



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.06.2018 Bulletin 2018/24

(51) Int Cl.:
B28B 7/46 (2006.01) E04C 3/293 (2006.01)

(21) Application number: **17202678.3**

(22) Date of filing: **21.11.2017**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(71) Applicant: **Anstar Oy**
15540 Villähde (FI)

(72) Inventor: **PULKKANEN, Juha**
15540 Villähde (FI)

(74) Representative: **Heinänen Oy Patent Agency**
Äyritie 8 D
01510 Vantaa (FI)

(30) Priority: **08.12.2016 FI 20165934**

(54) **A BEAM AND A METHOD FOR PRODUCING A BEAM**

(57) A beam (1), which comprises a bottom plate (2), two web plates (3) and a top plate (5), which define a space (6), which can be filled with concrete. A pipe (10) is arranged in the space (6), through which pipe's wall moisture is arranged to transfer from the outside of the

pipe (10) to the inside of the pipe (10), and which pipe (10) is arranged to be in the flow contact with the outside of the space (6) for transferring moisture along the pipe (10) to the outside of the space (6).

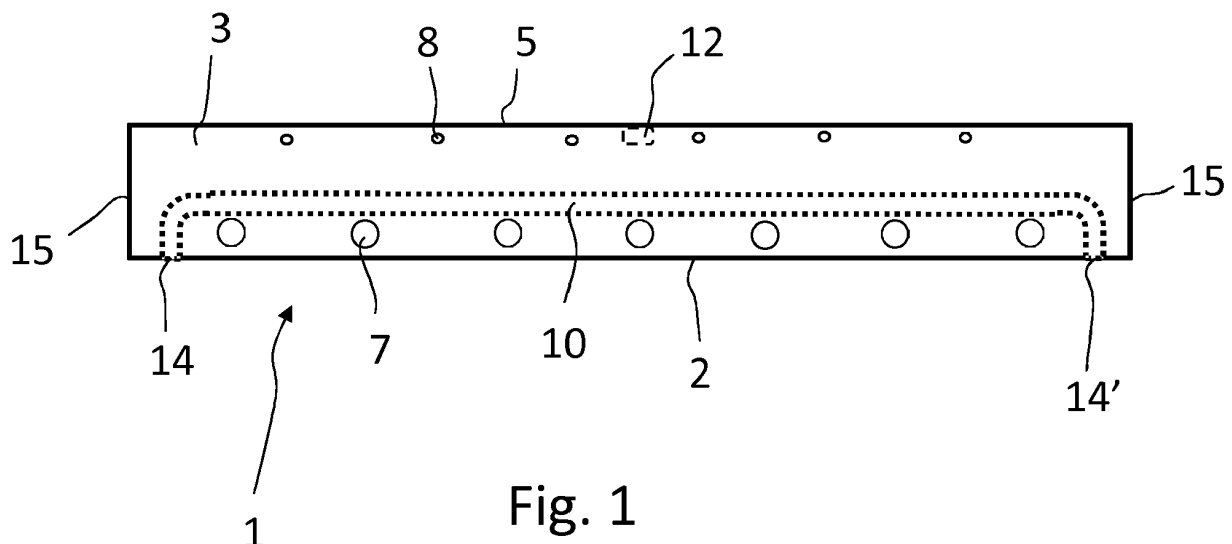


Fig. 1

Description

[0001] The object of the invention is a beam according to claim 1. Furthermore, the object of the invention is a method for producing a beam.

[0002] The invention relates to a steel beam, on which hollow-core slabs, composite slabs, thin shell slabs and other load-bearing structures of a building can be supported. A beam is filled with concrete, and after the concrete has hardened, the beam serves as a composite structure. With a composite structure longer beam spans can be achieved, and with regular beam spans the amount of steel can be reduced. A beam is filled with concrete at the assembling place or at the manufacturing place and transported to the assembling place after the concrete has hardened.

[0003] A problem with assembling and producing of beams is the long drying time of concrete, which is typically weeks, even months. This requires more assembling time and higher assembling costs. Furthermore, there has to be a storage room in the factory for drying of concrete, which might restrict the production capacity of beams. If a beam is filled with concrete only at the installation place, drying of concrete might delay the initiating of other operation stages.

[0004] The aim of this invention is to achieve a beam by means of which the above mentioned problems can be reduced.

