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[54] **MEANS FOR REDUCING SLIPPAGE OF STEEL BEAM RELATIVE TO CONCRETE SLAB**

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[51] **Int. Cl.** **E04b 1/38**

[58] **Field of Search** 52/334, 667, 684

[56] **References Cited**

UNITED STATES PATENTS

2,636,377	4/1953	Hilpert	52/334
1,597,278	8/1926	Kahn	52/334
3,596,421	8/1971	Miller	52/334 X

FOREIGN PATENTS OR APPLICATIONS

1,296,632	5/1962	France	52/334

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[57] **ABSTRACT**

A slip-preventive means to prevent a steel beam from slipping relative to a concrete slab in a bridge or the like structure, which includes one or more ribs welded to the upper flange of the steel beam, the ribs being connected to reinforcing iron bars in the concrete slab.

5 Claims, 4 Drawing Figures

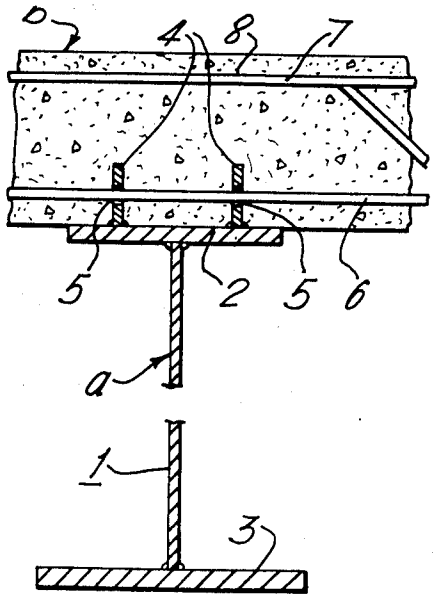


Fig. 1.

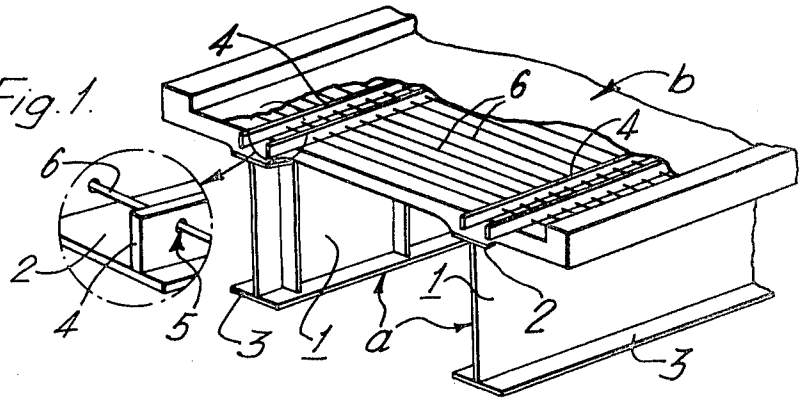


Fig. 2.

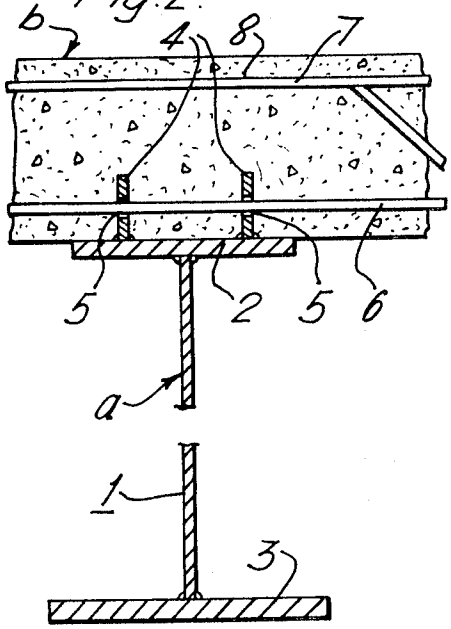


Fig. 3.

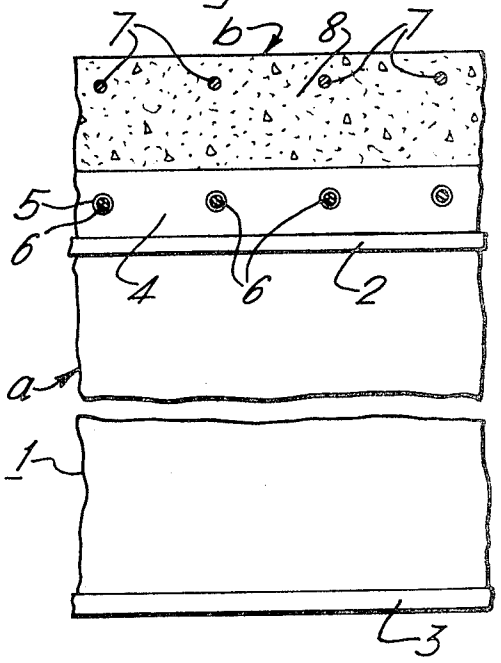
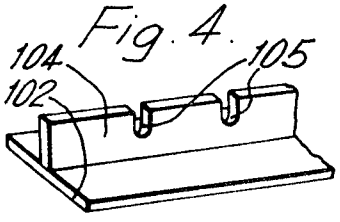


Fig. 4.



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MEANS FOR REDUCING SLIPPAGE OF STEEL BEAM RELATIVE TO CONCRETE SLAB

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a means for preventing a steel beam for slipping relative to its coacting concrete slab.

