(19) LE GOUVERNEMENT DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Économie

(11) N° de publication : **LU509472**

https://patent.public.lu/fo-eregister-view/

(12) **BREVET D'INVENTION** **B1**

(21) N° de dépôt: LU509472

(22) Date de dépôt: 20/12/2024

(51) Int. Cl.:
E02D 1/00, E04G 1/00, E01D 1/00

(30) Priorité:

(43) Date de mise à disposition du public: 20/06/2025

(47) Date de délivrance: 20/06/2025

(DX) Date d'expiration: 20/12/2030

(85) Date d'entrée en phase nationale:

(86) N° de dépôt de la demande internationale:

(73) Titulaire(s):
CHINA RAILWAY CONSTRUCTION BRIDGE ENGINEERING BUREAU GROUP FOURTH ENGINEERING CO., LTD – 150000 Harbin City (China), CHINA RAILWAY CONSTRUCTION BRIDGE ENGINEERING GROUP CO., LTD – 300000 Tianjin (China), CHINA RAILWAY CONSTRUCTION BRIDGE ENGINEERING BUREAU GROUP SOUTHERN ENGINEERING CO., LTD – 511400 Guangzhou City (China)

(72) Inventeur(s):
REN Yanlong – China, HUO Yanlei – China, LI Kai – China, LI Xiang – China, ZHAO Jian – China, AN Luming – China, LIU Changhui – China, NIE Ligong – China, AN Dongsheng – China, WANG Rundong – China

(74) Mandataire(s):
Patent42 SA – 4081 Esch-sur-Alzette (Luxembourg)

(54) METHOD OF JACKING CONSTRUCTION FOR A LONG-SPAN STEEL BEAM COMBINED WITH AN EXTERNAL TRUSS.

(57) The present invention relates to a method of jacking construction for a long-span steel beam combined with an external truss, which relates to the field of bridge construction and includes the following steps: building an assembly platform, a guide platform, an anti-collision system, a temporary pier, mounting a jacking equipment, mounting a guide beam, mounting an external truss, pre-splicing a beam body, a walking jacking combined jacking beam body, a beam body drop beam, and the jacking construction of external truss is completed. The method is suitable for different construction environments and bridge spans, having better stability and safety, reducing influence on existing traffic lines, and realizing rapid construction of bridges. FIG. 1

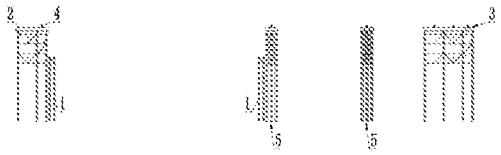

FIG. 1

DESCRIPTION

METHOD OF JACKING CONSTRUCTION FOR A LONG-SPAN STEEL BEAM COMBINED WITH AN EXTERNAL TRUSS

TECHNICAL FIELD

The present invention relates to the field of bridge construction, and in particular to a method of jacking construction for a long-span steel beam combined with an external truss.

BACKGROUND

In recent years, there are more and more applications of long-span steel structure composite bridges, which include multiple steel beam members assembled along width direction. When constructing a long-span steel structure combined bridge, first one of the steel beam members is hoisted between the piers on two sides of a river, then other steel beam members are hoisted in turn, and finally all the steel beam members are spliced to complete the construction of the long-span steel structure combined bridge.

With the rapid development of transportation infrastructure, requirements for bridge construction technology are getting higher and higher. Among bridge construction methods, jacking method is widely used in long-span bridge construction because of advantages such as small interference to existing traffic and strong adaptability.

However, the traditional jacking method is only suitable for straight bridges with equal height or curved bridges with equal radius, which has many restrictions on a geometric shape of a bridge structure. At the same time, the boundary of the beam changes constantly during the jacking process, and the stress is complex, which leads to the increase of the beam height and material consumption.

The local stress of the beam can be increased during the jacking process, so it is necessary to take corresponding measures to ensure the safety and stability of the structure, especially for the long-span bridge.

SUMMARY

An object of the present application is to: in order to solve the problem that the local stress of the beam body can be increased during the jacking process, corresponding measures should be taken to ensure the safety and stability of the structure, especially for traditional jacking mode of long-span bridges. The limitation is more and more obvious, and then affects the construction efficiency. The present application provides a method of jacking construction for a long-span steel beam combined with an external truss.

In order to achieve the above object, the present application specifically adopts the following technical solutions.

