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(54) **METHOD AND EPOXY RESIN FOR REPAIRING A DAMAGED WOODEN CONSTRUCTION**

(57) In a method for repairing a damaged wooden structure 21, in particular a partially submerged mooring post 23, a floating structure 1 is placed in the water and then a work platform 3 is hung on the floating structure 1. Thereafter a professional stands on the work platform 3 to remove the affected wood. Then a formwork is placed around the part of the pile where the affected part 25 has been removed. This formwork is equipped with a casting nozzle at the top. After filling the space in the formwork with epoxy resin through the casting nozzle, the formwork is removed and the repaired part can be finished.

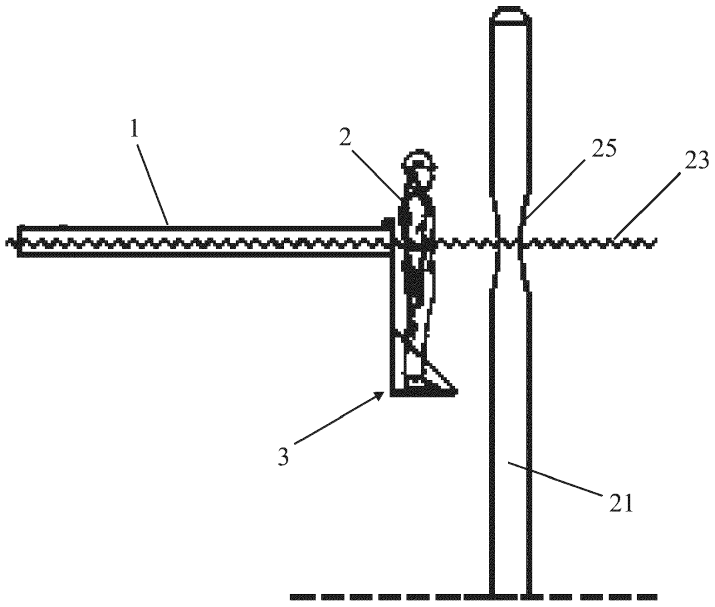

FIG. 1

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Description

Technical field of the invention

[0001] The invention relates to a method for repairing a damaged wooden structure, in particular a partially submerged mooring post.

Background of the invention

[0002] Degradation of wooden structures partly present in the water, such as mooring posts and jetty posts, lock gates, wooden bridges and the like, usually occurs just above the water surface. If the wooden structure is weakened too much by the attack, it must be replaced, which is laborious.

[0003] A method for repairing a damaged mooring post that is partially submerged is known from EP 2199498A. A vertically divided container, open at the top, is placed around the wooden structure, partly below the water level, whereby the parts of the container are connected to each other and to the wooden construction in a watertight manner. The water is then pumped out of the container and the affected part of the wooden structure is then removed. The resulting cavity in the wooden construction is then filled with an epoxy mortar. This means that the wooden construction does not have to be replaced, saving a lot of labor time and therefore money. However, this work must be done in a water-free environment. The waterproof container is used for this, which allows you to work below or just above the water surface.

Summary of the invention

[0004] An aim of the invention is to provide a method for repairing a damaged, partly submerged wooden structure, with which a partly submerged wooden structure can be repaired more quickly and therefore cheaper than with the known method. To this end, the method according to the invention is characterized in that:

- a floating structure is brought onto the water,
- an underwater work platform is hung on the floating structure,
- a professional stands on the work platform and removes the affected part of the wooden construction,
- a formwork is placed around the part of the wooden construction where the affected part has been removed, which formwork is provided with a casting nozzle at the top,
- filling the formwork with epoxy resin via the casting nozzle,
- removing the formwork, and
- finishing the repaired part.

[0005] It has been found that a suitable epoxy resin can be used in water, so it is not necessary to first create a dry environment around the part to be repaired, but can be worked directly in the water. As a result, less time is required for repairs with the method according to the invention than with the known method.

