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(54) **COMPONENT ASSEMBLY**

(57) A component assembly comprises a structure (14) defining a receiving cavity (24) for a component (12), the structure (14) including a locking cavity (32) for a locking device (16). The locking device (16) has a pair of elongate arms (38) extending along a main axis (A) and arranged in facing relationship, and an elastically deformable bridge (42) connecting said arms (38). The bridge (42) divides said locking device (16) into: a locking portion, on one side of the bridge (42), in which the arms (38) are configured to positively engage with respective locking elements (54) in the locking cavity (32), thereby defining a locked position, and an engaging portion, on the opposite side of the bridge (42), in which the arms (38) are provided with means (58) adapted to engage with the component (12) to maintain the latter in its receiving cavity (24), when the locking device (16) is in the locked position.

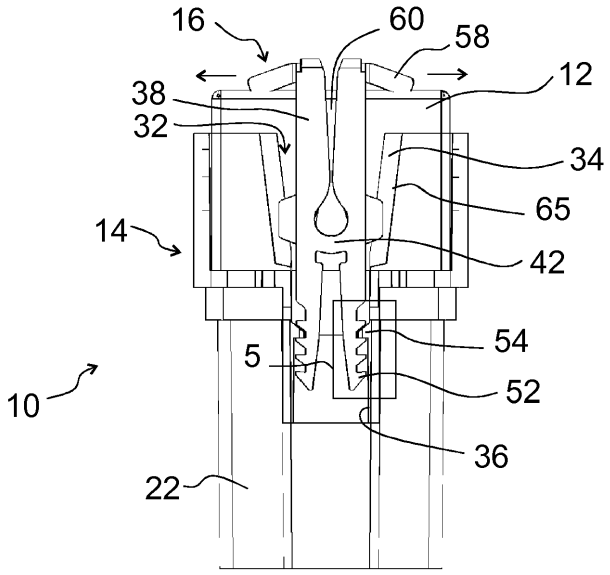

Fig. 4

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Description

Technical field

[0001] The present invention generally relates to an assembly of a component on a structure defining a receiving cavity for the component.

Background of the Invention

[0002] The need for assembling a component in a receiving cavity may exist in a variety of technical fields. One particular example relates to the field of electric or electronic components. Many electronic components such as fuses, relays, etc., are distributed throughout automotive vehicles. Relays are plugged into sockets generally provided on a circuit board or in a junction box.

[0003] Relays are generally designed with a parallelepiped body having a square or rectangular base, and a bottom face equipped with conductive pin terminals. Automotive relays are declined in different ISO standards having different plug-in configuration. Moreover, standard relays are provided in various sizes corresponding to specific electrical characteristics.

[0004] Relay sockets are normally made from an insulating material and comprise a base plate with pin apertures or receptacles for receiving associated pin terminals of the relays. The pin apertures cooperate with connector terminals arranged to be in contact with the relay pin terminals. The socket comprises side walls surrounding the base plate to form an open cavity protecting the relay, and means to prevent accidental removal of the relay. With the increase in electronic systems in vehicles, the space provided to house the relays is limited and relays are not necessarily mounted in a horizontal plane but also plugged in sockets arranged in vertical or inclined planes.

[0005] Vehicle compartments also offer relays a tough environment in terms of temperature, vibrations, and humidity, which may cause the electrical connection between relays and the mating components of the socket to be ineffective. It is therefore important that the relays be maintained in electrical contact with the sockets over time.

[0006] A conventional design of relay socket comprises a body with a roughly square flat base plate comprising pin apertures. Side walls extend from the base plate to form a housing defining an open cavity for a relay. A plurality of elastically deformable locking elements are provided integrally with the side walls. The locking elements are formed by fingers of different lengths in the side walls, provided with a hook-shaped end configured to engage with a top face of the relay opposite the pin terminals. Each locking element has a length adapted to engage a relay having a predetermined height, allowing the same socket to be used with several types of relays (having the same pin configuration).

[0007] When plugging a relay into the socket, the relay body slides into the housing, elastically spreading the locking elements out of the housing until a bottom face of the relay abuts against the base plate of the socket. Once the relay is fully inserted in the socket, the locking element having a length adapted to the height of the relay body will engage the top relay surface, thereby maintaining the relay in proper electrical engagement.