The present invention relates to a method of jacking construction for a long-span steel beam combined with an external truss, including a floating crane, a bridge deck crane, an external truss, a guide beam, a guide platform, an assembly platform, a temporary pier, an anti-collision pier system, a steel box girder and a walking jacking combination, including the following steps:

S1: arranging the assembly platform, the guide platform, the temporary pier, and the anti-collision pier near a navigation hole;

S2: using floating crane to erect the bridge deck crane, hoisting the external truss and the guide beam to the assembly platform, using the bridge deck crane to lift to the assembly platform and assemble the steel box girder;

S3: repeating the jacking of the beam body by using the walking jacking combination;

S4: using the tower crane to remove a rear part of the external truss after the guide beam approaches the guide platform;

S5: dropping the beam body and converting a system after the beam body is

pushed into place; and

S6: using the tower crane to remove the guide beam and all external trusses.

Further, at two main pier positions, the assembly platform is arranged on one side, the guide platform is arranged on one side; and the anti-collision pier is arranged near the temporary support of the navigation hole.

Further, the assembly platform assembles the external truss, and the external truss is hoisted to a predetermined position above the steel box girder by using the tower crane.

Furthermore, the external truss and the steel box girder are reinforced to ensure overall stability of superstructure.

Further, the guide platform is arranged at a middle span of the main bridge close to the two main piers to prevent the steel box girder from overturning if a span is too large.

Further, the beam body is slowly lowered from the jacking equipment to a permanent support by using a jack, after the beam body is pushed in place; and during landing process, a displacement monitoring equipment needs to be used to monitor the position of the beam body in real time to ensure accurate position.

Further, firstly, the bridge deck crane is dismantled, then the walking jacking combination is dismantled, then the guide beam is dismantled, and finally the external truss is dismantled.

In summary, the present application includes at least one of the following benefits.

In the present application, by setting a truss outside the main structure of the bridge, the jacking equipment is used to gradually push the bridge segment forward, to complete the construction of the bridge, effectively improve construction efficiency, and ensure the structural safety and stability in the construction process.

At the same time, it is suitable for long-span bridges, especially when crossing rivers, deep valleys or other obstacles, improves the structural stability and safety in the construction process, can realize more accurate construction control, ensure a bridge line type and stress meet design requirements, thereby improving the construction efficiency and construction safety.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of S1 according to the present invention;

FIG. 2 is a schematic view of S2 according to the present invention;

FIG. 3 is a schematic view of S3 according to the present invention;

FIG. 4 is a schematic view of S4 according to the present invention; and

FIG. 5 is a schematic view of S5 and S6 according to the present invention.

Reference numerals and denotations thereof:

1-anti-collision pier; 2-guide platform; 3-assembly platform; 4-walking push combination; 5-temporary support; 6-guide beam; 7-external truss; 8-bridge deck crane; and 9-steel box girder.

DETAILED DESCRIPTION

The present application will be described in further detail below with reference to FIGS. 1-5.

An example of the present application provides a method of jacking construction for a long-span steel beam combined with an external truss.

Referring to FIGS. 1-5, a method of jacking construction for a long-span steel beam combined with an external truss includes a floating crane, a bridge deck crane 8, an external truss 7, a guide girder 6, a guide platform 2, an assembly platform 3, a temporary pier, an anti-collision pier 1 system, a steel box girder 9 and a walking jacking combination 4, including the following steps.

In S1: the assembly platform 3, a guide platform 2, a temporary pier, and an anti-collision pier 1 are arranged near a navigation hole.

In S2: the floating crane is used to erect the bridge deck crane 8, the external truss 7 and the guide beam 6 are hoisted to the assembly platform 3, the bridge deck crane 8 is used to lift to the assembly platform 3 and assemble the steel box girder 9.

In S3: the jacking of the beam is repeated by using the step-by-step jacking combination 4.

In S4: the tower crane is used to remove a rear part of the external truss 7 after the guide beam 6 approaches the guide platform 2.

In S5: the beam body is dropped and the system is converted after the beam body is pushed into place.

In S6: the tower crane to is used remove the guide beam 6 and all the external trusses 7.

Referring to FIG. 1, at two main pier positions, the assembly platform 3 is arranged on one side, the guide platform 2 is arranged on one side; and the anti-collision pier 1 is arranged near the temporary support 5 of the navigation hole.

Two platforms are arranged and anti-collision piers 1 is for mounted, and anti-collision piers 1 is mounted on temporary supports 5 near the main tower to prevent navigable vessels from colliding with temporary supports 5 and ensure construction safety.