[0005] The aim of the invention is achieved with a beam according to claim 1, which beam comprises a base plate, two web plates and a top plate, which define a space, which can be filled with concrete. A pipe is provided in the space, through the wall of which pipe moisture is arranged to transfer from the outside of the pipe to the inside of the pipe, and which pipe is arranged to be in the flow connection with the outside of the space for transferring moisture along the pipe to the outside of the space.

[0006] In the method according to the invention the space defined by a base plate, web plates and a top plate of a beam is filled with concrete. A pipe is arranged in the space through the wall of which pipe moisture is arranged to transfer from concrete to the inside of the pipe. Moisture is transferred along the pipe to the outside of the space.

[0007] Significant advantages are achieved by the invention. Moisture of concrete inside of the beam is transferred to the pipe, and further along the pipe to the outside of the beam, wherein concrete can be dried faster than earlier, which for one shortens the manufacturing time of a beam at the factory or the installation time at the installation place. Drying of concrete can be made more effective by conducting pressurized air into the pipe. The pressurized air can be heated, if necessary.

[0008] In the following, the invention will be described in more detail by the aid of embodiments with reference to the attached drawings, wherein

embodiment of the invention,

Fig. 2 shows a cross-section of a beam of Fig. 1, and

5 Fig. 3 shows a side view of a pipe placed in a beam of Figures 1 and 2.

[0009] Slab systems of a building, such as hollow-core slabs, composite slabs and shell slabs and in-situ cast concrete slabs can be supported on a steel beam 1 presented in the drawings. During seam concreting or other concreting, the beam 1 is filled with concrete, and after the concrete has hardened, the beam 1 serves with concrete as a load-carrying composite structure for slab systems. The beam 1 is filled with concrete at the assembling place or in the factory during the manufacturing phase, and will be delivered to the assembling place ready-concreted.

[0010] Beam 1 comprises a base plate 2, to which two web plates 3 are fixed, which form the sides of the beam 1. The web plates 3 are arranged parallel at a distance from each other. The base plate 2 extends in lateral direction of the beam 1 into both sides of the web plates 3, and thus forms protruding parts 4 for slab systems to be supported on beam. If beam 1 is so-called edge beam, there is only on one side of the beam 1 a protruding part 4, on which the plate is supported.

[0011] The angle between the web plates 3 and the base plate 2 is less than 90° , wherein the distance between the web plates 3 is smaller in upper parts of the web plates 3 than in lower parts. Alternatively, one web plate 3 can be perpendicularly against the base plate 2, if beam 1 is a so-called edge beam.

[0012] Web plates 3 are connected to each other with their upper edges by a top plate 5. Base plate 2, web plates 3 and top plate 5 form a space 6, which can be filled with concrete. Web plates 3 are fixed to base plate 2 and to top plate 5 by welding, for example. Alternatively, top plate 5 and web plates 3 can be formed of the same plate by bending. The ends of beam 1 can be closed by end plates 15. There are concrete feeding openings 7 in web plates 3 through which feeding openings 7 concrete is fed into the space 6 defined by base plate 2, web plates 3, and top plate 5. Moreover, there are air venting openings 8 in the upper parts of web plates 3 for removing air from the space 6 during concreting.

[0013] Beam 1 comprises fire steels 9 extending in the longitudinal direction of the beam, which are arranged in the space 6. In an embodiment according to drawings fire steels are fixed on their place by steel bands. Steel bands are looplike. Alternatively, fire steels can be placed to be supported by supports fixed to base plate 2 of the beam. Supports 7 are placed at regular intervals in the longitudinal direction of the beam 1. Fire steels 9 are fixed to supports with seal bands 13, for example. Moreover, fire steels 9 are placed on top surface of the top plate 5 of the beam and to corners between top plate 5 and web plates 3 in space 6. Fire steels 9 are corrugated bars.

