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(54) **Connector for the connection between a metal element and an element made of concrete**

(57) The invention regards a connector (100) for the connection of a steel beam (6) and a concrete slab (11), characterised in that it has a substantially rectangular-shaped base (1) fastenable against the beam or possibly against a trapezoidal corrugated sheet (7) interposed be-

tween the beam and the connector, through at least one fixed fastening element (2); in particular, it is provided that from said base (1) there be two substantially flat-shaped side-edges, arranged slanting with respect to the abovementioned base in such a manner to widen moving from the base upwards.

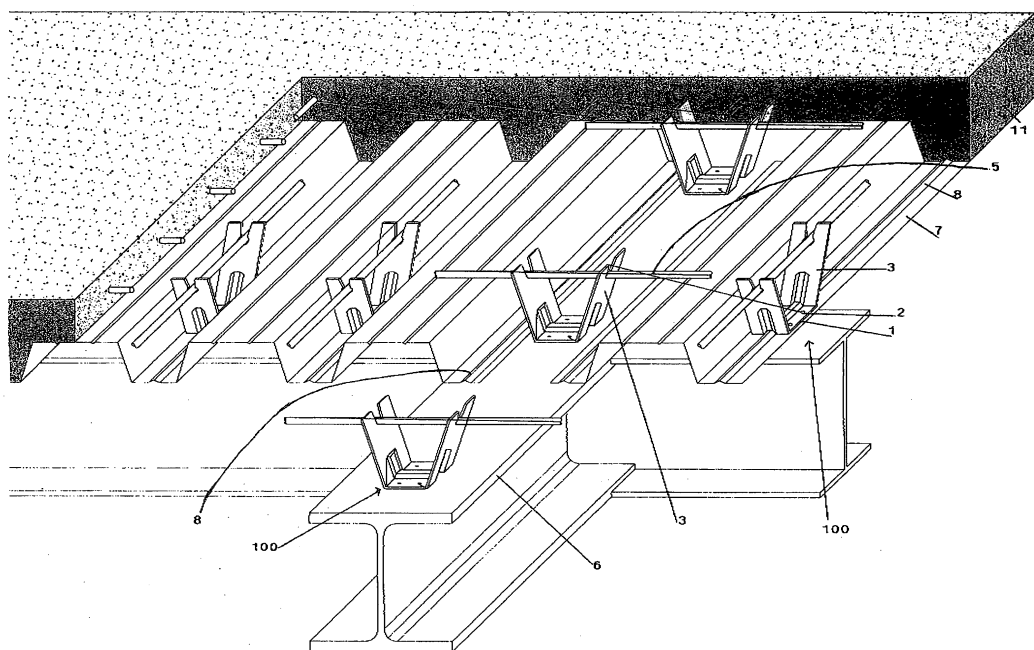


FIG. 21

Description

[0001] The present finding regards a connector for the connection between a metal element and an element made of concrete.

[0002] A typical case of use of this kind of connection is the one between a steel beam and a concrete slab. The connector mainly exercises a resistance against the horizontal movement between the underlying beam and the slab. Furthermore, the connector is shaped in such a manner to resist against vertical detachment forces between the beam and the slab.

[0003] As known in the building industry there often arises the problem regarding proper connection of steel beams with a concrete slab. The steel beams are referred to as primary or secondary depending on their importance from a static point of view in the building industry. The structure of the transverse section of these beams can be extremely varied and, strictly for exemplification purpose, only IPE or HE beams are mentioned hereinafter. On the upper part, the beams are covered with a layer of concrete and thus there is the possibility of providing for reciprocal fastening between the beam and the concrete itself.

[0004] As a matter of fact, in cases where the performance of these kind of connections are not provided for, the beams would require to be made with much greater dimensions, hence implying higher costs for manufacturing structures comprising the beams themselves. In practice, it is possible to ensure the connection between the steel and concrete material and considerably reduce the amount of steel used at the same time, consequently leading to advantages in terms of reducing both the manufacturing costs and the overall dimensions of the structure.

