

5 Elbe Flugzeugwerke GmbH
Az. 315.0001DE

Munich, January 18, 2019

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Elbe Flugzeugwerke GmbH
Grenzstr. 1, 01109 Dresden

Arranging a composite element at a component

15 FIELD OF INVENTION

The present invention relates to a method for arranging at least one composite element at a component and a use of an engagement apparatus for arranging the composite element at a component.

20 BACKGROUND OF THE INVENTION

Components, for example panels with supporting core, are provided with an insert for the purpose of fixating. Assembling of such often two-part inserts at a component is usually performed by use of a hammer or a stationary press. When such a component is to be installed in an airplane, for example, such an installation of inserts at the component is
25 difficult or not at all possible.

Additionally, when using this method in case that the components are panels with supporting core, assembling of such an insert can damage the panel with supporting core easily. Two-part inserts which are used today in the area of floor panels in airplanes, for example, must often be joined with a hammer or under the stationary press during assembly.

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SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved method which enables joining of one or more inserts at a component efficiently, safely and fast.

This object is achieved buy a method for arranging at least one composite
35 element at a component and use of an engagement apparatus and least one composite element for arranging the at least one composite element at a component according to one of the

independent claims. It should be noted that the following described aspects for the method also apply for the use of the engagement apparatus.

According to the invention a method for arranging at least one composite element at a component is provided, which comprises at least a sleeve element and at least an insert element. The method comprises the following steps: arranging the sleeve element in a bore of the component; connecting the sleeve element with the insert element, so that at least one composite element is formed; inserting an engagement apparatus in the at least one composite element, wherein the engagement apparatus aligns and/or assembles the sleeve element and the insert element to each other.

The composite element can be a two-part insert, particularly for joining of components in the aerospace industry and comprises a sleeve element and an insert element. The sleeve element is arranged in the bore of the component, for example in a floor panel in an aircraft (usually formed as panel with supporting core / sandwich panel). The sleeve element can comprise the bore completely or partially.

The sleeve element is connected with the insert element, so that a composite element is formed. Thereby the insert element is placed or arranged in the sleeve element. Such a connection can be loose at first, so that the insert element can be removed from the sleeve element.

Next, an engagement apparatus is inserted in the at least one composite element. The engagement apparatus is configured to align and/or assemble the sleeve element and the insert element to each other. For example, the engagement apparatus is aligning the sleeve element and the insert element in such a way, that the insert element and the sleeve element are substantially aligned parallel to the borehole wall.

An engagement apparatus can be, for example, a Cleco Type Fastener or a fastener (a connection element for connection of components via bores, whose preloaded force is either obtained by a spring-load or via a nut and threaded pin).

The final composite element, for its part, can then be used for fixating of the component or for other purposes.

According to the invention, a simple and efficient method for arranging at least one composite element at a component can be provided. Possible damages of sandwich panels by setting composite elements as in the prior art are almost eliminated with the inventive method. Furthermore, the method is equally reproducible for each composite element, so that various composite elements, which are arranged at one component, are substantially identical.

According to an example, the engagement apparatus introduces a preload in the composite element. By transferring the preloaded force to the composite element its insert element is connected with the sleeve element. The preloaded force can be predetermined for all engagement apparatuses.

5 According to an example, before the sleeve element or the insert element is arranged, an adhesive can be applied in the bore and/or on the sleeve element and/or the insert element. The adhesive is, for example, high-strength epoxy adhesive. The adhesive can be applied or introduced as adhesive layer. The adhesive prevents an early fall out of the composite element, for example before the engagement apparatus is inserted into the
10 composite element. Furthermore, the adhesive prevents intrusion of fluids, such as water or cleaning agent, contamination etc. which might damage the component from within.

According to an example, the engagement apparatus provides a self-locking mechanism or a screw-on mechanism. Such mechanism ensures that the engagement apparatus remains in the composite element.

15 According to an example, the engagement apparatus is inserted in the sleeve element or in the insert element. For most components, the engagement apparatus is inserted in the insert element, wherein the insert element was arranged before in the sleeve element, which on its part was arranged in a bore of the component. It is however also possible to arrange the insert element first in the bore, to insert the engagement apparatus in the insert
20 element and only afterwards arrange the sleeve element in the bore and connect it with the insert element. The engagement apparatus can be inserted in the sleeve element, this is the case for a two-part engagement apparatus, for example, where one part of the engagement apparatus is formed as counter bearing, when the sleeve element and/or the insert element only partially fills the bore along its length. In other words, for thick components having a
25 thickness larger than the length of the sleeve element or insert element, a two-part engagement apparatus can be employed.

According to an example, the sleeve element is arranged at one side of the bore and the insert element is arranged on the opposite side of the bore.