[0006] An embodiment of the method according to the invention is characterized in that before the formwork is applied, vertical glass fiber reinforcing bars are placed in the removed part, whereby the reinforcing bars are placed with their ends in slots made in the unaffected part of the wooden construction adjacent to the removed part of the pile. This further strengthens the wooden structure at the affected part. This is particularly beneficial if a large part has been damaged and the wooden structure is subjected to relatively heavy loads during operation to provide extra strength.

[0007] Preferably, a two-component epoxy resin is used as epoxy resin, of which:

- a first component is composed of 60-100% reaction product Bisphenol A-epichlorohydrin epoxy resin and 15-30% oxirane, mono(C12-14-alkoxy)methyl derivatives, and
- the second component is composed of 10-25% benzyl alcohol, 10-25% 1,3-Benzoldimethanamine, 10-25% 4-tert-butylphenol, 2.5-10% 3-aminomethyl-3,5,5-trimethylcyclohexylamine, 2.5 -10% trimethylhexane-1,6-diamine, 2.5-10% 4,4-isopropylidene diphenol.

[0008] This is a suitable epoxy resin that can be applied to the wooden structure in water so that it is not necessary to first create a dry environment around the affected part of the wooden structure.

[0009] The invention also relates to a more general method for repairing a damaged wooden structure. With regard to this more general method, the invention is characterized in that the affected part of the wooden structure is removed and the resulting cavity in the wooden structure is filled with the above-mentioned epoxy resin without first creating a dry environment around the affected part of the wooden structure.

[0010] The invention also relates to the above-mentioned epoxy resin for repairing a damaged wooden structure of a partially submerged wooden structure.

Brief description of the drawings

[0011] The invention will be explained in more detail below on the basis of an exemplary embodiment of the method according to the invention shown in the drawings. Hereby shows:

Figure 1 a professional on the work platform during repairing the affected wooden structure;
Figure 2 a side view of the work platform shown in figure 1;
Figure 3 a front view of the work platform shown in figure 1;
Figure 4 the wooden construction after removing the

affected part;
Figure 5 the wooden construction with formwork installed; and
Figure 6 the wooden construction with formwork fitted around it and fiberglass reinforcement rods fitted in it.

Detailed description of the drawings

[0012] Degradation of wooden structures partly present in the water, such as mooring posts and jetty posts, lock gates, wooden bridges and the like, usually occurs just above the water surface. Replacing part of the wooden construction with epoxy resin prevents replacement of the entire mooring post. Repairing the mooring post can be done in the water provided a suitable epoxy resin is used.

[0013] First of all, the affected part of the mooring post must be removed. To this end, a floating structure 1, for example a raft, is first placed on the water 23. A metal work platform 3 is then hung on this floating construction 1. To this end, the work platform 3 is provided with a suspension hook 3A. This work platform 3 is provided with a part 3B on which one can stand as well as a staircase 3C leading to it, see figures 2 and 3.

[0014] The professional 2 then stands on the work platform 3 and removes the affected part 25 of the wooden construction 21, for example using a hydraulic chainsaw. The affected part must be removed down to the unaffected part to ensure that no affected wood remains under the epoxy resin to be applied. In figure 4, the mooring post 21 is shown provided with a recess at the location of the part 21B of the mooring post where the affected part has been removed.

[0015] A formwork 5 is then placed around the part 21B of the pile 21B where the affected part has been removed, see figure 5. The formwork 5 is provided at the top with a casting nozzle 7 that extends over the entire circumference of the formwork. The space between the formwork 5 and the part 21B of the mooring post 21 where the affected part has been removed is filled with epoxy resin 9 via the casting nozzle 7.

[0016] As epoxy resin, preferably a two-component epoxy resin is used, of which a first component is composed of 60-100% reaction product Bisphenol A-epichlorohydrin epoxy resin and 15-30% oxirane, mono(C12-14-alkoxy)methyl derivatives, and the second component is composed of 10-25% benzyl alcohol, 10-25% 1,3-Benzoldimethanamine, 10-25% 4-tert-butylphenol, 2.5-10% 3-aminomethyl-3,5,5-trimethylcyclohexylamine, 2.5-10% trimethylhexane-1,6-diamine, 2.5-10% 4,4-isopropylidene diphenol.

[0017] Finally, the formwork 5 is removed and the repaired part is finished.

