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(54) **Method for creating a building under an architectural monument**

Verfahren zum Bau eines Gebäudes unter einem architektonischen Denkmal

Méthode pour créer une construction sous un monument architectural

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(56) References cited:
**FR-A1- 2 647 481**
**GB-A- 325 093**
**JP-A- H09 184 144**
**JP-A- S58 123 925**
**JP-A- 2006 274 746**

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EP 2 236 677 B1

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## Description

### Technical field

**[0001]** The invention belongs in the construction field, treating more specifically a method for creating a new building under and around an authentically preserved architectural monument, which is located on an infirm base.

### Prior art

**[0002]** From the prior art there are solutions known, where a new building is created under an existing building.

**[0003]** A vertical dredging-type structural design is known (JP4092020, Obhayashi Corp, published on 25.03.1992), where the soil is excavated from beneath an existing building, using a method, where a steel-sheet cylinder is pressed down while using the existing building as the supporting points for the jack. A cylinder-shaped shaft is dug into the soil and jacks are positioned between the upper edge of the shaft and the building. The shaft is pressed down with the compressive force of the jacks and with the inner concave. When the reaction force to the traction(repulsive) force of the jacks is removed, the shaft will sink in the bottom and a building can be created under the existing building without using temporary structures.

**[0004]** Another known method is that of producing an insulated foundation recess to an existing building (JP 184144, Taisei Corp, published on 15.07.1997). The soil around the existing building is excavated, whereby a recess is formed. The soil that is immediately under the framework casing of the existing building is also excavated, to achieve an underground space that joins the lower part of the recess, while the upper parts of the existing piles, where the piles have been installed in the soil in the lower part of the framework casing, remain exposed. New piles are driven into the soil of the lower part of the recess. Then a pad footing together with new piles is created in the upper soil of the joined casing recess. The support wall that surrounds the side walls of the casing is built into a joint casing together with the pad footing. In the underground space a pressure-resistant slab is formed, to increase the contact area with the underground soil. In this case the existing piles will penetrate the pressure-resistant slab without being in contact with it.

**[0005]** A method that is closest to this invention by the technical nature, is the method for creating a new building under an existing building (JP 58123925, Tekken Constr Co, published on 23.07.1983). In that solution the foundation of the existing building is joined with a new created support beam and is installed by means of a jack between the installed new support beam and support piles so that the new support beam will rise up, the weight of the existing building will be transferred to support piles. The horizontal layer is formed by inserting a support material between the support beam and support piles, when the support material has expanded and hardened, the jack is removed, a recess is excavated and the new building is created under the existing building.

**[0006]** A drawback of the known solutions is that these do not allow creating a new building under architectural monuments, since special requirements apply to the preservation of architectural monuments.

### Description of the invention

**[0007]** In built-up areas it is often necessary to create buildings near (beneath, next to and/or on top) an architectural monument due to natural factors, economic conditions or functional needs. At this, proceeding from historical principles, the existing architectural heritage should be preserved in its authentic form, while ensuring that it will be displayed. A majority of architectural monuments are not on a rigid soil (e.g. rock), and thereby complex problems will occur with the maintenance of the stability of the existing building and the new additional building.

**[0008]** The problem is made more complicated by the fact that architectural monuments are located on a relatively infirm soil and the level of surface water is at the height of the pad footing. The level of surface water may not be lowered, since it would cause subsiding in other buildings in the area. The National Heritage Board requests the preservation of existing architectural monuments in their authentic form, meaning that it is not permitted to disassemble and reassemble the monuments.

**[0009]** The applicant presents a method according to claim 1 for creating a building under an architectural monument, comprising the following stages:

- a rigid loadbearing structure is created under the preserved building, whereas the structure is produced vertically in two parts;
- the two parts of the structure are created with gaps and by sections as to the plan and after completing the executed sections, the structural parts that have not been executed will be created;
- temporary piles will be created, which will rest on and reach to a loadbearing surface layer;
- cross-beams are installed in the load bearing structure, leaving openings in the structure for tensile fittings, and the loadbearing structure is pre-tensioned by means of the tensile fittings in the upper and lower half of the structure;
- jacks are mounted between the cross-beams and temporary piles;
- under the preserved building, a loadbearing and waterproof structure is created around the underground

part of the new building down to the loadbearing soil;

