodiment of the supporting device in a three-dimensional representation;

Figure 7a shows a cross section through the connecting region between a receiving bolt and a fastening element;

Figure 7b shows the detail represented in Figure 7a, with dimensions; and

Figure 7c shows an enlarged representation of the contact region between the receiving bolt and the fastening element to illustrate the mechanism by which the receiving bolt material is displaced by the internal thread of the fastening element.

In the description that follows, the same reference signs denote the same components or the same features, so that the description of a component that is given with reference to one figure also applies to the other figures, thereby avoiding a repeated description.

Furthermore, when reference is made in the description that follows to a fuel tank and a fuel tank wall, the statements made are correspondingly applicable generally to operating fluid containers (in particular a container for aqueous urea solution) and to an operating fluid container outer wall.

The structure of a fastening bolt that is known from the prior art can be seen in Figure 1. The fastening bolt comprises a threaded bolt 30 with a foot 31. The fastening bolt also comprises a plastic receptacle 40, which is connected to a fuel tank wall 1 with a material bond by means of welding. On account of the welding process, a weld seam 41 or a weld bead 41 is formed between the fuel tank wall 1 and the plastic receptacle 40.

Both the threaded bolt 30 and the foot 31 consist of a metal and are in direct contact with the fuel tank wall 1. A heat-shielding and/or impact-protection plate, which is not represented in the figure, can be fastened to the fuel tank by means of the fastening bolt, the threaded bolt 30 protruding through a corresponding fastening opening in the protective plate, and the protective plate being fastened on the threaded bolt 30 by means of a nut that is not represented. When there is heat input, for example by way of an exhaust system of the motor vehicle, the threaded bolt 30 heats up, and consequently so does the foot 31, so that the contact point between the foot 31 and the fuel tank wall 1 is likewise heated up. If the heat transfer by

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way of the threaded bolt 30 takes a long time, there is the risk of the tank wall being reduced by the heated punch effect, to the extent that the tank wall may be penetrated, which in turn has the consequence of the
5 fuel tank leaking.

The fastening of a heat-shielding and/or impact-protection plate 2, which is referred to hereinafter simply as a protective plate 2, by means of
10 a fastening system according to the invention can be seen from Figure 3. The fastening system according to the invention comprises a cylindrical receiving bolt 10 and a fastening element 12, which has an internal thread 14. In the embodiment represented, the fastening
15 element 12 is formed as a cap nut 12. The receiving bolt 10 consists of a first plastic and the cap nut 12 consists of a second plastic, the hardness of the second plastic being greater than the hardness of the first plastic. Therefore, by screwing the cap nut 12
20 onto the receiving bolt 10, an external thread is formed on the receiving bolt 10 by material displacement of the first plastic by means of thread flanks 15 of the internal thread 14 into gaps between the flanks 16 (see Figure 2b) at the root 18 of the
25 internal thread 14.

It can also be seen from Figure 3 that the receiving bolt 10 is connected to the fuel tank wall 1 with a material bond. Arranged between the cap nut 12, which
30 comprises a supporting ring 13, and the fuel tank wall 1 is the protective plate 2. For the fastening, the protective plate 2 must have a corresponding fastening opening (not represented), through which the receiving bolt 10 protrudes. By screwing the cap nut 12 onto the
35 receiving bolt 10, an external thread is formed on the outer circumference of the receiving bolt 10, and the cap nut 12 is driven on in the direction of the fuel tank wall.

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The supporting ring 13 is in direct contact with the protective plate 2 and subjects it to a force that is directed in the direction of the fuel tank wall 1, so that the protective plate 2 is fastened to the fuel tank wall 1 by means of the cap nut 12 and by means of the receiving bolt 10.

The form of the internal thread 14 of the fastening element 12 can be seen from Figures 2a, 2b, in particular from Figures 7a to 7c. The internal thread 14 is formed in such a way that, by screwing the cap nut 12 onto the receiving bolt 10, the material of the outer circumference of the receiving bolt 10 is displaced by means of thread flanks 15 of the internal thread 14 into the gaps between the flanks 16 at the root 18 of the internal thread 14.

Consequently, the fastening element, and in particular the internal thread 14, is formed in such a way that a thread is not cut in the receiving bolt 10, but instead the thread on the outer circumference of the receiving bolt is formed by material displacement.

