(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 483 089 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **91850249.3**

(22) Date of filing : **10.10.91**

(51) Int. Cl.[5] : **E04B 5/29,** E04C 3/06, E04C 3/293

(30) Priority : **16.10.90 SE 9003314**

(43) Date of publication of application : **29.04.92 Bulletin 92/18**

(84) Designated Contracting States : **AT BE CH DE DK ES FR GB GR IT LI LU NL SE**

(71) Applicant : **Johansson, Bengt**
Kyrkvägen 60
S-183 74 Täby (SE)
(71) Applicant : **Stenmark, Jan**
Vikingagatan 3
S-113 42 Stockholm (SE)

(72) Inventor : **Johansson, Bengt**
Kyrkvägen 60
S-183 74 Täby (SE)
Inventor : **Stenmark, Jan**
Vikingagatan 3
S-113 42 Stockholm (SE)

(74) Representative : **Örtenblad, Bertil Tore**
Noréns Patentbyra AB Box 27034
S-102 51 Stockholm (SE)

(54) A beam for floor structures.

(57) A floor beam structure comprises a steel beam for a concrete floor which is cast completely or partially on site, and includes a bearing flange and parts which project outwardly therefrom. The invention is characterized in that the steel beam includes the bearing flange (1) and a web-flange (2) which extends perpendicular to the bearing flange. The web-flange is provided, either in or adjacent to its upper edge, with recesses (4) and/or penetrating holes (12) which are intended to cooperate with elongated structural members (3), preferably steel rods or bars, which extend perpendicularly to the web-flange (2) and which are intended to coact with the surrounding concrete (5).

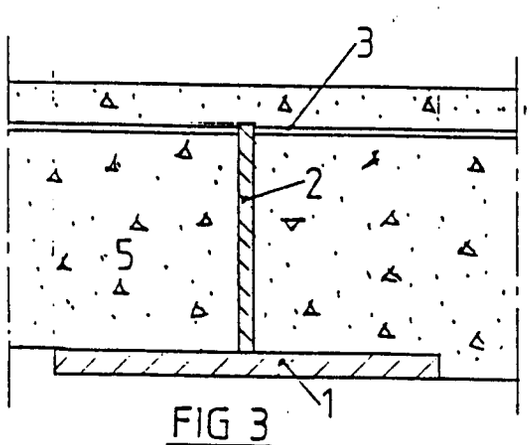

FIG 3

EP 0 483 089 A2

The present invention relates to a beam structure which is intended primarily as a load-bearing beamwork or girderwork in concrete floors that are cast on site. The inventive floor beam structure includes a steel beam which is encased in concrete on the working site. The steel beam is preferably prefabricated.

The beam structure is constructed in a manner to obtain static coaction between the beam and the surrounding concrete. Due to its special construction, the beam structure has a high degree of stiffness and mechanical strength in relation to its weight and constructional height. The beam is also highly fire resistant, due to the design of the beam among other things.

Conventional methods of producing such concrete-coacting floor structures include the use of rolled steel sections or profiles as supporting beams or girders, and the floor is laid on the upper flanges of the beams. The constructional height of the beam and the extent to which it protrudes vertically then become quite considerable, which renders room division and the laying of electric cables problematic and difficult to achieve. A large area of the steel beam is left exposed with such conventional constructions and since a fire-resistance of between 60 and 120 minutes is normally required it is necessary to protect the steel construction with a fire-insulating covering or to paint said construction with a fire-resistant paint.

These drawbacks are eliminated and costs greatly reduced when placing steel load-bearing beams in concrete floor structures in accordance with the invention. The fire resistance of the structure is also increased, because a major part of the steel beam is cooled by the surrounding concrete.

Floor beams of box-like profile and outwardly projecting bottom flanges have been developed, with the intention of avoiding the aforesaid problems. One such beam is described and illustrated in Swedish Patent Specification No. SE 457 364. This beam is produced from two rolled U-sections which are placed together with their open sides facing towards one another. The U-sections are welded to an underlying plate which projects outwardly from the sides of the U-sections. Attached to the upper edges of the U-sections, at right angles to the longitudinal axis thereof, are outwardly projecting devices which function as shear-connectors between concrete and steel. When concrete is cast around the steel beam, there is obtained a static coaction between steel and concrete and the beam is given a high degree of stiffness and mechanical strength in relation to its weight and constructional height. The beam also becomes highly resistant to fire, since a large part of the bearing capacity of the beam is represented by the bottom beam-flanges which are protected against thermal radiation by the underlying plate and are cooled by the surrounding concrete.

One decisive drawback with a beam structure of this kind, however, is that is comprises many components and includes a large number of welded joints.