[0008] Removing the relay requires to simultaneously spread the locking elements and pull the relay out of the socket. The removing operation is therefore rather cumbersome and may require special tools or skills.

Object of the invention

[0009] An object of the present invention is to provide an improved way of assembling a component in a receiving structure.

General Description of the Invention

[0010] This object is achieved by a component assembly according to the present invention, which comprises:

a structure defining a receiving cavity for a component, the structure including a locking cavity for a locking device;
the locking device having a pair of elongate arms extending along a main axis and arranged in facing relationship, and an elastically deformable bridge connecting the arms;
wherein the bridge divides the locking device into:

a locking portion, on one side of the bridge, in which the arms are configured to positively engage with respective locking elements in the locking cavity, thereby defining a locked position, and
an engaging portion, on the opposite side of the bridge, in which the arms are provided with means adapted to engage with the component to maintain the latter in its receiving cavity, when the locking device is in the locked position.

[0011] The present invention relies on the use of a locking device that is designed to lock in place in a cavity attached to the structure receiving the component, while at the same time, from another end of the locking device, come into engagement with the component received in its cavity. A fast and secure mounting of the component is thus obtained.

[0012] The elasticity of the bridge is used to give some flexibility such that the arms of the locking device can be selectively displaced from an initial configuration, in order to allow movement of the arm portions in the locking portion for the purpose of engagement with, or disengagement from, the locking elements in the locking cavity. When no external forces are applied to the locking device, it remains or returns in the initial configuration.

[0013] In the engaging portion, the arms are advantageously provided with tabs protruding at an angle from the main axis. In addition, these tabs preferably extend from lateral faces of the arms, namely out of the bending plane of the locking device. The tabs thus extend out of the general plane of the locking device and in use will come to bear against a surface of the component that is arranged nearby.

[0014] This being said, different forms of engagement means can be provided in the engagement portion. Tabs, or other protruding elements, can be provided at different positions along the arms. They may be designed to bear onto the component from above, or to engage a lateral side of the component, and/or to cooperate by form-fitting. The skilled person may devise various means of engagement to block the component in place in the cavity.

[0015] The locking function may be obtained by providing the arm portions in the locking portion with at least one hook protruding from the arm's outer face and that cooperates with the respective locking element in the locking cavity. Preferably however, a plurality of hooks are arranged on the arms to extend along the main axis in order to define a plurality of locked positions at increasing depths. This advantageous design allows safely locking in place components of different heights.

[0016] The locking elements, in turn, may take the form of inwardly protruding teeth arranged in the locking section. One retentetion tooth is sufficient to cooperate with the hooks of one arm.

[0017] In embodiments, the locking device is configured such that in the locked position, the arm portions in the locking portion are spaced from one another. The bridge is configured such that spreading apart the arm portions in the engaging portion causes a reduction of spacing between the arm portions of the locking portion, to permit disengagement from the locked position.

[0018] Advantageously, the facing arm portions in the locking portion are configured to define a tapering gap from the free ends of the arms towards the center, so that the gap can be engaged by a tool. Such tool can thus be used to spread apart the arms of the engagement portion, in order to disengage the locking portion.

[0019] In embodiments, the locking cavity includes an inlet section and a locking section, in which the locking elements are arranged. The locking cavity is preferably arranged in a lateral wall defining the component receiving cavity in the structure.

[0020] In embodiments the inlet section has a width tapering towards the locking section. Each arm comprises a rib protruding from its outer face, which engages in a lateral guide groove in the inlet section. The ribs have a lateral extent that is larger than the end aperture of the inlet section towards the locking section, to prevent full insertion of the locking device into the cavity.

Brief Description of the Drawings

[0021] Further details and advantages of the present invention will be apparent from the following detailed description of not limiting embodiments with reference to the attached drawings, wherein:

- Fig. 1 is a perspective view of a relay and socket assembly according to an embodiment of the present invention;
- Fig. 2 is a top view of the empty socket of Fig. 1;
- Fig. 3 is a front view of the locking device of Fig. 1;
- Fig. 4 is a cross-section view through the assembly along line 4-4 in Fig.2, with the locking device in locking position;
- Fig. 5 is a close up view of detail 5 in Fig. 4;
- Fig. 6 is a view of the socket assembly of Fig. 1, with a tool inserted in the locking device, illustrating the removal process.