It can be seen from Figure 3, and in particular from Figures 7a to 7c, that the receiving bolt 10 tapers conically in the region of its free end, so that the diameter of the receiving bolt 10 is greater in the region of its fastening base, i.e. the region that is in direct contact with the fuel tank wall 1, than in the region of its free end. Furthermore, it can be seen from the figures that the internal thread 14 of the cap nut 12 is likewise conically formed and, in the installed position, the internal thread diameter is greater in the region of the side facing the fuel tank wall than in the region of the side facing away from the fuel tank wall. As a result, it can be ensured that, by screwing the cap nut 12 onto the receiving

bolt 10, the cap nut is centered. Furthermore, as the cap nut 12 is progressively screwed onto the receiving bolt 10, this screwing on is opposed with a greater resistance, so that the connection between the
5 receiving bolt 10 and the cap nut 12 is strengthened.

It can be seen from Figure 7b that the thread flanks have a front flank angle and a rear flank angle. The front flank angle is preferably between 15° and 25° ,
10 most preferably between 15° and 20° , and the rear flank angle is preferably between 25° and 40° , most preferably between 30° and 40° . With the front flank angle of the thread flank, the material of the cap nut 12, that is to say the second plastic, presses itself
15 into the softer material of the receiving bolt 10, that is to say into the first plastic. The internal thread 14 of the cap nut 12 that is represented in Figure 7b is defined for a receiving bolt 10 with an outside diameter of 8 mm and can be scaled appropriately to
20 different diameters.

On account of the conical configuration of the internal thread 14 of the cap nut 12, as the cap nut 12 is progressively screwed onto the receiving bolt 10, the
25 thread flank 15 penetrates more into the outer circumference of the receiving bolt 10, so that, as the screwing on of the cap nut 12 onto the receiving bolt 10 progresses, more material of the receiving bolt 10 is displaced. As a result, in the further course of
30 screwing on the cap nut 12, the material displacement causes further material to follow on and slide over the next flank portion, which has the rear flank angle, into the gap between the flanks 16. There, the material of the receiving bolt 10 flows together and is
35 compacted. In Figure 7c, these material displacement paths of the material of the receiving bolt are represented by means of arrows.

To improve the thermal insulation of the fuel tank, the fastening system may also have a supporting device 3, on which the protective plate 2 can be placed. A corresponding arrangement is represented in Figure 4, from which it can be seen that the supporting device 3 is arranged between the fuel tank wall 1 and the protective plate 2. In the exemplary embodiment represented, the supporting bush 3 is connected to the fuel tank wall 1 with a material bond. By screwing the cap nut 12 onto the receiving bolt 10, which may also be referred to as a fastening bolt 10, the protective plate 2 is pressed in the direction of the supporting bush 3, an axial distance between the fuel tank wall 1 and the protective plate 2 being limited by the supporting bush 3. The remaining functionality of the fastening system that is represented in Figure 4 is identical to the fastening system that is represented in Figure 3. Furthermore, arranged between the fuel tank wall 1 and the protective plate 2 is a further supporting bush 20, which may for example be formed from a two-component plastic, which comprises a first plastic for damping vibrations of the protective plate 2 and a second plastic for reducing the heat transfer to the fuel tank wall 1.

A further embodiment of the fastening system according to the invention, in which the form of the cap nut 12 or the fastening element 12 is modified, can be seen from Figure 5. The supporting ring 13 is in this case not located at one end of the fastening element 12, but instead is arranged axially about midway along the fastening element 12, so that the flights of the internal thread have been shifted downward. This allows the structural height of the cap nut 12 to be reduced. The remaining functionality of the fastening system that is represented in Figure 5 is identical to that of the fastening system that is represented in Figure 4.

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It can be seen from Figure 6a that the supporting device 3 may be formed in the form of a supporting bush 3. The supporting bush 3 that is represented in Figure 6a is formed with a material bond with the fuel tank wall 1, and may be produced together with the fuel tank wall 1, for example by way of an injection-molding process. Alternatively, the supporting bush 3 may, however, also be connected to the fuel tank wall 1 by a welding process.

10

A further alternative embodiment of the supporting device 3 can be seen from Figure 6b. The supporting device 3 comprises four radial webs 3, which extend radially away from the receiving bolt 10 and on which a protective plate 2 can be placed.