The object of the present invention is to provide a prefabricated steel beam or girder structure which while possessing the same good properties of the aforedescribed beam structure comprises far fewer parts and can be produced at much lower costs than the earlier beam.

Accordingly, the present invention relates to a floor beam structure which comprises a steel beam for a concrete floor which is cast completely or partially on site, said beam including a bearing flange and parts which project outwardly from said flange, and is characterized in that the steel beam includes said bearing flange and a web-flange which is upstanding perpendicular to said bearing flange; in that the web-flange is provided, either in or adjacent to its upper edge, with recesses and/or penetrating holes which are intended to cooperate with elongated structural members, preferably steel rods or bars, which extend perpendicularly to the web-flange and which coact with the surrounding concrete.

The invention will now be described in more detail with reference to an exemplifying embodiment thereof and with reference to the accompanying drawing, in which

- Figure 1 is a cross-sectional view of a steel beam;
- Figure 2 is a longitudinal view of the beam shown in Fig.1;
- Figure 3 is a cross-sectional view of an inventive beam according to a first embodiment;
- Figure 4 is a cross-sectional view of a modified inventive beam;
- Figure 5 illustrates connections on the the rear side of the beam; and
- Figure 6 is a cross-sectional view of a second embodiment of an inventive beam.

Figures 1 and 2 illustrate a steel beam which is intended to be encased in concrete in floor structures that are cast on site, either completely or partially. The steel beam includes a bearing or supporting flange 1 and a beam part which is upstanding therefrom and which includes a web-flange 2 which extends perpendicular to the bearing flange.

Provided at or in the upper edge of the web-flange 2 are recesses 4 and penetrating holes 12, said recesses 4 and holes 12 being intended to cooperate with elongated structural members, preferably steel rods or bars, such as reinforcing irons, which extend perpendicularly to the web-flange 2 and which are intended to coact with the surrounding concrete 5. The Figure 2 illustration shows two holes 12, with the intention of illustrating where such holes are positioned in relation to the upper edge of the web-flange. The reinforcing irons are pressed down into the recesses, or inserted through the holes in that case when holes are provided, prior to casting.

The elongated members, i.e. the reinforcing irons for instance, function partly as shear-connectors between the beam and the surrounding concrete and partly as bend reinforcements when the concrete has a wide lateral extension. The direction of shear extends parallel with the longitudinal axis of the beam. The round members are placed at a predetermined distance apart, according to the loads concerned. The person skilled in this art will have no difficulty in calculating this distance or spacing. The lengths of the elongated members are also adapted according to the loads concerned and can be said to correspond roughly from 5 to 10 times the thickness of the concrete floor.

As shown in Figure 3, the concrete 5 is preferably laid to a thickness above the reinforcing irons 3.

The beam is prefabricated and transported to the building site. The elongated, round members are positioned in the recesses or in the holes in the web-flange and then encased in concrete.

According to one preferred embodiment of the invention, the web-flange 2 is welded to the bearing flange 1.

According to an alternative embodiment, the bearing flange and the web-flange are formed integrally with one another, which is achieved suitably by dividing the web of an H-section or profile in the direction of the longitudinal axis of the beam, along a line which extends centrally between the flanges of the H-section.

The beam can be provided with longitudinally extending reinforcing irons 6 suitably spaced on conventional spacers 7, as shown in Figure 4, so as to improve the fire-resistance of the beam.

According to one preferred embodiment the beam is thus provided with one or more reinforcing irons which extend close to and above the web and on both sides thereof.

As shown in Figure 5, the underside of the concrete floor can either consist of a so-called coaction plate 9 or of prefabricated concrete elemnts 10 which are placed on the bottom flange 1 of the steel beam.

Figure 6 illustrates another embodiment of the inventive beam, where angle irons are welded to and extend along each of the edges of the bearing flange 1. The advantage with this construction is that the bearing capacity and stiffness of the beam are increased.

It will be evident that the invention overcomes the drawbacks mentioned in the introduction.

Naturally, the described and illustrated beam can be modified with regard to its construction.

There invention shall not therefore be considered limited to the described and illustrated embodiments thereof, since modifications can be made within the scope of the following claims

Claims

1. A floor beam structure which comprises a steel beam for a concrete floor which is cast completely or partially on site, said beam including a bearing flange and parts which project outwardly from said flange, **characterized** in that the steel beam includes said bearing flange (1) and a web-flange (2) which extends perpendicular to said bearing flange; and in that the web-flange is provided, either in or adjacent to its upper edge, with recesses (4) and/or penetrating holes (12) which are intended to cooperate with elongated structural members (3), preferably steel rods or bars, which extend perpendicularly to the web-flange (2) and which are intended to coact with the surrounding concrete (5).

2. A beam structure according to Claim 1, **characterized** in that said web-flange (2) is welded to the bearing flange (1).