Referring to FIG. 2, the assembly platform 3 assembles the external truss 7, and the external truss 7 is hoisted to a predetermined position above the steel box girder 9 by using the tower crane.

The floating crane is used to hoist the bridge deck crane 8 to the assembly platform 3 first, and then the guide beam 6 and the external truss 7 are mounted, the guide beam 6 is mounted at a front end of a first section of steel beam, and the steel beam at the front end of the middle section of steel beam is pre-spliced, and then the whole beam body is hoisted by the bridge deck crane 8, so that the first section of steel beam reaches above the temporary support 5.

Referring to FIG. 1, the external truss 7 and the steel box girder 9 are reinforced to ensure the overall stability of the superstructure.

The external truss 7 is hoisted to the bridge deck by tower crane and connected by high-strength bolts to ensure structural stability.

Referring to FIGS. 3 and 4, the guide platform 2 is arranged at a middle span of the main bridge close to the two main piers to prevent the steel box girder 9 from overturning if a span is too large. The beam body is slowly lowered from the jacking equipment to a permanent support by using a jack, after the beam body is pushed in place; and during landing process, a displacement monitoring equipment needs to be used to monitor the position of the beam body in real time to ensure accurate position.

The beam body is jacked to the distance of the next steel beam length, and then spliced the next steel beam and the external truss 7. After the guide beam 6 approaches the guide platform 2, the external truss 7 on the rear side is dismantled, and then the jacking and assembling operation is repeated until one side of the main bridge reaches the design position, then the steel beams are dropped pier by pier in grading, the jacking equipment is pulled out, and permanent supports are mounted. The steel beam falls on the permanent bearing to complete the steel beam drop beam operation.

Referring to FIGS. 4 and 5, firstly, the bridge deck crane 8 is dismantled, then the walking jacking combination 4 is dismantled, then the guide beam 6 is dismantled, and finally the external truss 7 is dismantled.

After the jacking steel beam is completed, the front guide beam 6 and all the external trusses 7 are removed to complete all the jacking work.

The implementation principle is a method of jacking construction for a long-span steel beam combined with an external truss according to the present example. First, two platforms are arranged and the anti-collision pier 1 is mounted, and the anti-collision pier 1 is mounted on the temporary support 5 near the main tower to prevent the navigable ship from colliding with the support and ensure the construction safety.

Secondly, the floating crane is used to first hoist the bridge deck crane 8 to the assembly platform 3 and then the guide beam 6 and the external truss 7 are mounted, the guide beam 6 is mounted at the front end of the first section steel beam, and the steel beam at the front end of the middle section steel beam is pre-spliced. The integral beam body is hoisted using the bridge deck crane 8 so that the first section of steel beam reaches above the temporary support 5. The external truss 7 is hoisted to the bridge deck by a tower crane and connected by high-strength bolts to ensure structural stability. After that, the jacking and assembling operation is carried out, the next steel beam and the external truss 7 are pushed to the length of the steel beam next to the beam body, and the next section of the steel beam and the external truss 7 are spliced together. After the guide beam 6 approaches the guide platform 2, the rear part of the external truss 7 is dismantled, and then the jacking and assembling operation is repeated until one side of the main bridge reaches the design position, then the beam drop operation is carried out, the steel beams are dropped one by one, the pushing equipment is pulled out, and the temporary support is mounted, and the steel beams are dropped on the permanent support to complete the steel beam drop operation. Finally, After the steel beam is jacked, the front end guide beam 6 and all the external trusses 7 are dismantled to complete all the jacking work.

CLAIMS

1. A method of jacking construction for a long-span steel beam combined with an external truss, comprising a floating crane, a bridge deck crane (8), an external truss (7), a guide beam (6), a guide platform (2), an assembly platform (3), a temporary pier, an anti-collision pier (1) system, a steel box girder (9) and a walking jacking combination (4), comprising the following steps:

S1: arranging the assembly platform (3), the guide platform (2), the temporary pier, and the anti-collision pier (1) near a navigation hole;

S2: using floating crane to erect the bridge deck crane (8), hoisting the external truss (7) and the guide beam (6) to the assembly platform (3), using the bridge deck crane (8) to lift to the assembly platform (3) and assemble the steel box girder (9);

S3: repeating the jacking of the beam body by using the walking jacking combination (4);

S4: using the tower crane to remove a rear part of the external truss (7) after the guide beam (6) approaches the guide platform (2);

S5: dropping the beam body and converting a system after the beam body is pushed into place; and

S6: using the tower crane to remove the guide beam (6) and all external trusses (7).