Description of Preferred Embodiments

[0022] In the context of the following description, the terms "vertical", "horizontal", "top", "bottom" will be used in reference to the orientation of Fig. 1.

[0023] An embodiment of the present invention will be described in detail with reference to an example of application where the component is an electronic component, namely a relay, and the structure with cavity is a socket for such relay.

[0024] Fig. 1 shows an assembly 10 comprising three main elements: a relay 12, a socket 14 and a locking device 16. In use, the relay 12 is arranged inside the socket 14 to be in electrical connection with an electric circuit. The locking device 16 allows securing the relay 12 in place in the socket 14 in order to prevent accidental removal/disconnection of the relay 12.

[0025] The relay 12 is inserted into the socket 14 from the top. The socket 14 comprises a lower, connector portion 18 that can be simply connected to an electrical circuit or integrated with a circuit board or any other circuit element, not shown; and an upper, socket portion 20 configured to receive the relay 12. The socket 14 is preferably a one-piece element manufactured from an insulating material like for example plastic material, by injection moulding or any suitable manufacturing process.

[0026] The connector portion 18 is shown in Fig. 1 with straight external walls 22, but one will understand that it may be designed to comprise connection elements such as for example screw holes, pins or clips, compatible with a circuit board.

[0027] The socket portion 20 as shown in Figs. 1 and 2 forms a housing for the relay 12 that comprises a cavity 24 open at its top, delimited at its bottom by a substantially square bottom plate 26 and peripherally by four lateral walls 28 extending vertically from the edges of the bottom plate 26. The bottom plate 26 here comprises fives pin apertures 30 for receiving pin terminals of the relay 12.

Although not shown, it will be understood that when the relay 12 is properly inserted in the socket 14, the relay pin terminals engage through these pin apertures 30. On the lower side of bottom plate 30 (opposite the relay), the relay pin terminals are in contact with connector-side terminals that can be connected to a PCB or electrical circuit in any appropriate manner. The shape of the bottom plate, the walls, and the number and position of the pin apertures are adapted for one type of relay. These features are not critical and may be adapted otherwise to connect with other electronic components.

[0028] As it will now be more apparent from Figs. 3 and 4, the relay 12 is locked in place in the socket 14 by means of the locking device 16, which is engaged in a locking cavity 32 that is integrated in the socket 14. More specifically, the locking cavity 32 is formed as a narrow, elongate recess in one lateral wall 28 of the socket 14. The locking cavity 32 is open at its top and includes a guiding inlet section 34 (at the level of the housing wall), followed by a locking section 36 (extending along the connector portion). The cavity 32 is arranged such that the insertion direction of the locking device 16 into the cavity 32 is the same as the direction of insertion of the relay 12 into the socket 14, here vertical.

[0029] As better shown in Fig. 3, the locking device 16 comprises a pair of elongate arms 38 that extend along a main axis A in facing relationship. The arms 38 are connected with one another by an elastically deformable bridge 42. As seen in the figure, the two arms 38 are identical and in fact the device 16 is symmetrical with respect to main axis A that passes through the centre of the bridge 42. Each arm 38 comprises an inner face 44 facing the other arm, an opposite outer face 46 and two flat lateral sides 48 between the inner and outer faces 44, 46. The locking device 16 is typically a one-piece element that is made from plastic material, by injection moulding or any other suitable process. Suitable materials are e.g. polyamide 6, or the like. The bridge 42 divides the locking device 16 into two portions. On one side of the bridge 42, there is a locking portion 50, in which the arms 38 are configured to positively engage with respective locking elements in the locking cavity, to define a locked position. In this embodiment, the arms 38 are provided with hooks 52 that cooperate with corresponding retention teeth 54 in the cavity 32.

[0030] On the opposite side of the bridge 42, there is an engaging portion 56, in which the arms 38 are provided with means adapted to engage with the relay 12 to maintain the latter in the receiving cavity 24, when the locking device 16 is in the locked position. Here the engaging means comprise tabs 58 that extend transversally to the main axis A, from the upper ends of the arms 38

[0031] The two arms 38 interact via the flexible bridge 42 as two symmetrical levers in such a manner that the locking device 16 can be inserted from the top opening of the cavity 32 and locked therein, and can be removed therefrom. The bridge 42 is centrally positioned in between the engaging 56 and locking 50 sections. The arm portions on both sides of the bridge 42 have free ends.