Fig. 1 shows a side view of a beam according to one

[0014] One or more pipes 10 are arranged in the space 6, which comprises a moisture-permeable wall, through which moisture, such as water and/or steam, is arranged to transfer. In fig. 1, pipe 10, which has been placed in the space 6, is illustrated with dotted lines in order to illustrate the location of the pipe 10. Moisture is arranged to transfer from the outside of the pipe 10, i.e. from concrete in the space 6 to the inside of the pipe 10. This can be provided so that there are holes 11 in the wall of the pipe 10, through which holes 11 moisture can transfer through the wall. Holes 11 are placed at a distance from each other in the longitudinal direction of the pipe 10 and in the direction of circle. Typically, holes 11 are placed over the length of the whole pipe 10. Diameter of holes 11 is less than 3 mm, typically less than 2 mm. The pipe 10 is of plastic, or of other material suitable for the purpose. A drainage pipe, for example, can be used as a pipe 10. Alternatively, or addition to the holes, the pipe 10 can be made of moisture-permeable material. The pipe 10 can be a drainage pipe without holes, for example, through the wall of which moisture permeates from the outside of the pipe 10 to the inside of the pipe 10. The inner diameter of the pipe 10 is at least 30 mm, typically at least 40 mm.

[0015] The pipe 10 is in the longitudinal direction of the beam 1. The horizontal part of the pipe 10 is parallel to the longitudinal axis of the beam 1. Advantageously, the horizontal part of the pipe 10 is placed in vertical direction in the center of the space 6, wherein the lateral force influencing on the pipe 10 is smallest. The pipe 10 is placed in horizontal direction in the center of the space 6. The pipe 10 is fixed or supported on fire steels 9, seal bands of fire steels or supports or concrete feeding openings 7, for example.

[0016] The inner part of the pipe 10 is arranged to be in the flow contact with the outside of the space 6 for transferring moisture along the pipe 10 to the outside of the space 6. The flow contact with the inner part of the pipe 10 and with the outside of the space 6 can be provided e.g. so that in the plate, such as a bottom plate 2, of the beam defining the space 6, there is a hole 14 through which the end of the pipe is arranged or to which the end of the pipe 10 is connected with the help of a pipe fitting, for example. Additionally, in the plate, such as a bottom plate 2, of the beam defining the space 6, there is another hole 14' through which the other end of the pipe is arranged or to which the other end of the pipe 10 is connected with the help of the pipe fitting, for example. The end/ends of the pipe 10 can be provided with valves, with which the air flow in the pipe 10 can be regulated and the pipe 10 can be closed.

[0017] In an embodiment according to drawings the end of the pipe 10 is connected to the hole 14 in the bottom plate 2, and the other end of the pipe 10 to the other hole 14' in the bottom plate 2. Alternatively, the hole 14 and/or the other hole 14' can locate in the upper plate 5 or in the web plate 3. The hole 14 and the other hole 14' are placed as close as possible to the end and to the

other end of the beam 10, wherein moisture transfers from concrete to the pipe 10 over the longest possible length. Additionally, beam 1 is generally supported at its ends, wherein the bending moment influencing on the beam 1 is smallest at the ends. Because of this the ends of the pipe 10 can easily be fixed to the holes 14, 14'.

[0018] The hole 14 is next to the end of the beam 1. Typically, the distance of the hole 14 from the end is max. 1/10 of the length of the beam. The other hole 14' is next to the other end of the beam, respectively. Typically, the distance of the other hole 14' from the other end is max. 1/10 of the length of the beam.

[0019] Additionally, beam 1 comprises at least one moisture sensor 12 for measuring moisture content of concrete in the space 6. Proportional or absolute moisture content of concrete is measured with the moisture sensor 12. Additionally, temperature of concrete can be measured with the moisture sensor 12. The moisture sensor 12 is placed in the space 6, for example it is fixed to the inner surface of the upper plate 5. Measurement data in the moisture sensor 12 is transferred wireless or with wire to a display from which the measurement data can be read.

[0020] Beam 1 is produced as follows. Bottom plate 2, web plates 3 and upper plate 4 are fixed to each other so that they form a space 6. A pipe 10 is arranged in the space 6 so that the pipe 10 is arranged or supported on desired place before the plates 2, 3, 4 are fixed to each other, or thereafter. Flow connection is formed between the inside of the pipe 10 and the outside of the space 6 so that water and/or vapour is able to transfer along the pipe 10 to the outside of the space 6. The end and/or the ends of the pipe 10 are connected to the first hole 14 and/or to the other hole 14', or are arranged through the first hole 14 and through the other hole 14' to the outside of the space 6. The moisture sensor 12 is fixed to the inner surface of the upper plate 5. The ends of the space 6 are closed with end plates 15. Concrete is fed into the space 6 through concrete feeding openings 7. Moisture (water and/or vapour) in concrete is transferred from concrete through the wall of the pipe 10 to the inside of the pipe 10. Moisture is transferred along the pipe 10 to the outside of the space 6.

