Method and system for helping to position a piece on a structural element

The invention relates to a method and to a system for helping to position a piece on an element of a structure.

During the production of a structure, for example a surface ship or a submersible, after making or laying the main elements of the structure, such as the hull or the main subdivisions of the latter, a phase occurs for implanting various secondary pieces on the elements of the structure. The secondary pieces are for example ties, beds, structural parts or further pieces awaiting to be equipped, such as electrical pieces of equipment or equivalent. For a medium tonnage ship, such as a frigate, the matter is thus to position and attach about 50,000 pieces.

Presently, on the building site, an operator positions a piece on a structural element by means of a paper blueprint made in a design department, and then printed out. The dimensions indicated on this blueprint should be taken relatively to a local reference system of the structure also indicated on the blueprint. For each piece to be positioned, the operator should then identify, in position and in orientation, the local reference system. The operator then has to copy out, on the wall of the structural element, the dimensions indicating the suitable position and orientation with respect to the local reference system, of the surface of the piece, or base, bearing upon the structural element.

This conventional positioning method requires a substantial amount of time, not only for preparing the blueprints, but especially for using them on the site. Further, this method has the drawback of resorting to a local reference system. Further, under the particularly difficult conditions of a building site (congestion, shadowy light, etc.), the reading of the blueprints and the taking of measurements often carried out by hand are sources of errors on the exact positioning of the piece.

In order to optimize the positioning of the piece on the structural element prior to its attachment, the use of positioning aid systems was proposed, allowing the outline of the base imprint of the piece to be projected on the wall of the structural element used as a screen. The projection is made so that it accurately plots, in position and in orientation, the area for implanting the piece. Such a system, used in the building of aircraft, is disclosed by document WO2005/025199 A2.

The secondary pieces to be attached on the wall of a structural element of a ship are often ties for supporting a piece of equipment, the latter not being directly attached against the wall of the structural element. The tie is thus provided with connecting means intended to cooperate with conjugate connecting means provided on the piece of equipment to be supported.

CLAIMS

1.- A method for helping to position a piece (30) on a wall (23) of an element of a structure, characterized in that it includes the steps:

- elaborating an image intended to be projected on the wall of the structural element by means of a projector (10) from a virtual model of the structure and from the position and the orientation of the projector with respect to the structure, said image including a outline (26A) delimiting an area for implanting the piece on the wall of the element of the structure, the wall of the element of the structure being used as a projection substrate for said outline, and at least one additional motif providing positioning information of the piece with respect to a direction (n) normal to the wall of the element of the structure, said additional motif corresponding to a predefined set of points of the piece, said piece being used as a projection substrate for said or each additional motif;

- projecting the thereby elaborated image on the element of the structure;

- placing a surface of the piece which should come and face the wall, inside the outline projected on the element of the structure; and

- while keeping contact between the piece and the element, modifying the positioning of the piece with respect to the direction normal to the wall of the element, until said predefined set of points of the piece coincides with said additional motif.

2.- The method according to claim 1, characterized in that said additional motif is a line segment (26B) limited by a first end (26C) located inside said outline and a second end (26D) located away from said outline.

3.- The method according to claim 2, characterized in that it further consists of having the second end of the line segment and a predefined point of said set of points of the piece coincide.

4.-The method according to any of claims 2 to 3, characterized in that said line segment (26B) corresponds to a generatrix or an edge of said piece (30).

5.- A system for helping to position a piece (30) on the wall (23) of an element of a structure, characterized in that it comprises:

- a projector (10);

- a localization means able to determine the position of the projector with respect to the structure;

- a computer (8) connected to the localization means and to the projector and including:

- a module for controlling the projector,

- a database (20) including a detailed description of the constitutive objects of the structure,

- a module for elaborating a virtual model of all or piece of the structure, and

- a perspective module capable, from the position of the projector with respect to the structure and from the virtual model, of generating an image (26) intended to be projected on the wall (23) of the element of the structure by means of the projector, said image including a outline (26A) delimiting an area for implanting a piece on the wall of the element of the structure, the wall of the element being used as a projection substrate for said outline, and at least one additional motif providing positioning information of the piece with respect to a direction (n) normal to the wall of the element of the structure, said additional motif corresponding to a predefined set of points of the piece, said piece being used as a projection substrate for said or additional motif.

6. The system according to claim 5, characterized in that said localization means includes:

- a test pattern (4) located in a predefined position and with a predefined orientation with respect to the structure (1);

- a camera (6), the positioning of which, with respect to the projector (10), is known and which is able to acquire at least one image of the test pattern; and

- an image processing module, executed by the computer (8) to which the camera is connected, and able to determine, from the image of the test pattern, the position of the camera with respect to the structure and therefore the position of the projector relative to the structure.