- a horizontal waterproof layer is formed under the underground part of the new building, between the waterproof structure and the temporary piles;
- the recess for the underground part of the new building is excavated, installing simultaneously temporary pullers to the load bearing waterproof structure;
- piles, on-pile foundation and loadbearing framework are built;
- temporary piles are removed down to the on-pile foundation, removing also the jacks and cross-beams, releasing temporary pullers;
- new ground-level structures are built, using transparent materials for external borders;
- drainage is created around the underground part of the new building.

**List of figures**

**[0010]** The figure presents the conceptual solution for creating a building under and around an architectural monument.

**Exemplary embodiment of the invention**

**[0011]** A rigid loadbearing structure 2 is created vertically under the authentically preserved building 1. The rigid loadbearing structure 2 is first executed at a half width of structure 2. The rigid and loadbearing structure 2 is created with gaps and by sections as to the plan. After the completion of the executed section, the uncompleted parts of the rigid and loadbearing structure 2 are created. Then, after the first half of structure 2 has achieved its rigidity, the second half of structure 2 is executed similarly to the first half. During the construction of structure 2, cross-beams 3 are installed in the structure, whereat the installation of a cross-beam is preceded by the installation of temporary piles 5, which reach down to and rest on the loadbearing soil layer 6. Structure 2 is provided with openings for tensile fittings 4. The rigid and load bearing structure 2 is pre-tensioned with tensile fittings 4 in the upper and lower half. When the loadbearing structure 2 has been built, the cross-beam 3 is supported by means of temporary piles 5. Jacks 7 are installed between the cross-beams 3 and temporary piles 5, providing the temporary piles 5 with pre-tension. Pre-tension is provided to temporary piles 5 in order to prevent possible subsiding of the authentically preserved building 1 as a result of a possible unevenness of loadbearing soil layer 6 and deformation.

**[0012]** After resting the authentically preserved building 1 on the loadbearing soil layer 6, a loadbearing and waterproof structure 9 is created around the sideways perimeter of the underground part 8 of the new building to be created under building 1, reaching down to the loadbearing surface 6. The loadbearing and waterproof structure 9 is created under high pressure by pressing liquid binder into infirm soil 10, resulting in a slurry of the soil and the binder, which will turn into a hard and waterproof material, i.e. the loadbearing and waterproof structure 9, in the course of hardening. At the joint of the perimeters of the authentically preserved building 1 and the new underground part 8 of the new building, a loadbearing and waterproof structure 9 will be created in vertical, similarly to the loadbearing structure of the preserved building 1.

**[0013]** After the completion of the loadbearing and waterproof structure 9, a horizontal waterproof layer 11 is created under the underground part 8 of the new created building. The waterproof horizontal layer 11 is created in a concave form between the loadbearing and waterproof structure 9 and temporary piles 5. Due to the concave form of the waterproof horizontal layer 11, an arch will form between the load bearing and waterproof structure and temporary piles 5, holding the buoyancy force of surface water.

**[0014]** After the completion of the loadbearing and waterproof structure 9 and the waterproof horizontal layer 11, the recess for the underground part 8 of the new building will be excavated by reach sections. This is followed by building piles 12, on-pile foundation 13 and loadbearing framework 14, after which the temporary piles 5 will be removed down to on-pile foundation 13. Jacks 7 and cross-beams 3 are also removed. During the creation of the recess, the temporary pulls 15 are installed to the load bearing and waterproof structure 9 to receive the side trust of soil. The temporary pulls 15 are released after the completion of the underground part 8 of the new building.

**[0015]** After the creation of the underground part 8 of the new building under the authentically preserved building 1, the new surface structures 16 are built, using transparent materials for the external borders 17, making it possible to display the authentically preserved building 1.

**[0016]** The level of surface water 18 next to the underground part 8 of the new building of the authentically preserved building 1 is not lowered and in order to prevent the local rise of surface water level, drainage 19 will be created around the underground part 8 of the new building. Drainage 19 will ensure that the surface water level 18 will remain unchanged in the vicinity of the underground part 8 of the new building.