[0021] If it is desired to make the transfer of moisture from concrete to the pipe 10 more effective, air is conducted through the pipe 10 with a blower. The pressurized air is then conducted from the outlet to the pipe 10. If needed, air is heated, if for example humidity is high in the surrounding air. Alternatively, air can be sucked through the pipe 10 with a blower. Moisture content of concrete is measured with a moisture sensor 12 locating in the space 6. Measurement data of the moisture sensor 12 is transferred wireless or with wire to a display from which measurement data is readable. When measured moisture content has been lowered to a desired value, possible air conducting with a blower through the pipe 10 is ended. If needed, the blower can be provided with a guiding unit, into which measuring data of the moisture

sensor 12 is transferred, and which switches air blowing off, when measured moisture content has been lowered to a predetermined value. If needed, a heating cable can be placed in the space 6, with which heating cable concrete in the space 6 is heated. Concrete in the space 6 can be cooled down, if it warms too much. This can be made by arranging a hosepipe into the pipe 10, into which hosepipe cold water is led, wherein water flowing in the hose cools concrete off.

[0022] If it is noticed from the measurement data in the moisture sensor 12 that concrete is drying too fast, concrete in the space can be moistened. This happens so that water is led into the pipe 10, for example a water hose is arranged in the pipe 10, from which water hose water is led into the pipe 10, from which moisture is further transferred through the wall of the pipe 10 into concrete in the space 6. With the pipe 10 moisture content in concrete in the space 6 can be regulated by moisten and/or by drying concrete, where necessary.

[0023] The ends of the pipe 10 can be closed with fire-resistant mass to improve the fire resistance of the beam 1.

[0024] Regulation of moisture content and temperature influencing on hardening and usability of concrete structures of the invention is not restricted only to the structure beam presented in the patent application, but it can be utilized also in other concrete structures.

Claims

1. A beam (1), which comprises a bottom plate (2), two web plates (3) and a top plate (5), which define a space (6), which can be filled with concrete, **characterized in that** a pipe (10) is fitted in the space (6), through which wall of the pipe (10) moisture is arranged to transfer from the outside of the pipe (10) to the inside of the pipe (10), and which pipe (10) is arranged to be in the flow connection with the outside of the space (6) for transferring moisture along the pipe (10) to the outside of the space (6).
2. A beam (1) according to claim 1, **characterized in that** the end of the pipe (10) is arranged through the hole (14) in plate (2, 3, 4) defining the space (6) to the outside of the space (6) or connected to the hole (14).
3. A beam (1) according to claim 2, **characterized in that** the other end of the pipe (10) is arranged through the other hole (14') in plate (2, 3, 4) defining the space (6) to the outside of the space (6) or connected to the other hole (14').
4. A beam (1) according to any of preceding claims, **characterized in that** the wall of the pipe (10) comprises holes, through which moisture is arranged to transfer from the outside of the pipe (10) to the inside

of the pipe.

5. A beam (1) according to any of preceding claims, **characterized in that** there is a hole (14) in the bottom plate (2) of the beam, into which hole (14) the end of the pipe is connected, and/or there is another hole (14') in the bottom plate of the beam, into which another hole (14') the other end of the pipe is connected.
6. A beam (1) according to claim 3, **characterized in that** the hole (14) of the bottom plate is next to the end of the beam and/or the other hole (14') is next to the other end of the beam.
7. A beam (1) according to any of preceding claims, **characterized in that** the pipe (10) is placed in vertical direction in the center of the space (6).
8. A beam (1) according to any of preceding claims, **characterized in that** a moisture sensor (12) is placed in the space (6) for measuring moisture content and/or temperature of concrete.
9. A method for producing a beam (1), in which method a space (6) defined by a bottom plate (2), web plates (3) and a top plate (5), is filled with concrete, **characterized in that** a pipe (10) is arranged in the space (6), through the wall of which pipe (10) moisture is transferred from concrete to the inside of the pipe (10), and along the pipe (10) to the outside of the space (6).
10. A method according to claim 9, **characterized in that** air is conducted through the pipe (10).
11. A method according to any of preceding claims, **characterized in that** a moisture sensor (12) is arranged in the space (6) with which moisture content and/or temperature of concrete is measured.