Method and system for helping to position a component on a structural element

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During the production of a structure, for example a surface ship or a submersible, after making or laying the main elements of the structure, such as the hull or the main subdivisions of the latter, a phase occurs for implanting various secondary pieces on the elements of the structure. The secondary pieces are for example ties, beds, structural parts or further pieces awaiting to be equipped, such as electrical pieces of equipment or equivalent. For a medium tonnage ship, such as a frigate, the matter is thus to position and attach about 50,000 pieces.

Presently, on the building site, an operator positions a piece on a structural element by means of a paper blueprint made in a design department, and then printed out. The dimensions indicated on this blueprint should be taken relatively to a local reference system of the structure also indicated on the blueprint. For each piece to be positioned, the operator should then identify, in position and in orientation, the local reference system. The operator then has to copy out, on the wall of the structural element, the dimensions indicating the suitable position and orientation with respect to the local reference system, of the surface of the piece, or base, bearing upon the structural element.

This conventional positioning method requires a substantial amount of time, not only for preparing the blueprints, but especially for using them on the site. Further, this method has the drawback of resorting to a local reference system. Further, under the particularly difficult conditions of a building site (congestion, shadowy light, etc.), the reading of the blueprints and the taking of measurements often carried out by hand are sources of errors on the exact positioning of the piece.

In order to optimize the positioning of the piece on the structural element prior to its attachment, the use of positioning aid systems was proposed, allowing the outline of the base imprint of the piece to be projected on the wall of the structural element used as a screen. The projection is made so that it accurately plots, in position and in orientation, the area for implanting the piece. Such a system, used in the building of aircraft, is disclosed by document WO2005/025199 A2.

The secondary pieces to be attached on the wall of a structural element of a ship are often ties for supporting a piece of equipment, the latter not being directly attached against the wall of the structural element. The tie is thus provided with connecting means intended to cooperate with conjugate connecting means provided on the piece of equipment to be supported.

What is claimed is:

1. A method for helping to position a piece on a wall of an element of a structure, the method comprising the following steps:

elaborating an image intended to be projected on the wall of the structural element using a projector from a virtual model of the structure and from a position and an orientation of the projector with respect to the structure, the image including an outline delimiting an area for implanting the piece on the wall of the element of the structure, the wall of the element of the structure being used as a projection substrate for said outline, and at least one additional motif providing positioning information of the piece with respect to a direction normal to the wall of the element of the structure, said additional motif corresponding to a predefined set of points of the piece, said piece being used as a projection substrate for the at least one additional motif;

projecting the elaborated image on the element of the structure; placing a surface of the piece which should come and face the wall, inside the outline projected on the element of the structure; and

while keeping contact between the piece and the element, modifying the positioning of the piece with respect to the direction normal to the wall of the element, until said predefined set of points of the piece coincides with said additional motif.

2. The method as recited in claim 1 wherein said additional motif is a line segment limited by a first end located inside said outline and a second end located away from said outline.

3. The method as recited in claim 2 wherein the second end of the line segment and a predefined point of said set of points of the piece coincide.

4. The method as recited in claim 2 wherein the line segment corresponds to a generatrix or an edge of said piece.

5. A system for helping to position a piece on the wall of an element of a structure, the system comprising: a projector; a localizer able to determine a position of the projector with respect to the structure;

a computer connected to the localizer and to the projector and including:

a module for controlling the projector,

a database including a detailed description of constitutive objects of the structure,

a module for elaborating a virtual model of all or piece of the structure, and

a perspective module capable, from the position of the projector with respect to the structure and from the virtual model, of generating an image intended to be projected on the wall of the element of the structure using the projector, said image including a outline delimiting an area for implanting a piece on the wall of the element of the structure, the wall of the element being used as a projection substrate for said outline, and at least one additional motif providing positioning information of the piece with respect to a direction normal to the wall of the element of the structure, said additional motif corresponding to a predefined set of points of the piece, said piece being used as a projection substrate for the at least one additional motif.

6. The system as recited in claim 5 wherein the localizer includes:

a test pattern located in a predefined position and with a predefined orientation with respect to the structure;

a camera, a positioning of the camera, with respect to the projector, being known and the camera able to acquire at least one image of the test pattern; and

an image processing module, executed by the computer, the camera being connected to the computer, and the image processing module able to determine, from the image of the test pattern, the position of the camera with respect to the structure and therefore the position of the projector relative to the structure.