[0005] At times, provided on the upper part of the beams, are metal sheets, of the so called trapezoidal corrugated type, given that they have alternating furrows and reliefs; in particular, it is provided for that the concrete be applied over the sheets, which thus end up interposed between the concrete and the beams. Thus, when using trapezoidal corrugated sheets, reciprocal fastening between the underlying steel beam and the concrete slab through the trapezoidal corrugated sheet is required.

[0006] In order to allow these connections many types of connectors have been invented and among which the one described in the EP-A-0504500 document, of the same applicant, which regards a connector-pin provided with a fastening plate and studs or any other fastening material.

[0007] The objective of the present invention is to provide for a connector of the type described above, easier to mount and also more resistant once mounted, with respect to similar connectors of the known type.

[0008] According to the invention, this is attained by providing a connector having a substantially rectangular base, fastenable against a beam or against a sheet interposed between the plate and the concrete through at

least one fixed connection element, represented, for example, in particular by a stud, being provided for that from such base there rises two substantially flat shaped side edges, arranged slanting with respect to the abovementioned base.

[0009] Said connector is capable of adapting both to the presence of straight or U-shaped bars, for reinforcing the connection with the concrete, which will be arranged in proximity to the upper ends of said side edges, and also to the presence of possible ribs (usually referred to as bosses) at the bottom of the trapezoidal corrugated sheets.

[0010] These and other characteristics of the finding shall be described in details hereinafter, with reference to some of its particular embodiments, provided for exemplification purposes, with the aid of the attached drawings wherein:

- Figures 1-5 (tab. I) represent some views of the device subject of the finding;
- Figures 6-10 (tab. II) represent the same views of the device subject of the finding, provided with accessories and fastening means;
- Figures 11-14 (tab. III) represent alternative modes of the fastening means provided for in the device subject of the finding;
- Figures 15-16 (tab. IV) represent the device subject of the finding, in a cross-sectional view and side view respectively, applied on a filled slab;
- Fig. 17 (tab. V) represents a cross-sectional view of the device subject of the finding applied on a trapezoidal corrugated sheet;
- Figures 18, 19 and 20 (tab. VI) represent side views of the device subject of the finding, applied on various types of trapezoidal corrugated sheets;
- Represented in fig. 21 (tab. VII) is a plurality of devices according to the finding, applied in various ways onto beams also provided with a trapezoidal corrugated sheet.

[0011] In figures 1-5 it can be observed that the connector subject of the finding, generally indicated by 100, has a substantially rectangular-shaped base 1, which is fastenable against a beam (possibly through an interposed sheet), through one or more studs 2 or other equivalent fixed connection elements. Rising from said base are two substantially flat-shaped side edges 3 arranged slanting with respect to the abovementioned base, in such a manner to widen moving from the base upwards. Advantageously provided at the upper face of the side edges 3 are some grooves 4 provided with a widened end 4', to allow the insertion of a metal rod 5 (see figures

6-10) inside the same, which will serve as a reinforcement element for the concrete; the insertion is conceived in a manner such that the rod cannot dislodge neither during the execution step, nor during the operation step when the connector exercises its resistance against the horizontal movement between the slab and the beam.

[0012] As observable in fig. 19, the connector subject of the finding shall be directly fastened against a beam 6 or against a trapezoidal corrugated sheet 7. Furthermore, very often, the trapezoidal corrugated sheet 7 is provided with a boss 8 at the bottom of its furrows and, to allow the fastening of the device subject of the finding against the sheet, it is provided that the bottom 1 of the base be advantageously wavy 9, purposely for adapting to the corresponding boss of the trapezoidal corrugated sheet; additionally, advantageously provided at the inner surface of the connector is a reinforcement rib 10.

[0013] On the other hand, figures 11-14 show that the fastening of the base 1 to the trapezoidal corrugated sheet or directly against a beam shall require at least one fastening point, through studs 2 or other connection means, though the best results shall be obtained by means of a pair of studs, as illustrated in fig. 11.

[0014] As observable in figures 15 and 16 the device subject of the present invention shall be advantageously used for direct connection between the concrete 11 and the beam 6; provided within the concrete are reinforcement ribs 5.