15

List of reference signs

- 1 Operating fluid container wall/fuel tank wall
- 2 Heat-shielding and/or impact-protection plate/
protective plate
- 3 Supporting device/supporting bush/radial web
- 10 Receiving bolt
- 12 Fastening element/cap nut
- 13 Supporting ring (of the fastening element)
- 14 Internal thread (of the fastening element)
- 15 Thread flanks (of the internal thread)
- 16 Gap between the flanks (of the internal thread)
- 18 Root (of the internal thread)
- 20 Supporting bush
- 30 Threaded bolt
- 31 Foot (of the threaded bolt)
- 40 Plastic receptacle
- 41 Weld seam/weld bead (between plastic receptacle and
fuel tank wall)

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Patent claims:

1. A fastening system for fastening a heat-shielding
and/or impact-protection plate (2) to an operating
5 fluid container wall (1) with the following
features:
 - the fastening system comprises a cylindrical
receiving bolt (10) and a fastening element (12)
with an internal thread (14);
 - 10 - the receiving bolt (10) is formed from a first
plastic and/or comprises a first plastic at its
outer circumference;
 - the fastening element (12) is formed from a
second plastic and/or its internal thread (14)
15 is formed from a second plastic;
 - a hardness of the second plastic is greater than
a hardness of the first plastic;
 - the fastening element (12) can be screwed onto
the receiving bolt (10); and
 - 20 - by screwing the fastening element (12) onto the
receiving bolt (10), an external thread is
formed on the outer circumference of the
receiving bolt (10) by material displacement of
the first plastic by means of thread flanks (15)
25 of the internal thread (14) into gaps between
the flanks (16) at the root (18) of the internal
thread (14).
2. The fastening system as claimed in claim 1,
30 **characterized** in that a heat resistance of the
second plastic is greater than a heat resistance of
the first plastic.
3. The fastening system as claimed in one of the
35 preceding claims, **characterized** in that the
fastening element (12) is formed as a cap nut (12).

4. The fastening system as claimed in one of the preceding claims, **characterized** in that the receiving bolt (10) tapers conically in the region of its free end, so that the diameter of the receiving bolt (10) is greater in the region of its fastening base than in the region of its free end.
5. The fastening system as claimed in one of the preceding claims, **characterized** in that the internal thread (14) of the fastening element (12) is conically formed and, in the installed position, an internal thread diameter is greater in the region of the side facing the operating fluid container wall than in the region of the side facing away from the operating fluid container wall.
6. The fastening system as claimed in one of the preceding claims, **characterized** in that the fastening system also comprises a supporting device (3), which in the installed position can be arranged between the heat-shielding and/or impact-protection plate (2) and the operating fluid container wall (1), it being possible for the heat-shielding and/or impact-protection plate (2) to be pressed onto the supporting device (3) by means of the fastening element (12).
7. The fastening system as claimed in claim 6, **characterized** in that the supporting device (3) is formed from a plastic.
8. The fastening system as claimed in either of claims 6 and 7, **characterized** in that the supporting device (3) is formed from or comprises an elastomer and/or thermoplastic elastomer.

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9. The fastening system as claimed in one of claims 6 to 8, **characterized** in that the supporting device (3) is formed as a two-component structural part and comprises a first plastic for damping vibrations of the heat-shielding and/or impact-protection plate (2) and a second plastic for reducing the heat transfer to the operating fluid container wall (1).
10. An operating fluid container with a heat-shielding and/or impact-protection plate (2), **characterized by** the following features:
- the operating fluid container comprises a fastening system as claimed in one of the preceding claims;
 - the receiving bolt (10) that is connected to the operating fluid container wall (1) protrudes through a fastening opening in the heat-shielding and/or impact-protection plate (2), which is arranged between the operating fluid container wall (1) and the fastening element (12); and
 - the fastening element (12) is screwed on the receiving bolt (10) and is in contact with the heat-shielding and/or impact-protection plate (2).
11. The operating fluid container as claimed in claim 10, **characterized** in that the receiving bolt (10) is welded on the operating fluid container wall (1).
12. The operating fluid container as claimed in claim 10, **characterized** in that the receiving bolt (10) is injection-molded on the operating fluid container wall (1).