[0032] As it will appear from the description of Fig.4, the locking device 16 can be locked in place in the cavity 32 and can actually take several locked positions to accommodate to different relay heights.

[0033] As already indicated, the locking device 16 is introduced from above into the locking cavity 32, in a direction parall to main axis A, with the locking portion 50 first. The locking device 16 is pushed downward so that the locking portion 50 traverses the guide section 34 and passes into the locking section 36 where the hooks 52 can engage with the retention teeth 54. The locking device 16 is pushed downward until the tabs 58 come into abutment with the top face 14.1 of the relay 14 and a pair of hooks 52 are engaged with the retention teeth 54. This is the locked position illustrated in Fig.4. The locking device 16 is form fittingly locked in the cavity 24 whereas the upper movement of the relay (out of the socket cavity 24) is prevented by the tabs 58 of the locking device 16. The relay 14 is thus securely plugged in the socket 12 and cannot be removed without removing the locking device 16.

[0034] Since the locking device 16 is provided with a plurality of hooks 52, at different positions along the main axis A, it can be locked in place at different depths inside the cavity 32, and thereby accomdate for fixing relays of different heights. In the illustrated embodiment, the locking device 16 is retained by its third hook 54. But alltogether the locking device 16 can be locked in four different positions, to fix in place relays that are shorter and longer.

[0035] It may be noted here that the tabs 58 are advantageously inclined somewhat downwards, i.e. the free ends of the tabs 58 are not perpendicular to the main axis A but inclined towards the locking portion 50. The distance between the upper and lower ends of the tab 58, seen along axis A, is preferably about half the disance between two successive hooks 52. This inclined configuration of the tabs 58 allows using the elasticity of the plastic material forming the device 16 to absorb small variations of height of the relay and having the locking device 16 in tension in the locked position. Also to be noticed is the fact that the tabs 58 project out of the general plane of the locking device 16. As can be understood from Fig.3, the locking device 16 globally extends in the plane of the drawing sheet, and it is also the plane in which the arms 38 will move due to bridge 42 bending. Specifically, the top of each tab 58 is fixed to the non-visible rear lateral side (opposite the front lateral side 48 visible in Fig.3), i.e. behind the plane of the drawing sheet, and project readward, as can be seen in Fig.1, so that they can bear from above against the relay top face 14.1.

[0036] Another remarkable aspect of the locking device 16 is that it is designed to be easily removed from the locking cavity 32. For this purpose, the bridge 42 is designed to give some flexibility allowing moving together the arm ends in the locking portion 50.

[0037] In the locked position of Fig.4, the arm ends in

the locking portions 50 are spaced apart, while the hooks 52 are engaged with the teeth 54. As it will be understood, due to the flexibility of the bridge, spreading apart the arms 38 in the engaging portion (direction of the horizontal arrows in Fig.4) will cause the arms ends in the locking portion 50 to come closer together, thereby disengaging the hooks 52 from the teeth 54. The locking device 16 can thus be removed by acting on the upper arm ends.

[0038] It may be noted that the locking device configuration shown in Fig.3 may be referred to as initial or rest configuration. When forces are applied on the upper ends of the arm 38, namely to spread them apart, the lower ends move, due to the elasticity provided by the bridge 42, closer together, in a kind of lever reaction. When these forces are cancelled, the locking device tends to return to its initial configuration.

[0039] For convenience, the locking device 16 is advantageously designed to cooperate with a tool to facilitate its removal. As can be seen, in the engaging portion 56 the arm ends are close together and are configured such that the inner surfaces 44 define an inwardly tapering gap 60 (i.e. from the free ends towards the bridge 42). This gap 60 can be engaged by a tool having a wedge-shaped extremity, such as a flat-blade screwdriver 62, see Fig.6. A chamfer is preferably provided at the inlet of the gap 60 at the top end of the arms 38 to facilitate entry of the screwdriver blade. Pushing down the screwdriver tip will spread apart the arms 38, causing the arm sections in the locking portion 50 to move together and disengage from the locked position, as explained before. The intrinsic elasticity of the locking device 16 also causes the locking device 16 to clamp on the screwdriver. Removal of the locking device 16 is thus achieved by engaging the tool/screwdriver 62 into the gap 60, moving downward to cause disengagement of the hooks 52 and grip onto the screwdriver, and moving the screwdriver 62 upward to extract the locking device 16. The locking device 16 being removed, the relay 12 can be pulled out of the cavity 24.