[0015] Fig. 17 shows that the finding shall also be used in cases where a trapezoidal corrugated sheet 7 is provided and in such case the connector shall be fastened against the beam 6 passing through the trapezoidal corrugated sheet.

[0016] Figures 18-20 show that the device subject of the finding is adapted to be applied to various shapes of a trapezoidal corrugated sheet 7; obviously the structure of the base 1 of the connector shall vary depending on the boss 8 if provided on said trapezoidal corrugated sheet.

trapezoidal corrugated sheet (7).

3. Connector, according to claim 1 or 2, **characterised in that** it has a groove (4) on the upper face of the side edges (3), ending with a widened end (4'), within which a rod (5) is intended to be accommodated for the reinforcement of the concrete, the insertion of the rod into the groove being performed in such a manner that the rod cannot dislodge neither during the execution, nor during the operation step.
4. Connector according to one or more of the preceding claims, **characterised in that** it has a reinforcement rib (10) at the lower portion of the connector itself.
5. Connector, according to one or more of the preceding claims **characterised in that** it is fastened against a beam (6), possibly through an interposed trapezoidal corrugated sheet (7), through a plurality of fixed fastening elements (2), represented for example by a stud.

Claims

1. CONNECTOR FOR THE CONNECTION OF A METAL ELEMENT AGAINST A CONCRETE ELEMENT, **characterised in that** it has a substantially rectangular-shaped base (1) fastenable against the beam (6), also through a sheet (7) interposed between the beam and the connector, through at least one fixed fastening element (2) being provided for that rising from said base (1) there be two substantially flat-shaped side edges (3) arranged slanting with respect to the abovementioned base, in such a manner to widen moving from the base upwards.
2. Connector according to claim 1, **characterised in that** the base (1) has a relief (9) to adapt to the presence of a boss (8) at the bottom of the furrows of the