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13. The operating fluid container as claimed in one of claims 10 to 12, insofar as they refer to one of claims 6 to 9, **characterized** in that the supporting device (3) is connected to the operating fluid container wall (1) with a material bond.
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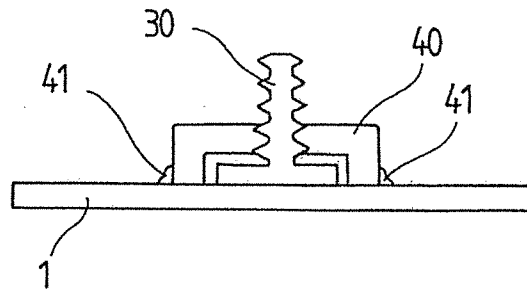


Fig. 1

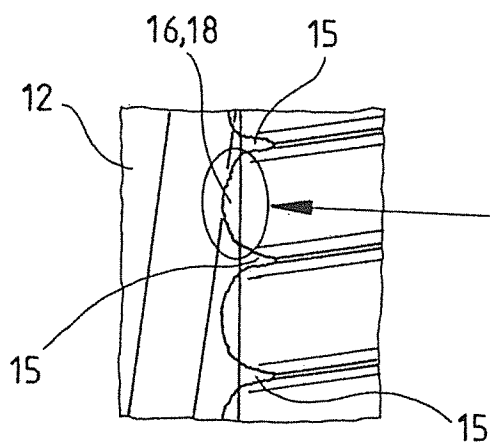


Fig. 2b

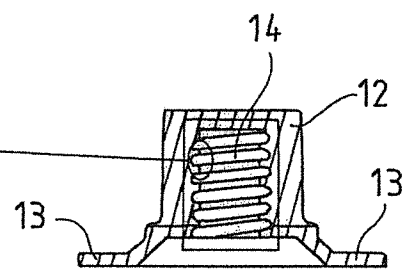


Fig. 2a

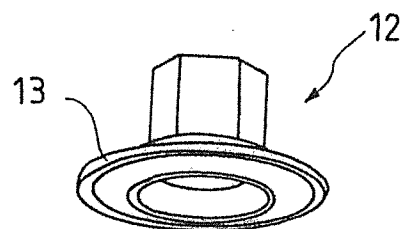


Fig. 2c