2. The method of jacking construction for a long-span steel beam combined with an external truss (7) according to claim 1, wherein at two main pier positions, the assembly platform (3) is arranged on one side, the guide platform (2) is arranged on one side; and the anti-collision pier (1) is arranged near the temporary support (5) of the navigation hole.

3. The method of jacking construction for a long-span steel beam combined with an external truss according to claim 1, wherein the assembly platform (3) assembles the external truss (7), and the external truss (7) is hoisted to a predetermined position above the steel box girder (9) by using the tower crane.

4. The method of jacking construction for a long-span steel beam combined with an external truss according to claim 1, wherein the external truss (7) and the steel box girder (9) are reinforced to ensure overall stability of superstructure.

5. The method of jacking construction for a long-span steel beam combined with an external truss according to claim 1, wherein the guide platform (2) is arranged at a middle span of the main bridge close to the two main piers to prevent the steel box girder (9) from overturning if a span is too large.

6. The method of jacking construction for a long-span steel beam combined with an external truss according to claim 1, wherein the beam body is slowly lowered from the jacking equipment to a permanent support by using a jack, after the beam body is pushed in place; and during landing process, a displacement monitoring equipment needs to be used to monitor the position of the beam body in real time to ensure accurate position.

7. The method of jacking construction for a long-span steel beam combined with an external truss according to claim 1, wherein, firstly, the bridge deck crane (8) is dismantled, then the walking jacking combination (4) is dismantled, then the guide beam (6) is dismantled, and finally the external truss (7) is dismantled.

REVENDICATIONS

1. Méthode de construction par vérinage d'une poutre en acier à longue portée combinée à une poutrelle externe, comprenant une grue flottante, une grue de pont (8), une poutrelle externe (7), une poutrelle de guidage (6), une plate-forme de guidage (2), une plate-forme d'assemblage (3), une jetée temporaire, un système de jetée anti-collision (1), un caisson en acier (9) et une combinaison de vérinage à pied (4), comprenant les étapes suivantes :

S1 : disposition de la plate-forme d'assemblage (3), de la plate-forme de guidage (2), de la jetée temporaire et de la jetée anticollision (1) à proximité d'un trou de navigation ;

S2 : utilisation d'une grue flottante pour ériger le pont roulant (8), levage de la poutrelle extérieure (7) et de la poutrelle de guidage (6) jusqu'à la plate-forme d'assemblage (3), utilisation du pont roulant (8) pour soulever la plate-forme d'assemblage (3) et assembler la poutre-caisson en acier (9) ;

S3 : répéter le levage du corps de la poutre en utilisant la combinaison de levage à pied (4) ;

S4 : utilisation de la grue à tour pour retirer une partie arrière de la poutrelle externe (7) après que la poutrelle de guidage (6) se soit approchée de la plate-forme de guidage (2) ;

S5 : déposer le corps de la poutre et convertir un système après que le corps de la poutre a été poussé en place ; et

S6 : utiliser la grue à tour pour retirer la poutre de guidage (6) et toutes les fermes externes (7).

2. Méthode de construction par vérinage d'une poutre en acier à longue portée combinée à une poutrelle externe (7) selon la revendication 1, dans laquelle, à deux positions de la pile principale, la plate-forme d'assemblage (3) est disposée d'un côté, la plate-forme de guidage (2) est disposée d'un côté, et la pile anticollision (1) est disposée près du support temporaire (5) du trou de navigation.

3. Méthode de construction par vérinage d'une poutre en acier à longue portée combinée à une poutrelle externe selon la revendication 1, dans laquelle la plate-forme d'assemblage (3) assemble la poutrelle externe (7), et la poutrelle externe (7) est hissée à une position prédéterminée au-dessus de la poutrelle en caisson d'acier (9) à l'aide de la grue à tour.

4. Méthode de construction par vérinage d'une poutre en acier à longue portée combinée à une poutrelle extérieure selon la revendication 1, dans laquelle la poutrelle extérieure (7) et la poutre-caisson en acier (9) sont renforcées pour assurer la stabilité globale de la superstructure.