[0018] If the wooden structure 21 is severely damaged, meaning that a lot of damaged material had to be removed, the wooden structure can be strengthened by installing reinforcing bars 13, for example glass fiber rods, in the mooring post 21 after removing the affected part. This is shown in figure 6. The epoxy resin described above has the property that it adheres well to fiberglass rods. The reinforcing bars 13 are placed with their ends 15 in slots 29, which have previously been made in the unaffected part 27 of the wooden construction 21.

[0019] Although the present invention is elucidated above on the basis of the given drawings, it should be noted that this invention is not limited whatsoever to the embodiments shown in the drawings. The invention also extends to all embodiments deviating from the embodiments shown in the drawings within the scope of the invention defined by the appended claims.

Claims

1. Method for repairing a damaged wooden structure (21), in particular a partially submerged mooring post (23), **characterized in that** successively:

   - a floating structure (1) is placed on the water (23),
   - an underwater work platform (3) is hung on the floating structure (1),
   - a professional (25) stands on the work platform (3) and removes the affected part (25) of the wooden construction (21),
   - a formwork (5) is placed around the part (21B) of the wooden construction (21) where the affected part (25) has been removed, which formwork (5) is provided with a casting nozzle (7) at the top,
   - filling the formwork (5) with epoxy resin (9) via the casting nozzle (7),
   - removing the formwork (5), and
   - finishing the repaired part.

2. Method according to claim 1, **characterized in that** before the formwork (5) is applied, vertical glass fiber reinforcing bars (13) are placed in the removed part, whereby the reinforcing bars (13) are placed with their ends (15) in slots (29) made in the unaffected part (27) of the wooden construction (21) adjacent to the removed part of the pile.

3. Method according to claim 1 or 2, **characterized in that** a two-component epoxy resin is used as epoxy resin, of which:

   - a first component is composed of 60-100% reaction product Bisphenol A-epichlorohydrin epoxy resin and 15-30% oxirane, mono(C12-14-alkoxy)methyl derivatives, and
   - the second component is composed of 10-25% benzyl alcohol, 10-25% 1,3-Benzoldimethanamine, 10-25% 4-tert-butylphenol, 2.5-10% 3-aminomethyl-3,5,5-trimethylcyclohexylamine,

2.5 -10% trimethylhexane-1,6-diamine, 2.5-10% 4,4-isopropylidene diphenol.

4. Epoxy resin for repairing a damaged wooden structure, in particular a partially submerged mooring post, comprising a mixture of two components, **characterized in that**:

- a first component is composed of 60-100% reaction product Bisphenol A-epichlorohydrin epoxy resin and 15-30% oxirane, mono(C12-14-alkoxy)methyl derivatives, and
- the second component is composed of 10-25% benzyl alcohol, 10-25% 1,3-Benzoldimethanamine, 10-25% 4-tert-butylphenol, 2.5-10% 3-aminomethyl-3,5,5-trimethylcyclohexylamine, 2.5 -10% trimethylhexane-1,6-diamine, 2.5-10% 4,4-isopropylidene diphenol.