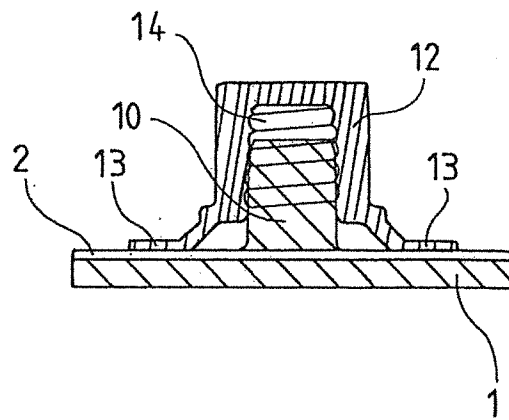


Fig. 3

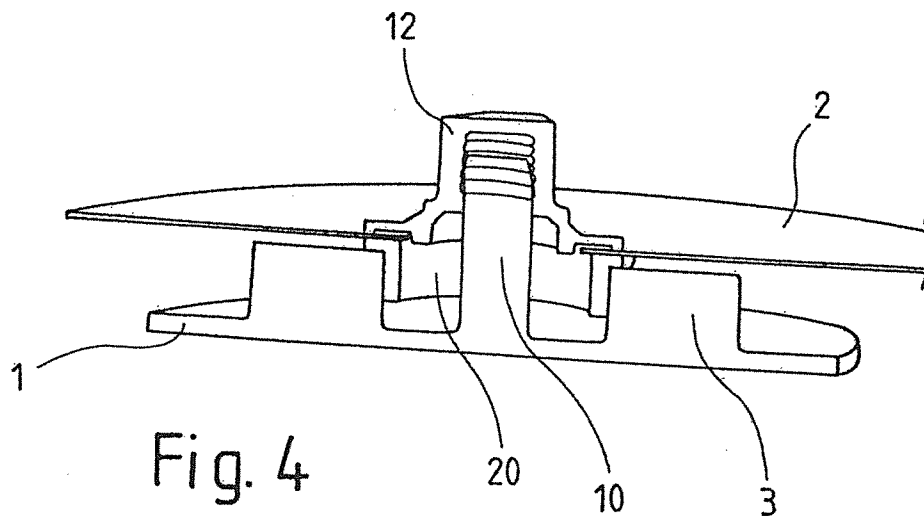
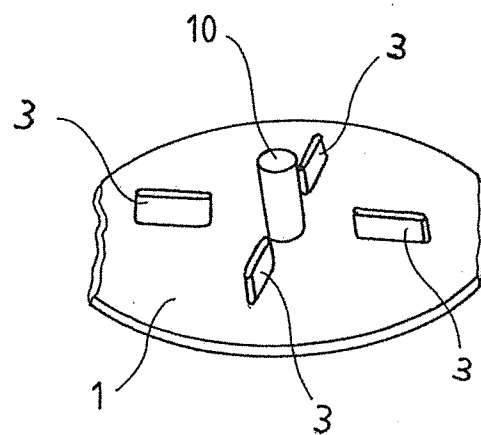
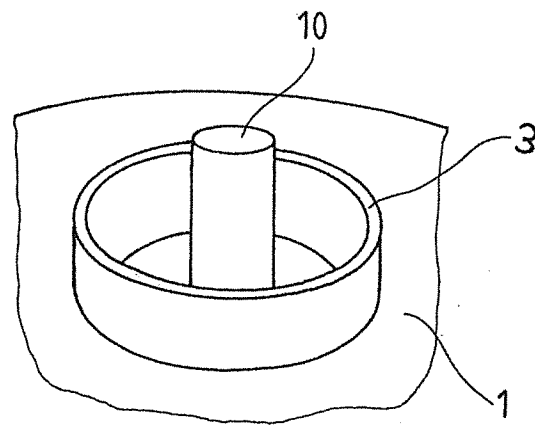
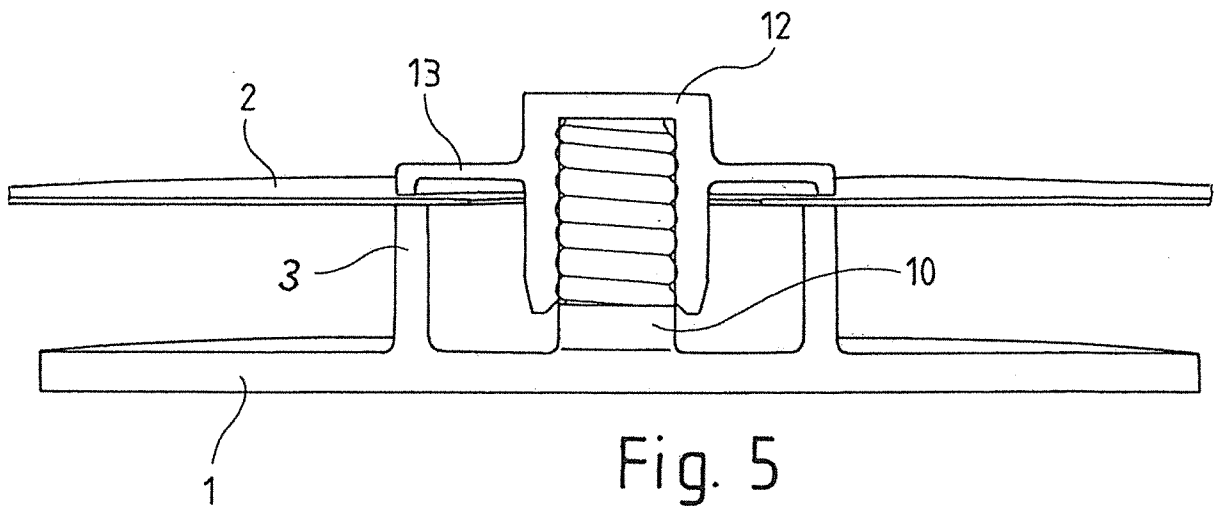
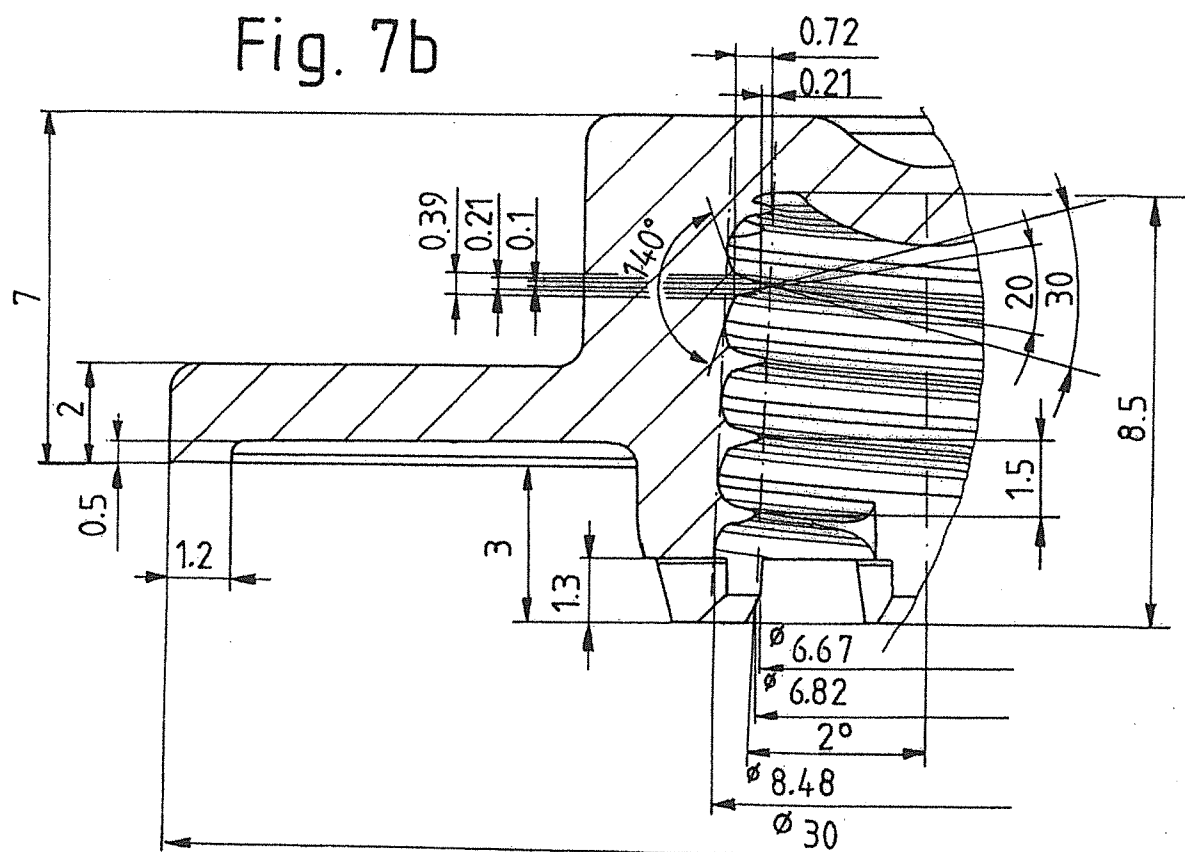
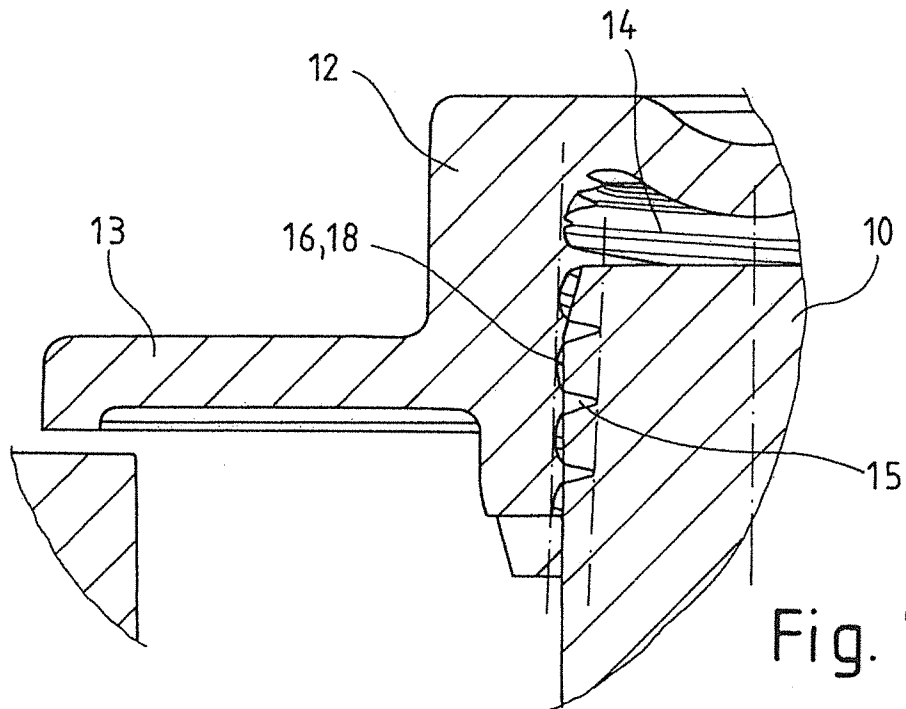