**Claims**

1. Method for creating a building under an architectural monument, comprising the stages of: supporting the foundation of the existing building by means of support beams and piles and with jacks; a horizontal

layer is created, the jacks are removed, an underground recess is excavated, a new building is built under the existing building, **characterized in that**

- a rigid loadbearing structure (2) is built under the building in order to support the foundation of the existing building (1), whereas the structure (2) is produced vertically in two parts;
- two parts of the structure (2) are created with gaps and by sections as to the plan, and after the completed sections are ready, the structure (2) is further created in the uncompleted parts;
- the structure (2) is pre-tensioned with tensile fittings (4) from the upper and lower part of the structure (2);
- temporary piles are driven (5);
- cross-beams (3) are installed in the structure (2) and the cross-beams are supported with the temporary piles (5);
- jacks (7) are installed between the cross-beams (3) and the temporary piles (5);
- under the existing building (1), around the underground part (8), a loadbearing and waterproof structure (9) is created down to the loadbearing surface;
- under the underground part (8) of the new building a horizontal waterproof layer (11) is formed between the loadbearing and waterproof structure (9) and the temporary piles (5);
- a recess is excavated for the new building and temporary pullers (15) are installed to the loadbearing and waterproof structure (9);
- piles (12), on-pile foundation (13) and loadbearing framework (14) are built;
- temporary piles (5), jacks (7), cross-beams (3) and temporary pullers (15) are removed;
- new surface structures (16) are built, using a transparent material for external borders (17) and
- drainage (19) is created around the underground part (8) of the new building.

**2.** Method accordingly to claim 1, **characterized in that** structure (2) is produced by executing structure (2) first in a half width of structure (2) and when the first part has achieved its rigidity, the second part of structure (2) is executed, leaving openings for the tensile fittings (4) in the upper and lower part of structure (2).

**3.** Method accordingly to claim 1, **characterized in that** the temporary piles (5) are driven so that they rest in a loadbearing layer of soil (6).

**4.** Method accordingly to claim 1, **characterized in that** structure (9) is loadbearing and waterproof, executed by pressing liquid binder into infirm soil (10) under high pressure.

**5.** Method accordingly to claim 1, **characterized in that** the temporary piles (5) are removed down to the on-pile foundation (13).

**Patentansprüche**

**1.** Verfahren zur Herstellung eines Gebäudes unter einem architektonischen Monument mit Schritten (1) zur Unterstützung des Fundaments des vorhandenen Gebäudes durch Stützträger und Pfähle mit Hebern; Herstellung einer horizontalen Schicht, Entfernen der Heber, Ausgraben einer unterirdischen Aushöhlung, Bau eines neuen Gebäudes unter einem vorhandenen Gebäude, **gekennzeichnet dadurch, dass**

- eine starre tragfähige Konstruktion (2) unter dem Gebäude gebaut wird, um das Fundament des vorhandenen Gebäudes (1) zu unterstützen, wobei die Konstruktion (2) vertikal in zwei Teilen hergestellt wird;
- zwei Teile der Konstruktion (2) mit Aussparungen und abschnittsweise nach dem Plan hergestellt werden und nachdem die Abschnitte fertig sind, die Konstruktion (2) in unbeendeten Teilen hergestellt wird;
- die Konstruktion (2) mit dehnbaren Teilen (4) am oberen und unteren Teil der Konstruktion (2) vorgespannt wird;
- temporäre Pfähle eingerammt werden (5);
- Querbalken (3) in der Konstruktion (2) eingebaut und mit temporären Pfählen (5) unterstützt werden;
- Heber (7) zwischen Querbalken (3) und temporären Pfählen (5) eingebaut werden;
- unter dem vorhandenen Gebäude (1), um den unterirdischen Teil (8) eine tragfähige und wasserfeste Konstruktion (9) bis zur tragfähigen Oberfläche hergestellt wird;
- unter dem unterirdischen Teil (8) des neuen Gebäudes eine horizontale wasserfeste Schicht (11) zwischen der tragfähigen und wasserfesten Konstruktion (9) und den temporären Pfählen (5) hergestellt wird;
- eine Aushöhlung für das neue Gebäude ausgegraben und temporäre Heber (15) an der tragfähigen und wasserfesten Konstruktion (9) eingebaut werden;
- Pfähle (12), Pfahlfundament (13) und tragfähiges Rahmen (14) gebaut werden;
- temporäre Pfähle (5), Heber (7), Querbalken (3) und temporäre Heber (15) werden entfernt;
- neue Oberflächenkonstruktionen (16) mit einem transparenten Material für externe Grenzen (17) gebaut werden und
- Abfluss (19) wird um den unterirdischen Teil (8) des neuen Gebäudes hergestellt wird.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die Konstruktion (2) zuerst zur halben Breite der Konstruktion (2) hergestellt wird und wenn das erste Teil seine Steife erreicht hat, das zweite Teil der Konstruktion (2) hergestellt wird, wobei Öffnungen für dehnbare Teile (4) im oberen und unteren Teil der Konstruktion (2) gelassen werden.

3. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die temporären Pfähle (5) auf eine Weise eingerammt werden, dass sie in der tragfähigen Schicht der Erde liegen (6).

4. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die Konstruktion (9) tragfähig und wasserfest ist, indem Flüssigkeitsbinder in die unsteife Erde (10) unter Hochdruck eingepresst wird.

5. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die temporären Pfähle (5) bis zum Pfahlfundament (13) entfernt werden.

**Revendications**

1. Méthode de création d'un bâtiment sous un monument architectural, comprenant les étapes de soutenir la fondation du bâtiment existant au moyen de faisceaux et des pieux de soutien et de vérins; une couche horizontale est créée, les vérins sont enlevés, une cavité souterraine est creusée, un nouveau bâtiment est construit sous le bâtiment existant, **caractérisé en ce que**

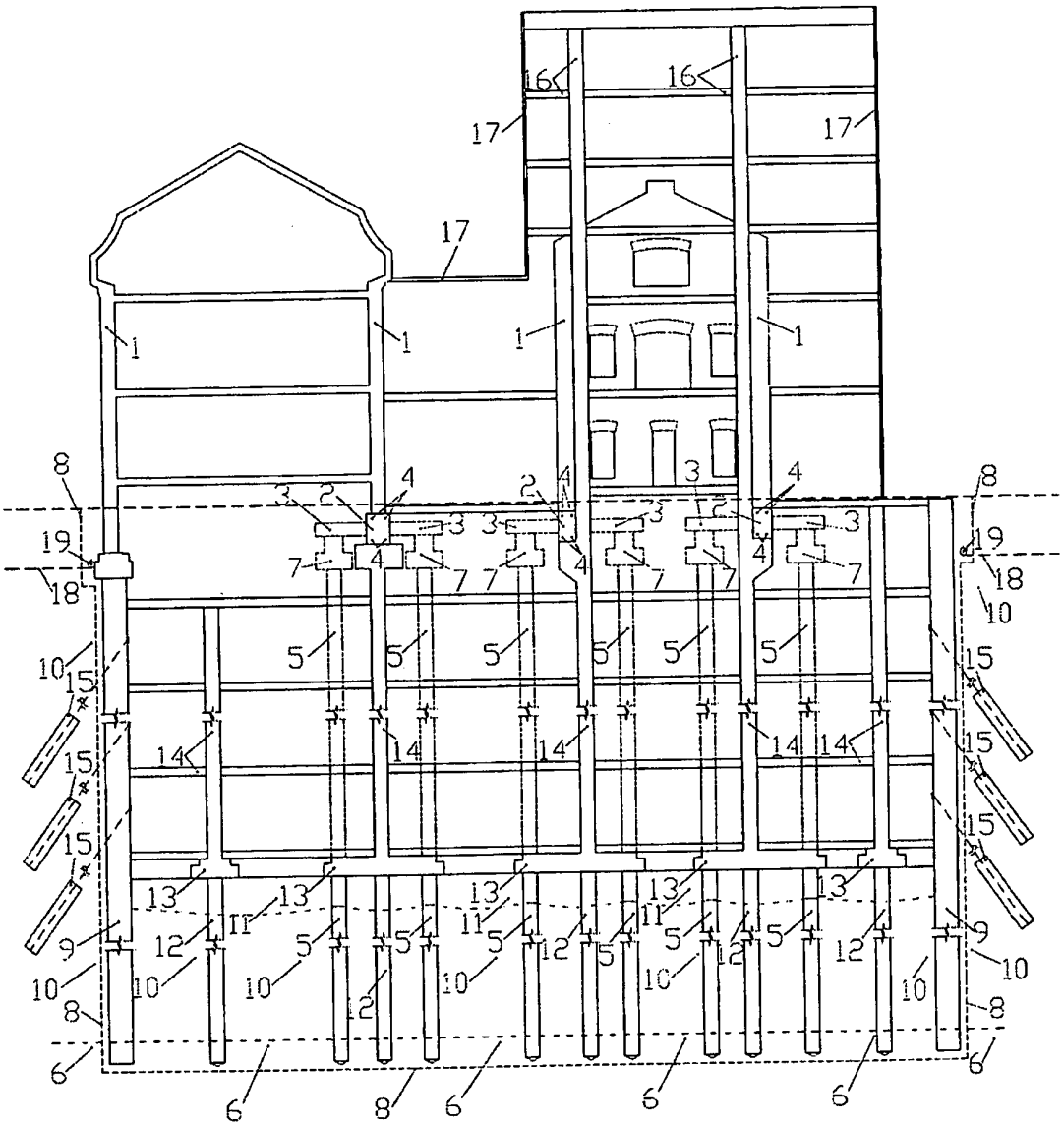
   - une structure portante rigide (2) est construite sous le bâtiment en vue de soutenir la fondation du bâtiment existant (1), alors que la structure (2) est réalisée verticalement en deux parties;
   - deux parties de la structure (2) sont créées avec des espaces et par sections comme selon le plan et après que les sections complètes sont prêtes, la structure (2) est ensuite créée dans les parties inachevées;
   - la structure (2) est précontrainte avec des dispositifs de traction (4) à partir de la partie supérieure et inférieure de la structure (2);
   - des pieux provisoires sont battus (5);
   - des traverses (3) sont installés dans la structure (2) et les traverses sont supportées par les pieux provisoires (5);
   - des vérins (7) sont installés entre les traverses (3) et les pieux provisoires (5);
   - sous le bâtiment existant (1), autour de la partie souterraine (8), une structure portante et étanche (9) est créée au-dessous de la surface portante;