30 According to an example, the sleeve element and/or the insert element provides a flange. By the flange arrangement and retainment of the sleeve element or the insert element in the bore of the component is ensured. In some examples, also the flange of the sleeve element and/or insert element is provided with an adhesive or an adhesive layer. In some examples, the flange of the sleeve element and/or insert element can be free of adhesive.

According to an example, the engagement apparatus is provided as guiding apparatus for the at least one composite element. In some embodiments the engagement apparatus can guide the sleeve element or the insert element in the bore. This can comprise an insertion as well as an alignment of the sleeve element or the insert element.

5 According to an example, the engagement apparatus provides a spring force. This can be a spring / spring system, for example. The spring force can be provided mechanically or by fluids or gases or in a mixed operating principle. The spring force can be defined or undefined. For some engagement apparatuses having a preloaded spring the spring force can be specified very closely and, for example, be adjusted to the requirements of the
10 component (soft, hard). Thereby, the arrangement of one or more composite elements is a very reproducible process. The same applies for any kind of spring force of the engagement apparatus.

 According to the invention, also a use of an engagement apparatus and at least one composite element for arranging the at least one composite element at a component is
15 provided, wherein the at least one composite element comprises a sleeve element and an insert element, and the engagement apparatus aligns and/or assembles the sleeve element and the insert element to each other.

 The use of the engagement apparatus, for example Cleco or fasteners, for joining of composite elements, for example of two-part inserts for panels with supporting core
20 (e.g. floor panels), ensuring an efficient and particularly secure arrangement of the composite elements. No special tooling is required because particularly in aerospace industry engagement apparatuses are usually available in any aerospace maintenance organisation worldwide. Damaging of the sandwich panels is excluded by this inventive use method.

 It should be noted, that the features of the embodiments of the system as well
25 as the embodiments of a cabin segment as well as the vehicle apply vice versa. Furthermore, also those features can be freely combined with each other for which this is not stated explicitly.

 These and further aspects of the invention will be evident with reference to the following description.

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BRIEF DESCRIPTION OF THE DRAWINGS

 Exemplary embodiments of the invention will be described in more detail in the following with reference to the drawings. It is shown:

- Fig. 1 a composite element according to the inventive method;
- Fig. 2 a composite element arranged at a component;
- Fig. 3 two exemplary engagement apparatuses;
- Fig. 4 one of the engagement apparatuses of Fig. 3 with a composite element;
- 5 Fig. 5 one further of the engagement apparatuses of Fig. 3 with a composite element;
- Fig. 6 an engagement apparatus during insertion in a composite element;
- Fig. 7 an inserted engagement apparatus; and
- Fig. 8 the inserted engagement apparatus of Fig. 7.

10 DETAILED DESCRIPTION OF THE EMBODIMENTS

Fig. 1 shows a composite element 2 according to the inventive method. The composite element 1 is shown in a perspective view (A) in an assembled state: the sleeve element 4 is connected with the insert element 6.

The sleeve element 4 has small bores 3 serving for insertion of adhesive
 15 between the outer wall of the sleeve element 4 and a surrounding supporting core of a component 18 as well as its upper and lower top layers (see Figure 2).

Views (B1), (B2) show the sleeve element 4 in a perspective view. View (B1) shows a flange 8 and a sleeve opening 10 of the sleeve element 4. View (B2) shows a perspective top view of the sleeve element 4. The flange 8 and the sleeve opening 10 are
 20 shown. The tubular formed sleeve 12 is formed to receive the insert element 6.

Views (C1), (C2) show the insert element 6 in a perspective view. View (C1) shows the flange 8 and an outer opening 14 of the insert element 6. View (C2) shows a perspective top view of the insert element 6. The flange 8 and the outer opening 14 are shown. The insert element 6 has an insert head 16 which connects with the tubular formed
 25 sleeve 12 of the sleeve element 4 and thus forms the composite element 2.

The composite element 2 in this example is made of titanium. It is also possible to use composite elements 2 of other materials (e.g. aluminum, steel, plastic).

The shown composite element 2 is only exemplary. Further designs are possible.

30 Fig. 2 shows a composite element 2 arranged at a component 18. The composite element 2 has the sleeve element 4 and the insert element 6. The insert element 6 is connected with the sleeve element 4. The component 18 has a supporting core (hatched) and an upper and a lower top layer.

The component 18 has a bore 20. In this embodiment an adhesive 22 has been applied on the sleeve element 4, its flange 8, the insert element 6 and its flange 8. The adhesive 22 secures the composite element 2 against premature falling out of the bore 20. The adhesive 22 has a protective function against intrusion of water, cleaning agent or contamination in the component.