[0040] Some advantageous details of design remain to be noted.

[0041] A guiding rib 64 protrudes from the outer face 46 of each arm 38. These ribs 64 engage into lateral grooves 65 extending in the inlet section 34 of the cavity 34, as can be seen in Figs. 2 and 4. For centering purposes, the lateral grooves 66 are inclinded to form a downwardly tapering inlet section 34. The inner end of the inlet section 34, at the transition with the locking section 36, has a width dimensioned to allow the passage of the locking portion 50 of the locking device 16. But the distance between the outer edges of the two ribs 64 is larger than the opening at the bottom of the inlet section 34, so that if the locking device 16 is inserted too deep into the cavity 32, it will be blocked by the ribs 64 coming into abutment with the narrow end of the inlet section 34.

[0042] As noticeable in Fig. 3, above and below the bridge 42, the inner surfaces 44 of the arms 38 are shaped to include recesses 66. These recesses 66 result from material reduction provided to improve the bending properties of the bridge 42 and the robustness of the locking device 16 at the junctions between the bridge 42 and the arms 38.

[0043] The locking section 36 of the cavity 32 is laterally delimited by a pair of walls 68. The two retention teeth 54 are arranged at same height and protrude inwardly from these walls 68. Each retention tooth 54 has an generally triangular shape with an oblique sliding face 69 and a bottom abutment face 70 that is substantially perpendicular to the lateral wall 68, i.e. horizontal, as best seen in Fig. 5.

[0044] The hooks 52 are also of generally triangular shape and extend from the outer face 46 of the arms 38. Each hook 52 comprises an oblique sliding face 72 and an upper locking face 74 configured to engage with the abutment face 70 of the locking tooth 54. As will be understood, when the locking device 16 is being installed, the hooks 52 slide over the teeth 54 until the desired depth is reached.

[0045] In the locked position the corresponding faces 70 and 74 of hook 52 and tooth 54 are in abutment. To facilitate the removal of the locking device 16, the locking face 74 of the hook 52 and the abutment face 70 of the tooth 54 are preferably tangent to each other. Also, it is preferred that the abutment face 70 of the retention tooth 54 has a negative angle α with respect to the perpendicular to main axis A. This angle α may be defined between 0.5° and 3°, in particular about 1°.

Claims

1. A component assembly comprising:

a structure (14) defining a receiving cavity (24) for a component (12), said structure (14) including a locking cavity (32) for a locking device (16);
the locking device (16) having a pair of elongate arms (38) extending along a main axis (A) and arranged in facing relationship, and an elastically deformable bridge (42) connecting said arms (38);
wherein said bridge (42) divides said locking device (16) into:

a locking portion (50), on one side of said bridge (42), in which the arms (38) are configured to positively engage with respective locking elements (54) in the locking cavity (32), thereby defining a locked position, and an engaging portion (56), on the opposite side of said bridge (42), in which the arms (38) are provided with means (58) adapted to engage with the component (12) to maintain the latter in its receiving cavity (24), when said locking device (16) is in said locked position.

2. The component assembly according to claim 1, wherein said bridge (42) is designed to give some flexibility such that the arms (38) of the locking device (16) can be selectively displaced from an initial configuration, in order to move the arm portions of the locking portion (50) for the purpose of engagement with, or disengagement from, the locking elements (54) in the locking cavity (32).

3. The component assembly according to claim 1 or 2, wherein in said engaging portion (56), said arms (38) are provided with tabs (58) protruding at an angle from said main axis (A).

4. The component assembly according to claim 3, wherein said tabs (56) extend from lateral faces (48) of said arms (38), namely out of a bending plane of said locking device.

5. The component assembly according to any one of the preceding claims, wherein the arm portions in the locking portion (50) are each provided on their outer face (46) with at least one hook (52) that cooperates with the respective locking element (54) in the locking cavity (32).

6. The component assembly according to claim 5, wherein a plurality of hooks (52) are arranged on the arms (38) along the main axis to define a plurality of locked positions at increasing depths.