   - sous la partie souterraine (8) du nouveau bâtiment, une couche étanche horizontale (11) est formée entre la structure portante et étanche (9) et les pieux provisoires (5);
   - une cavité est creusée pour le nouveau bâtiment et des extracteurs provisoires (15) sont installés sur la structure portante et étanche (9);
   - les pieux (12), fondation sur pieux (13) et le cadre porteur (14) sont construits;
   - les pieux provisoires (5), les vérins (7), les traverses (3) et les extracteurs provisoires (15) sont retirés;
   - de nouvelles structures de surface (16) sont construites, en utilisant un matériau transparent pour les parois extérieures (17) et
   - un système de drainage (19) est créé autour de la partie souterraine (8) du nouveau bâtiment.

2. Procédé selon la revendication 1, **caractérisé en ce que** la structure (2) est produite par l'exécution de la structure (2) premièrement dans la moitié de la largeur de la structure (2) et lorsque la première partie a atteint sa rigidité, la seconde partie de structure (2) est exécutée, ce qui laisse des ouvertures pour les raccords de traction (4) dans la partie supérieure et inférieure de la structure (2),

3. Procédé selon la revendication 1, **caractérisé en ce que** les pieux provisoires (5) sont battus afin qu'ils reposent sur une couche portante du sol (6).

4. Procédé selon la revendication 1, **caractérisé en ce que** la structure (9) est portante et étanche, exécutée en injectant sous haute pression du liant liquide dans le sol non ferme (10).

5. Procédé selon la revendication 1, **caractérisé en ce que** les pieux provisoires (5) sont enlevés jusqu'à la fondation sur pieux (13).



## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- JP 4092020 B **[0003]**
- JP 184144 A **[0004]**
- JP 58123925 B **[0005]**