The adhesive 22 can be introduced via the small bores 3 of the sleeve element 4 (see Figure 1) between the outer wall of the sleeve element 4 and the enclosing supporting core of the component 18 as well as its upper and lower top layer.

Fig. 3 shows two exemplary engagement apparatuses 24, 25. The engagement apparatus 24 has a self-locking mechanism. The engagement apparatus 25 has a screw-on mechanism. The engagement apparatus 24, 25 each has a preloaded force. It is spring-loaded as in engagement apparatus 24 or is obtained via a nut 23 and a threaded pin 27, as in engagement apparatus 25.

Fig. 4 shows the engagement apparatuses 25 of Fig. 3 inserted in the composite element 2. The engagement apparatus 25 extends through the sleeve element 4 of the composite element 2. By the nut 23 and the threaded pin 27 the preloaded force of engagement apparatus 25 is transferred to the composite element 2. The composite element 2 is aligned and assembled in a not shown bore of a component.

Due to inserting the engagement apparatus 25 in the composite element 2, the composite element is provided with sufficient assembly stability (see also the following Figures). The direction from which the engagement apparatus 25 is inserted can be neglected.

Fig. 5 shows the further engagement apparatuses 24 of Fig. 3 with the composite element 2. This engagement apparatus 24 is held with an engagement tool 26 and is inserted into the insert element 6 of the composite element 2. Also, by inserting this engagement apparatus 24 in composite element 2, the latter is provided with sufficient assembly stability (see also the following Figures). The direction from which the engagement apparatus 24 is inserted in composite element 2 can be neglected thereby.

Fig. 6 shows an engagement apparatus 24 during insertion in the composite element 2. The engagement apparatus 24 is inserted in the sleeve element 4 of the composite element 2. The engagement apparatus 24 has a preloaded force which is introduced into the insert element 6, when the engagement apparatus 24 is inserted.

The composite element 2 is aligned and assembled in a bore of the component 18. Via the small bores 3 adhesive can be introduced between the outer wall of the sleeve element 4 and the enclosing supporting core of component 18 (see also Figure 2).

Fig. 7 shows the inserted engagement apparatus 24 in a composite element 2 which is arranged in a component 18.

In a top view the insert element 6 is shown arranged in component 18. In this embodiment the engagement apparatus 24 is shown inserted in the sleeve element 4 and
5 extends through the insert element 6.

Fig. 8 shows in a top view the engagement apparatus 24 of Fig. 7, as it is inserted into the sleeve element 4.

The above described embodiments can be combined in different manner. In particular aspects of the method can be used for embodiments of the apparatuses as well as
10 use of the apparatuses and vice versa.

In addition, it is indicated, that “comprising” does not exclude other elements or steps and “one” or “a” does not exclude a plurality. Further it is indicated, that the features or steps, which are described in relation to one of the above embodiments, can also be used in combination with other features or steps of other above described embodiments. Reference
15 signs in the claims are not to be construed as limitations.

CLAIMS:

- 5 1. A method for arranging at least one composite element at a component, wherein the at least one composite element comprises at least a sleeve element and at least an insert element, wherein the method comprises the following steps:
 - a) arranging the sleeve element in a bore of the component;
 - b) connecting the sleeve element and the insert element, so that at least one
 10 composite element is formed;
 - c) inserting an engagement apparatus in the at least one composite element, wherein the engagement apparatus aligns and/or assembles the sleeve element and the insert element to each other.
- 15 2. Method according to claim 1, wherein the engagement apparatus introduces a preload into the composite element.
3. Method according to one of the claims 1 to 2, wherein an adhesive is applied in the bore and/or on the sleeve element and/or the insert element before arranging the sleeve
 20 element or the insert element.
4. Method according to claims 1 to 3, wherein the engagement apparatus provides a self-locking mechanism or a screw-on mechanism.
- 25 5. Method according to claims 1 to 4, wherein the engagement apparatus is inserted in the sleeve element or in the insert element.
6. Method according to claims 1 to 5, wherein the sleeve element is arranged at one side of the bore and the insert element is arranged on the opposite side of the bore.
- 30 7. Method according to claims 1 to 6, wherein the sleeve element and/or the insert element provides a flange.

8. Method according to claims 1 to 6, wherein the engagement apparatus is provided as guiding apparatus for the at least one composite element.
9. Method according to claims 1 to 8, wherein the engagement apparatus
5 provides a spring force.
10. A use of an engagement apparatus and at least one composite element for arranging the at least one composite element at a component, wherein the at least one composite element comprises a sleeve element and an insert element, and the engagement
10 apparatus aligns and/or assembles the sleeve element and the insert element to each other.