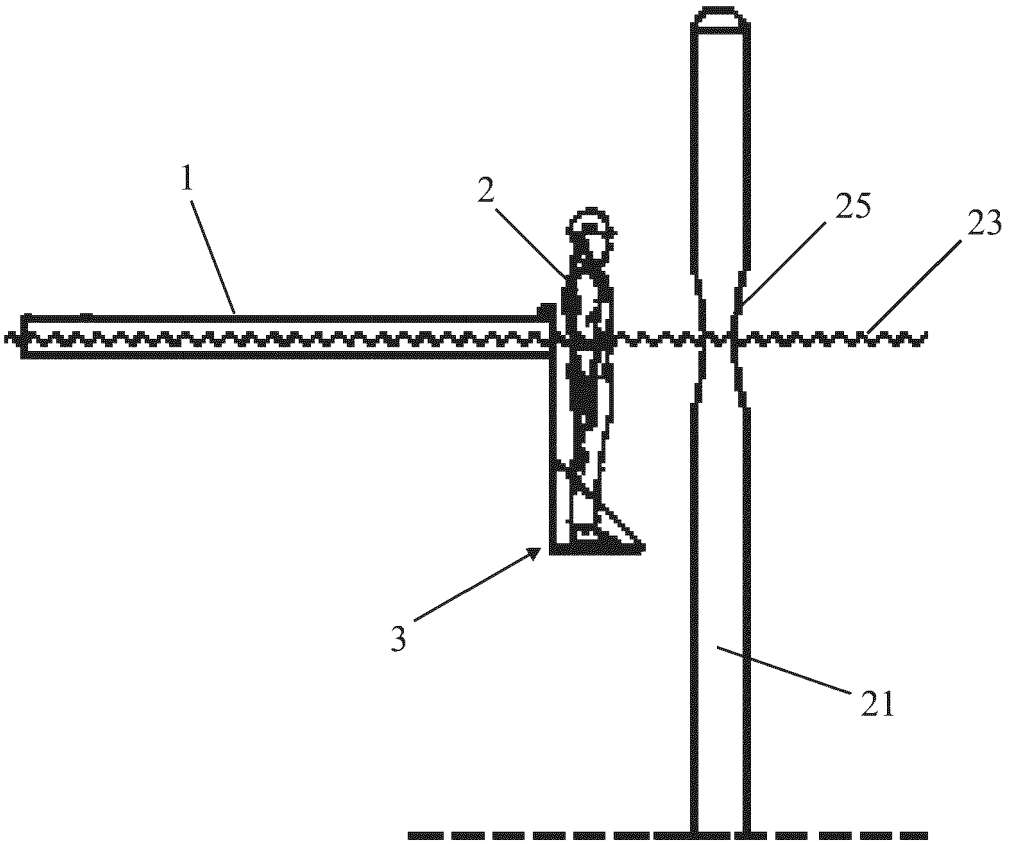

FIG. 1

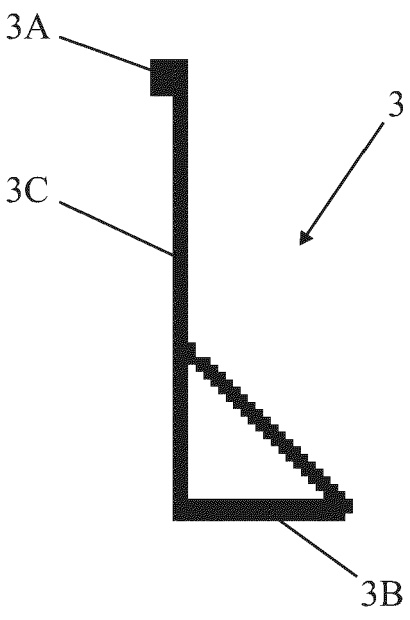

FIG. 2

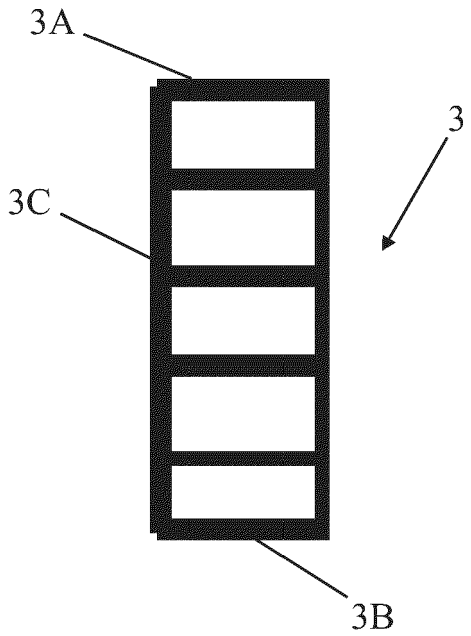

FIG. 3

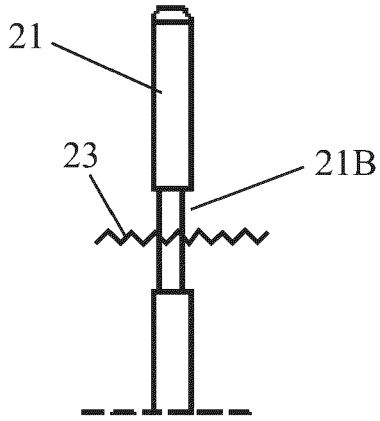

FIG. 4

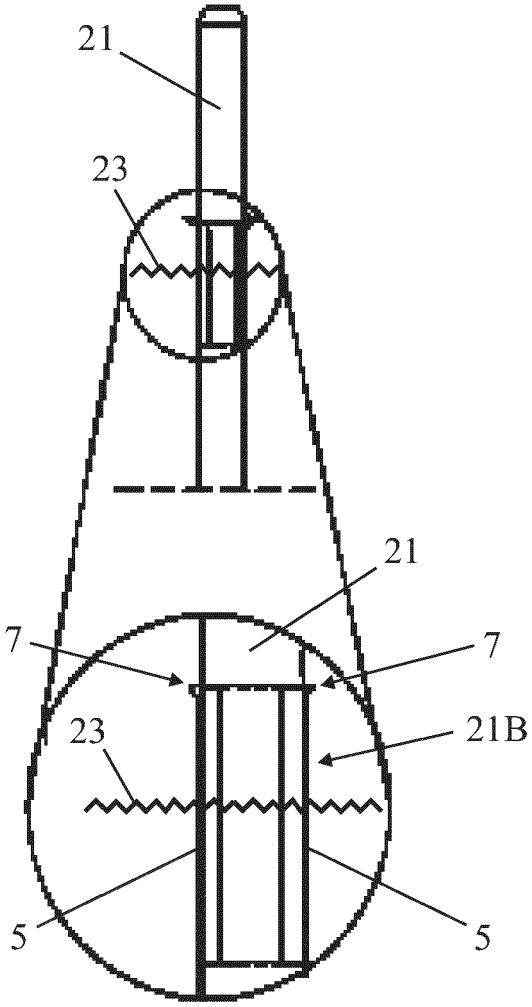

FIG. 5

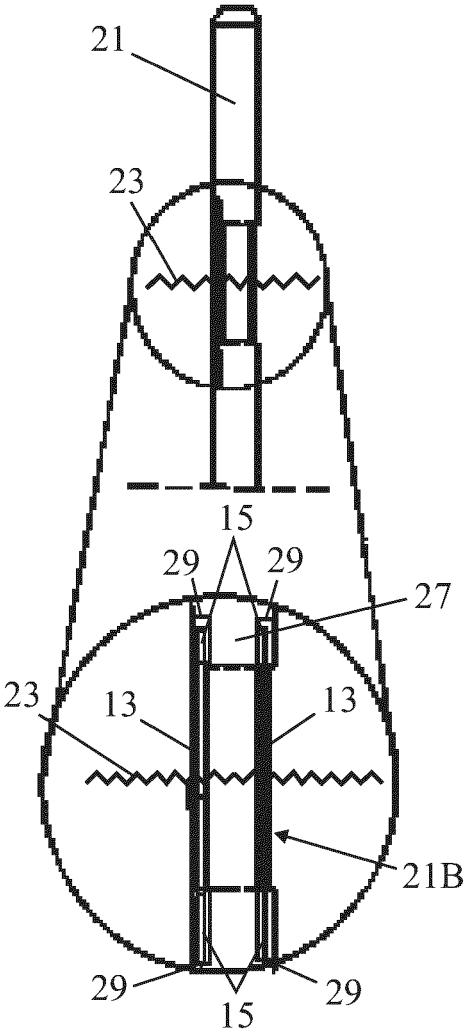

FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 23 18 5883

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 4 306 821 A (MOORE CHARLES D) 22 December 1981 (1981-12-22) * col.1, lines 5-10;col.3, lines 43-51 col.4, lines 18-36; col.5, lines 9-40; figures 1-5 *	1-4	INV. E02D5/64 E01D19/02 E01D22/00 E04H12/22 E02B3/24
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	21 September 2023	Patrascu, Bogdan

CATEGORY OF CITED DOCUMENTS

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REFERENCES CITED IN THE DESCRIPTION

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