5. Méthode de construction par vérinage d'une poutre en acier à longue portée combinée à une poutrelle externe selon la revendication 1, dans laquelle la plate-forme de guidage (2) est disposée à une travée centrale du pont principal près des deux piliers principaux pour empêcher la poutre-caisson en acier (9) de se renverser si une travée est trop grande.

6. Méthode de construction par vérinage d'une poutre en acier à longue portée combinée à une poutrelle externe selon la revendication 1, dans laquelle le corps de la poutre est lentement descendu de l'équipement de vérinage vers un support permanent à l'aide d'un vérin, après que le corps de la poutre ait été poussé en place ; et pendant le processus d'atterrissage, un équipement de surveillance du déplacement doit être utilisé pour surveiller la position du corps de la poutre en temps réel afin d'assurer une position précise.

7. Méthode de construction par vérinage d'une poutre en acier à longue portée combinée à une poutrelle externe selon la revendication 1, dans laquelle, tout d'abord, la grue de pont (8) est démontée, puis la combinaison de vérins de marche (4) est démontée, puis la poutre de guidage (6) est démontée, et enfin la poutrelle externe (7) est démontée.

FIGURES

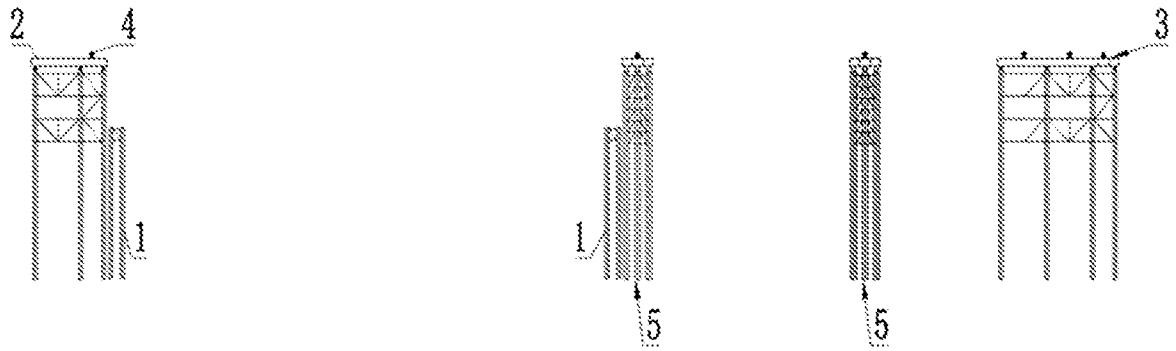

FIG. 1

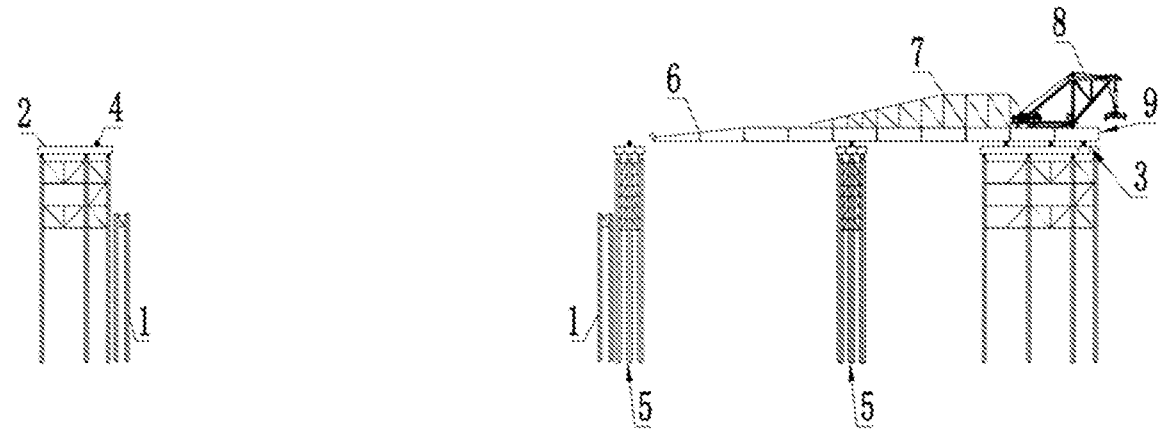

FIG. 2

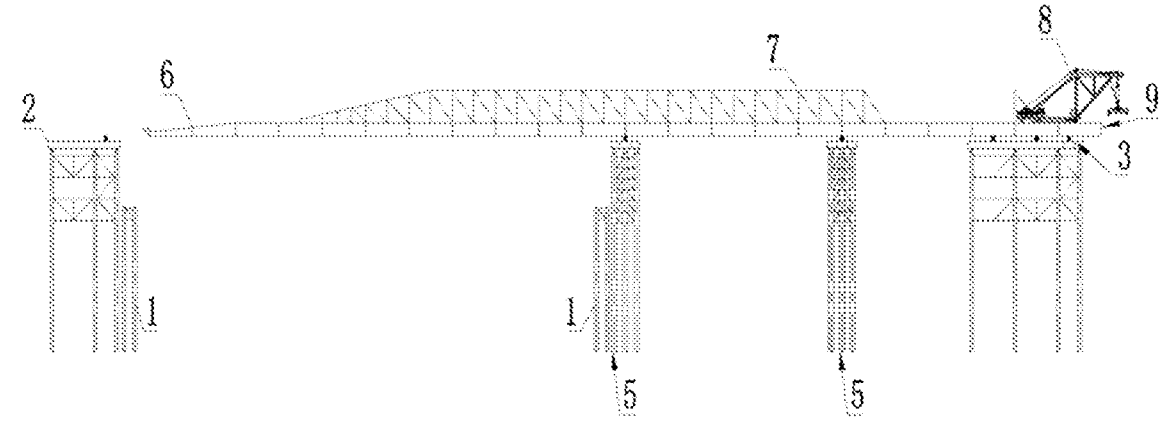

FIG. 3

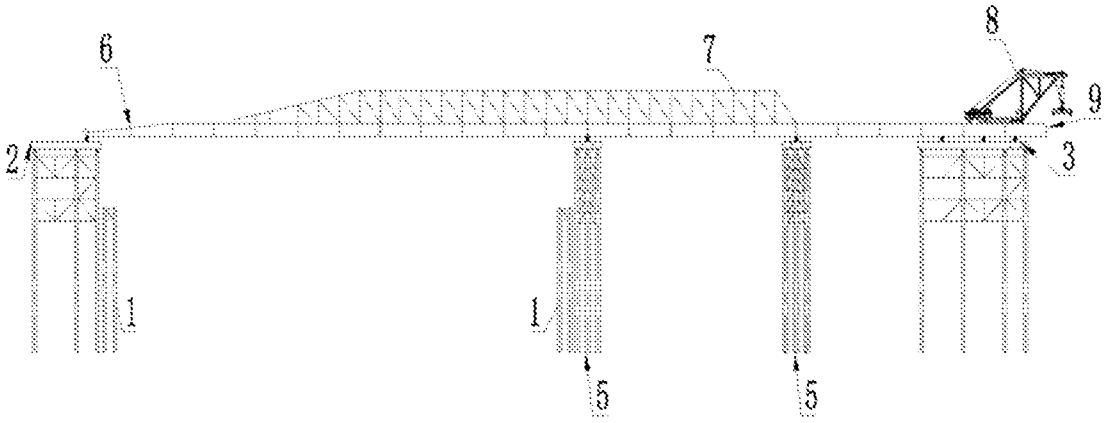

FIG. 4

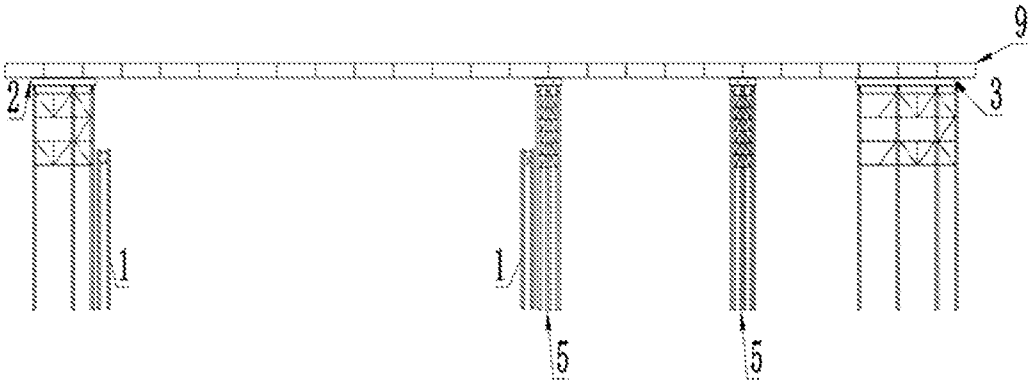

FIG. 5