Fig. 4

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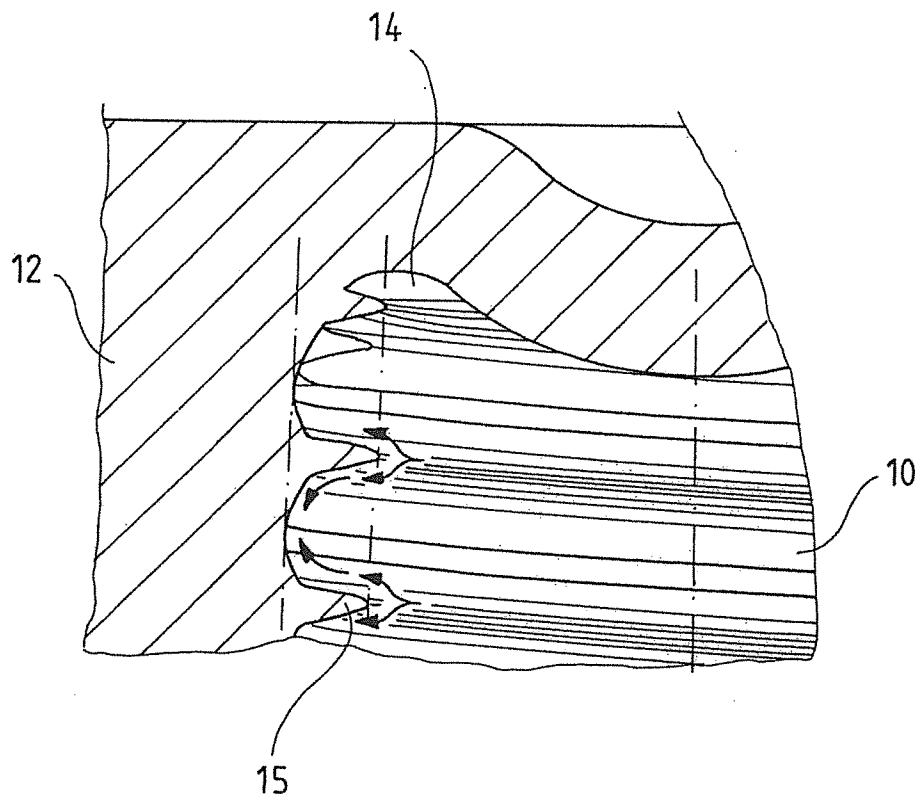


Fig. 7c

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/059577

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16B37/00
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 practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 934 859 A (DIXON STEPHEN J [US] ET AL) 19 June 1990 (1990-06-19)	1,2,4-13
Y	column 1, line 66 - column 5; figure 4 -----	3
X	FR 2 920 841 A1 (FAURECIA INTERIEUR IND SNC [FR] FAURECIA INTERIEUR IND [FR]) 13 March 2009 (2009-03-13) page 2, line 11 - page 5, line 12; figures 1-4 -----	1
Y	DE 28 02 465 A1 (UNITED CARR GMBH) 26 July 1979 (1979-07-26) the whole document -----	3



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

14 July 2014

Date of mailing of the international search report

22/07/2014

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Authorized officer

Comel, Ezio

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2014/059577

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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			EP 2185828 A2 19-05-2010
			FR 2920841 A1 13-03-2009
			WO 2009034276 A2 19-03-2009

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