3. A beam structure according to claim 1, **characterized** in that the bearing flange (1) and the web-flange (2) are formed integrally with one another, by dividing the web of an H-section in the direction of the longitudinal axis of the beam along a line which passes centrally between the flanges of said H-section.

4. A beam structure according to claim 1, 2, or 3, **characterized** in that the beam includes one or more longitudinally extending reinforcing irons (6) adjacent to, above and on both sides of the web-flange (2).

5. A beam structure according to claim 1, 2, 3, or 4, **characterized** in that an angle iron (8) is welded to and extends along each of the edges of the bearing flange (1).

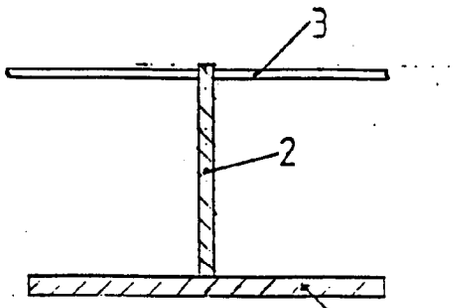

FIG 1

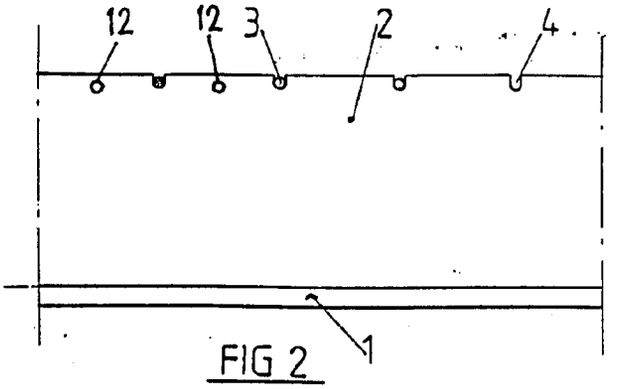

FIG 2

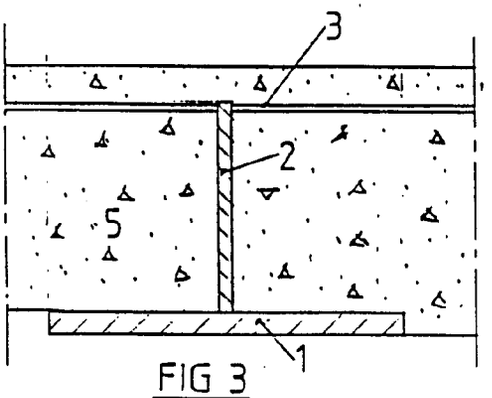

FIG 3

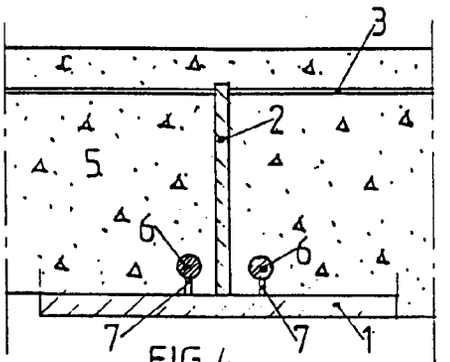

FIG 4

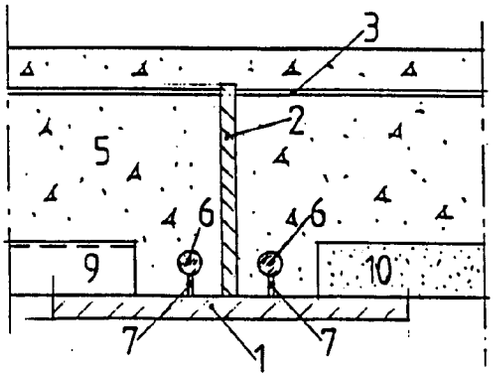

FIG 5

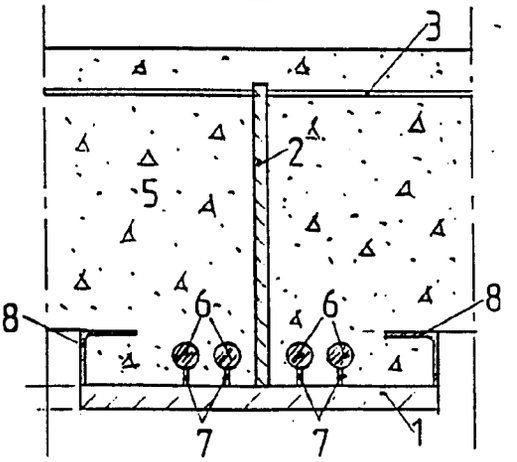

FIG 6