2. Description of Prior Art

When a bridge or bridge-like structure is formed by making a steel skeleton and forming concrete slabs on the steel skeleton, upon loading on the bridge or the like structure, a force is produced in the steel beams of the skeleton which tends to cause the steel beams to slip relative to the concrete slab in the longitudinal direction of each beam. One method of preventing the concrete slab from being separated from the steel beams is to weld a plurality of U-shaped or horsehoe-shaped dowels to the slab-facing side of the steel beams. Thus, the steel beam surface is roughened to increase the contact area between the steel beam and the concrete slab.

Such conventional practice, however, has a shortcoming in that it is time-consuming to weld many dowels to the steel beam one by one and that the use of extra dowels makes the structure costly.

SUMMARY OF THE INVENTION

An object of the present invention is to obviate the aforesaid difficulties of the conventional practice, by providing an improved slip-preventive means prevent a steel beam from slipping relative to a concrete slab. According to the present invention, steel beams are welded to those reinforcing iron bars in the concrete slab which extend at right angles to the longitudinal direction of the steel beams, so that slipping of the steel beams relative to the concrete slab can effectively be prevented by the shearing strength of the reinforcing iron bars thus welded to the steel beams. With the slip-preventive means of the present invention, the need for extra dowels and the time-consuming process of welding the dowels to the steel beam are completely eliminated. Furthermore, with the present invention, proper disposition of reinforcing iron bars is ensured in the concrete slab.

BRIEF DESCRIPTION OF THE DRAWING

For a better understanding of the invention, reference is made to the accompanying drawings, in which:

FIG. 1 is a schematic perspective view of a structure which incorporates the slip-preventive means constructed according to the present invention;

FIG. 2 is a vertical sectional view of an essential portion of the structure of FIG. 1, taken at right angles to the longitudinal direction of steel beams therein;

FIG. 3 is a vertical sectional view of the structure, taken along the longitudinal direction of the steel beams; and

FIG. 4 is a schematic perspective view of another embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 to 3, a steel beam a for a bridge or the like structure comprises a web 1, an upper flange 2 and a lower flange 3. One or more ribs 4 (two ribs are shown in the embodiment of FIG. 1) are welded to the upper surface of the upper flange 2 of each beam *a*, so as to extend in parallel with the longitudinal direction of the steel beam. Holes 5 are bored through the rib 4, for passing reinforcing iron bars 6 therethrough. Additional reinforcing iron bars 7 may be provided above the aforesaid bars 6 penetrating through the holes 5 of the ribs 4. A concrete slab *b* is formed by pouring concrete 8 in a space surrounding the reinforcing iron bars 6 and 7.

The construction of the rib 4 is not restricted to that which is shown in FIG. 1. For instance, in another embodiment of the invention as shown in FIG. 4, U-shaped notches 105 are formed on a rib 104 welded to the upper flange 102 of a steel beam, and no holes are bored therethrough.

Thus, with the aforesaid construction according to the present invention, it is possible to provide a concrete slab *b* which comprises one or more ribs 4 welded to upper flanges 2 of support beams, reinforcing iron bras 6 disposed in the slab and passing through the ribs 4 at either holes 5 or notches 105, optional reinforcing steel bars 7, and concrete 8 surrounding the reinforcing iron bars.

If the ribs of FIG. 4 are used, the reinforcing iron bars 6 can properly be disposed simply by laying them in the slab while fitting them in the notches 105 of the ribs 104.

With the aforesaid construction of a structure, according to the present invention, any force caused by load on the structure in such a direction as to force the steel beam *a* to slip relative to the concrete slab *b* is borne by the shearing strength of the reinforcing iron bars 6 connected to the ribs 4 welded to the steel beam *a*. Thus, the slipping between the concrete slab *b* and the steel beam *a* can be prevented more effectively by the construction of the present invention than by conventional construction using roughened surfaces of steel beams. More particularly, as compared with conventional slip-preventive means using dowels disposed between the concrete slab and the steel beam, the slip-preventive means according to the present invention is more effective, because the concrete slab *b* is directly connected to the steel beams *a*.

In FIG. 4, the notches 105 are shown made vertically. But the notches 105 may be cut in inclined direction to increase the rigidity of overall construction.

Furthermore, according to the present invention, the reinforcing iron bars can very easily be disposed, and orderly positioning of the reinforcing iron bars is ensured.

What is claimed is:

1. Slip preventive means for reducing undesired movement between structure steel beams and a concrete structure which the beams support, comprising a structural beam including a central web portion and a perpendicular flange portion, first and second longitudinal extending spaced parallel rib members affixed to said flange, each rib including means defining a plurality of spaced openings extending through each of said ribs, said openings in said first and second ribs arranged along a mutual alignment axis, said axis extending parallel to said flange and perpendicular to the longitudinal axis of said beam, and metal rods constituting a portion of the reinforcing system of the concrete structure extending through at least one selected aligned pair of openings in said rib members whereby to impede unde-

sired slip between said concrete structure and said structural beam.

2. A slip-preventive means as claimed in claim 1 in which the ribs have open notches for receiving the reinforcing iron bars therein.

3. A slip-preventive means as claimed in claim 1 in which there are at least two steel beams and said iron bars extend between and are connected to the ribs of each respective beam.

4. A slip-preventive means as claimed in claim 3 in which the ribs have holes for passing the reinforcing iron bars therethrough, the holes being in registry such that each registered set on two respective beams will receive one continuous iron bar.

5. A slip-preventive means as claimed in claim 4 in which each set of registered holes retains two reinforcing iron bars, one positioned above the other.

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