7. The component assembly according to any one of the preceding claims, wherein the locking device (16) is configured such that:

   in said locked position, the arm portions in the locking portion (50) are spaced from one another; and
   said bridge (42) is configured such that spreading apart the arms sections in the engaging portion (56) causes a reduction of spacing between the arm sections of the locking portion (50), to permit disengagement from the locked position.

8. The component assembly according to claim 7, wherein the facing arm portions in the locking portion (50) are configured to define a tapering gap (60) from the free ends of the arms (38) towards the bridge (42), so that said gap (60) can be engaged by a tool to spread apart the arms (38).

9. The component assembly according any one of the preceding claims, wherein the arm portions on both sides of said bridge (42) have free ends.

10. The component assembly according to any one of the preceding claims, wherein said locking cavity (32) includes an inlet section (34) and a locking section (36), in which the locking elements (54) are arranged.

11. The component assembly according to claim 10, wherein said inlet section (34) has width tapering towards the locking section (36).

12. The component assembly according to claim 10 or 11, wherein each arm (38) comprises a rib (64) protruding from its outer face (46), which engages in a lateral guide groove (65) in the inlet section (34).

13. The component assembly according to any one of the preceding claims, wherein said locking elements take the form of inwardly protruding teeth (54).

14. The component assembly according to any one of the preceding claims, wherein said component (12) is an electronic relay and said structure (14) is a socket for such relay.

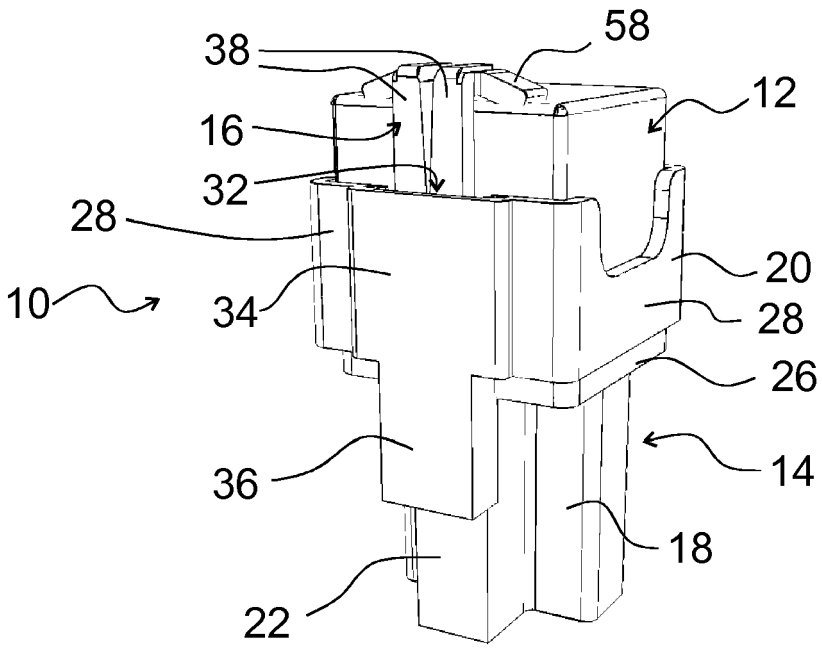
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Fig. 1