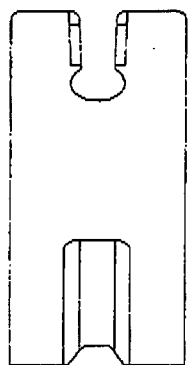


FIG. 3

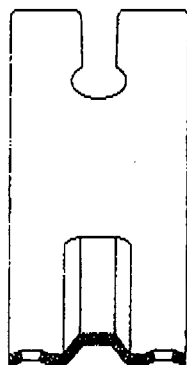


FIG. 4

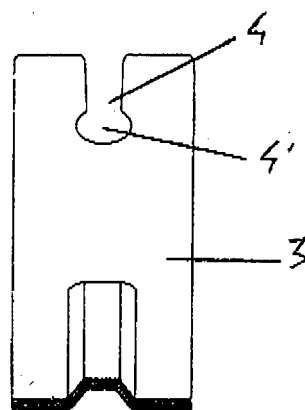


FIG. 5

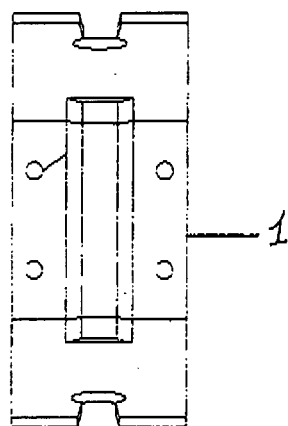


FIG. 1

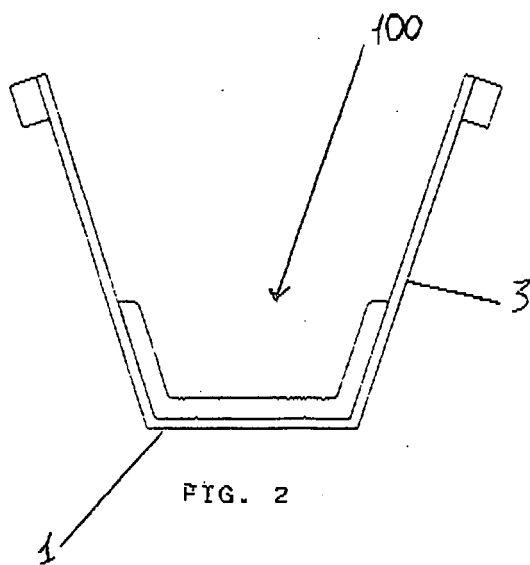
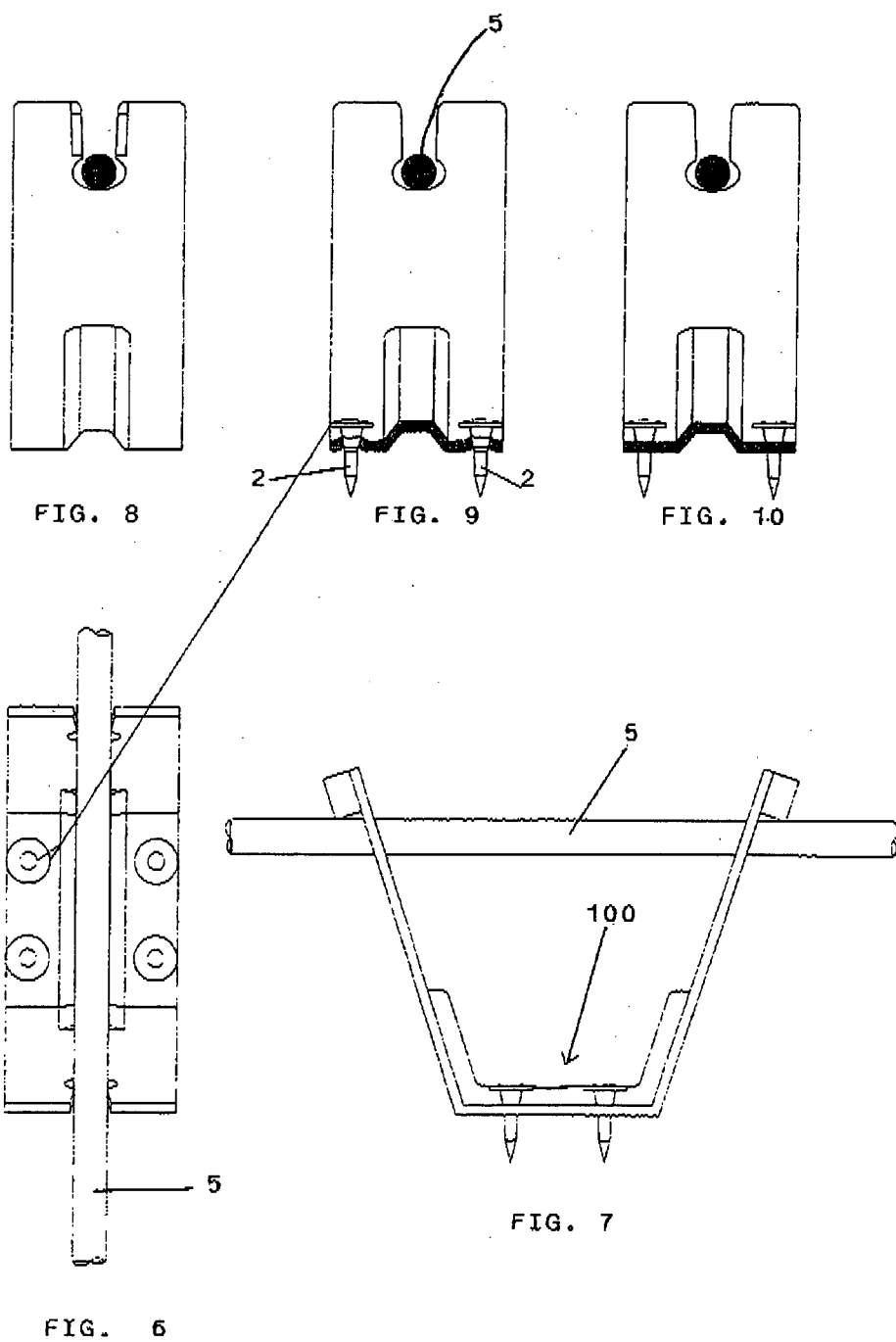