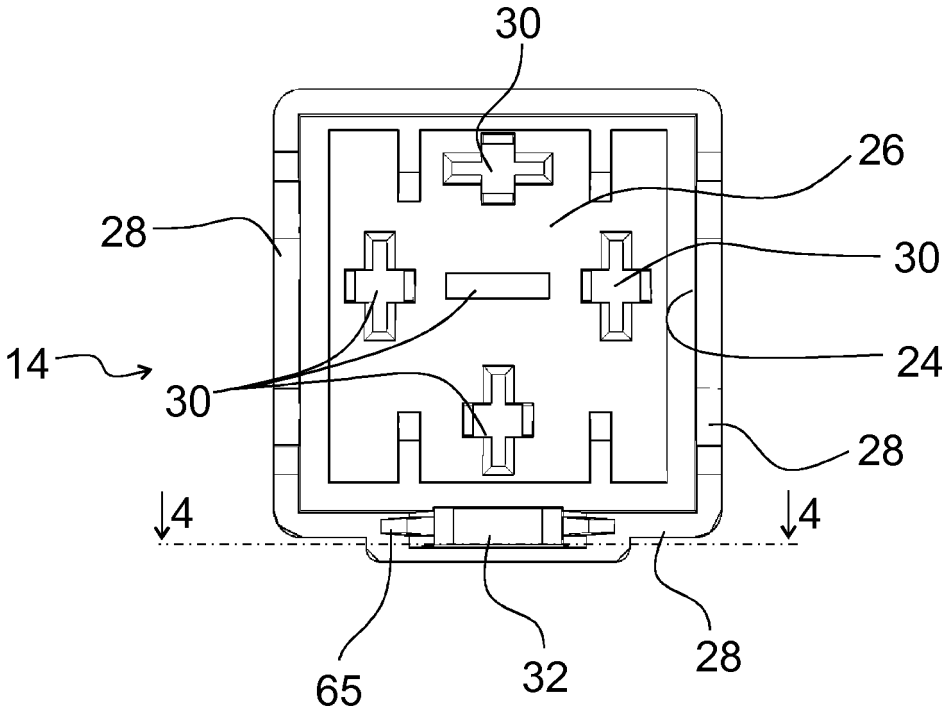
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Fig. 2

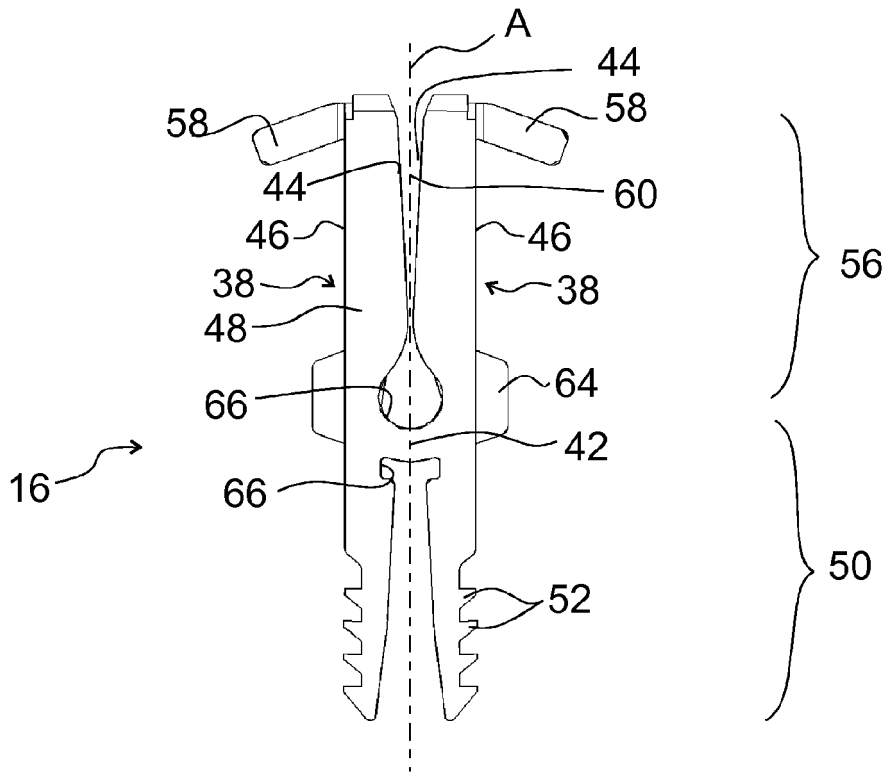
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Fig. 3