FIG. 2



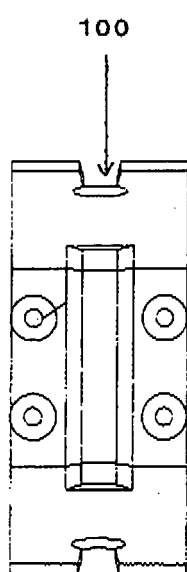


FIG. 11

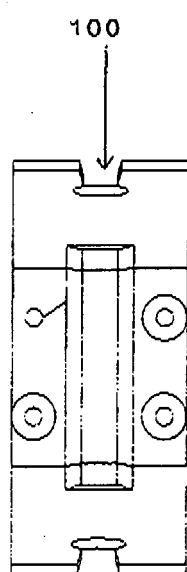


FIG. 12

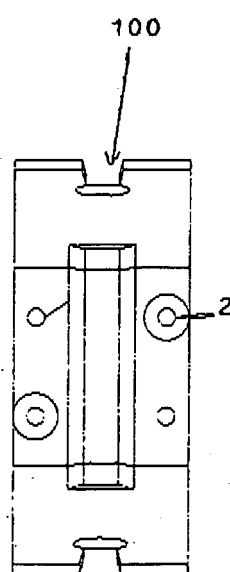


FIG. 13

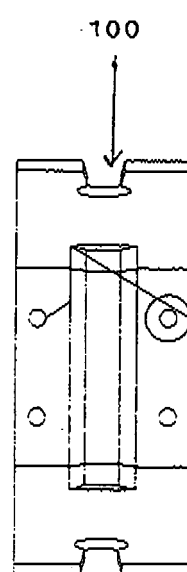


FIG. 14

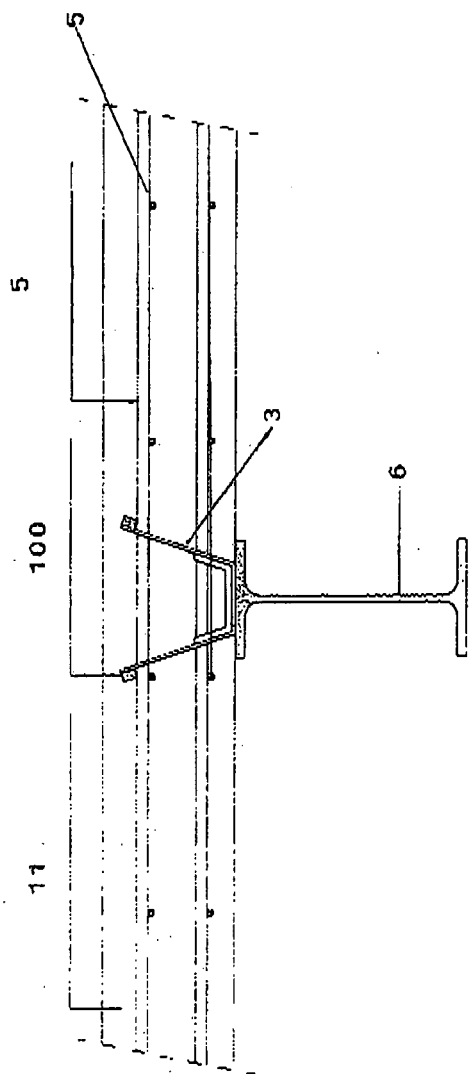


FIG. 15

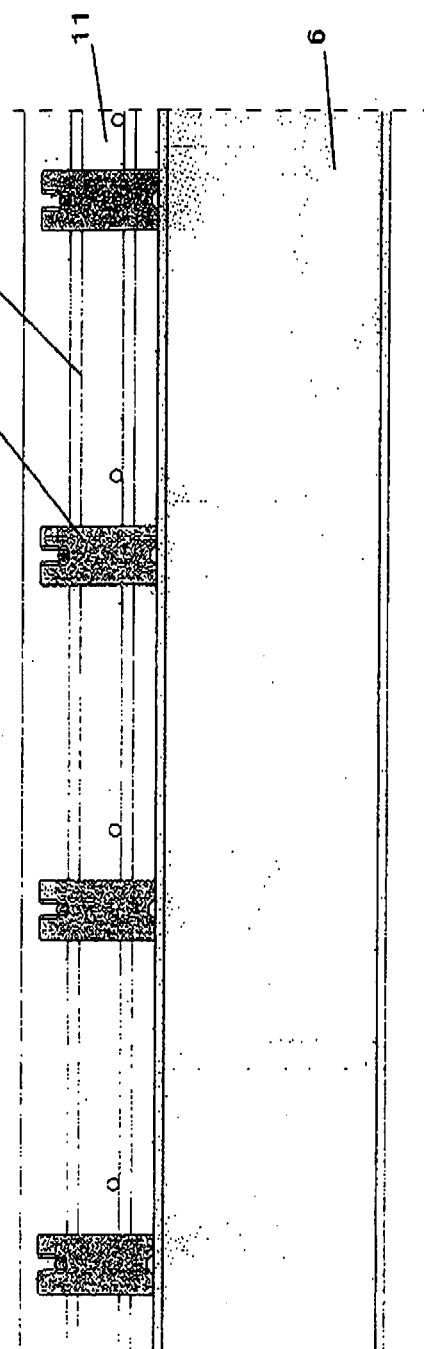


FIG. 16