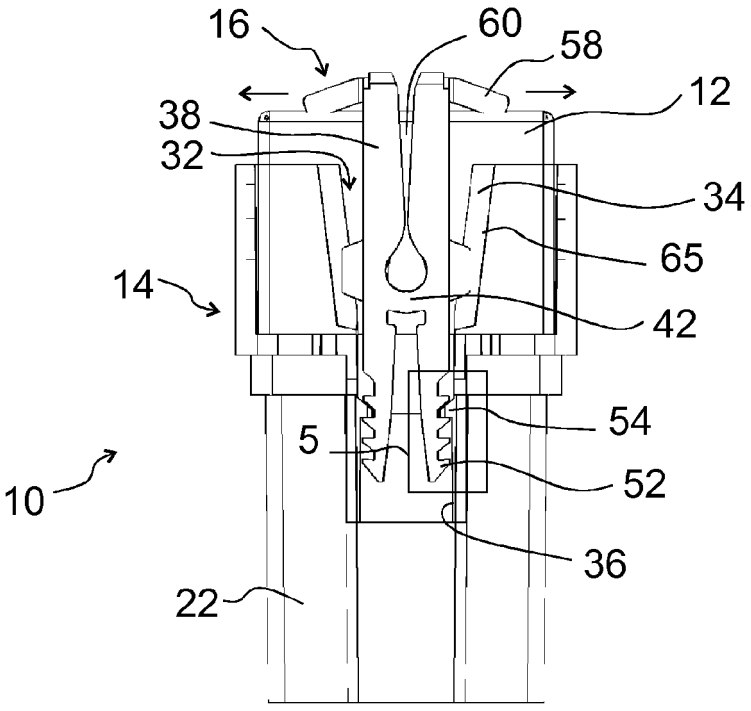
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Fig. 4

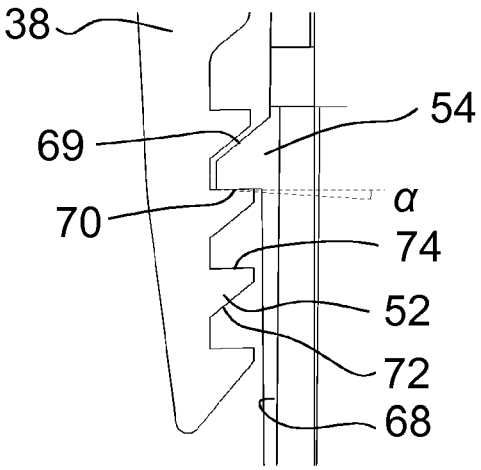

Fig. 5

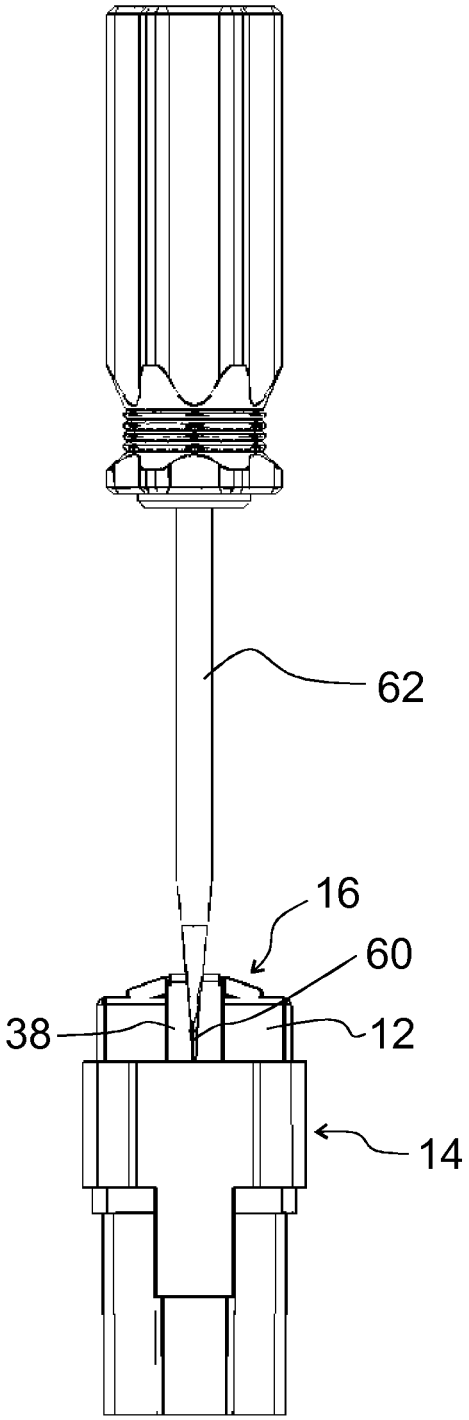

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 18 20 9595

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 199 06 446 A1 (DELPHI TECH INC [US]) 17 August 2000 (2000-08-17)	1-3,7-14	INV. H01H50/04
Y	* paragraphs [0014] - [0039]; figure 1a *	4,6	H01R13/627
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TECHNICAL FIELDS SEARCHED (IPC)

H01H
H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	28 May 2019	Arenz, Rainer

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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