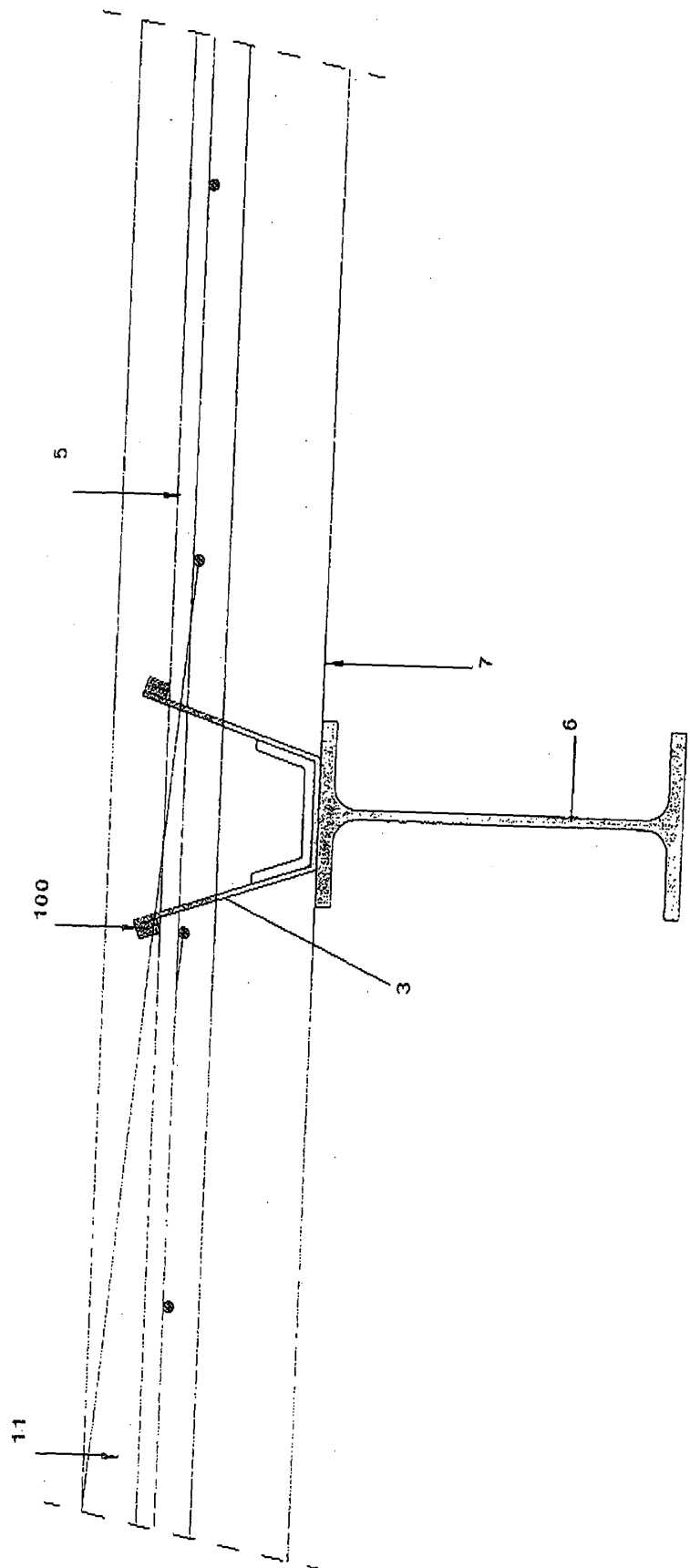


FIG. 17

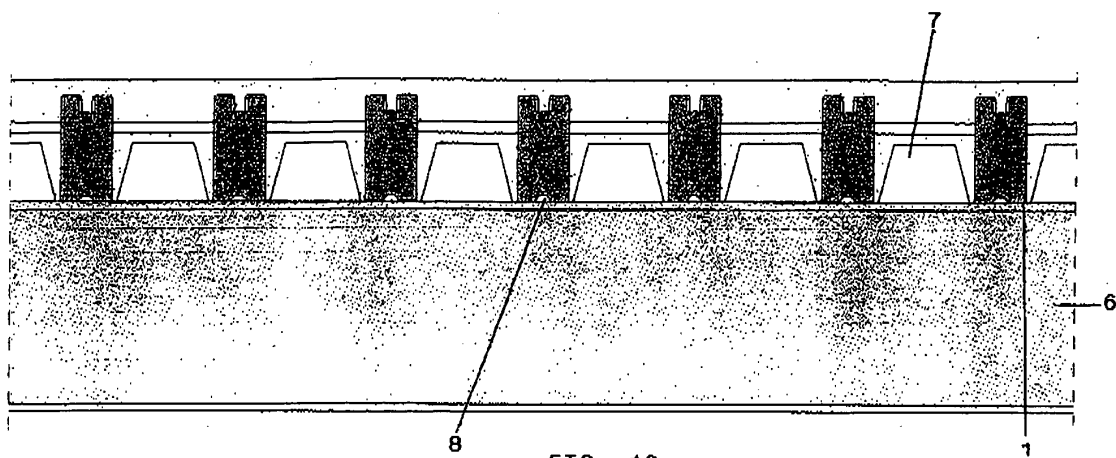


FIG. 18

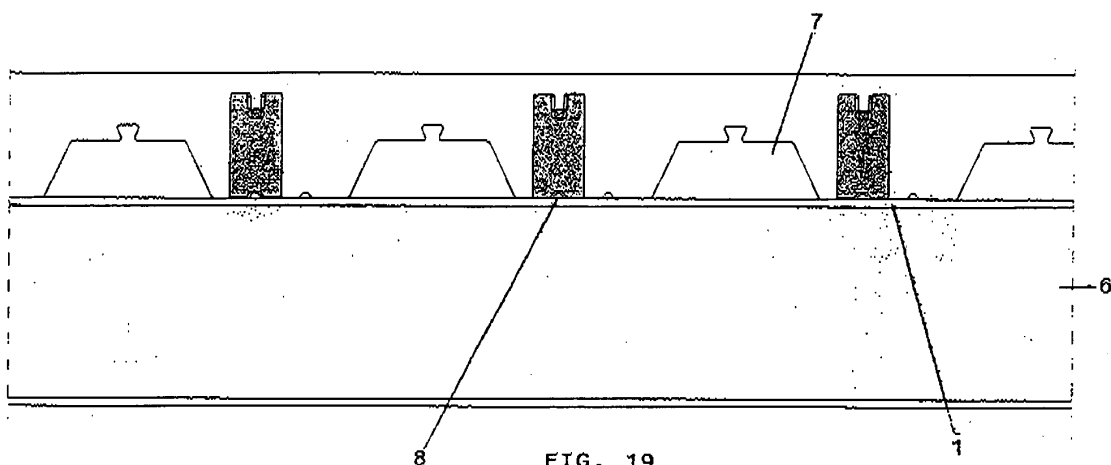


FIG. 19

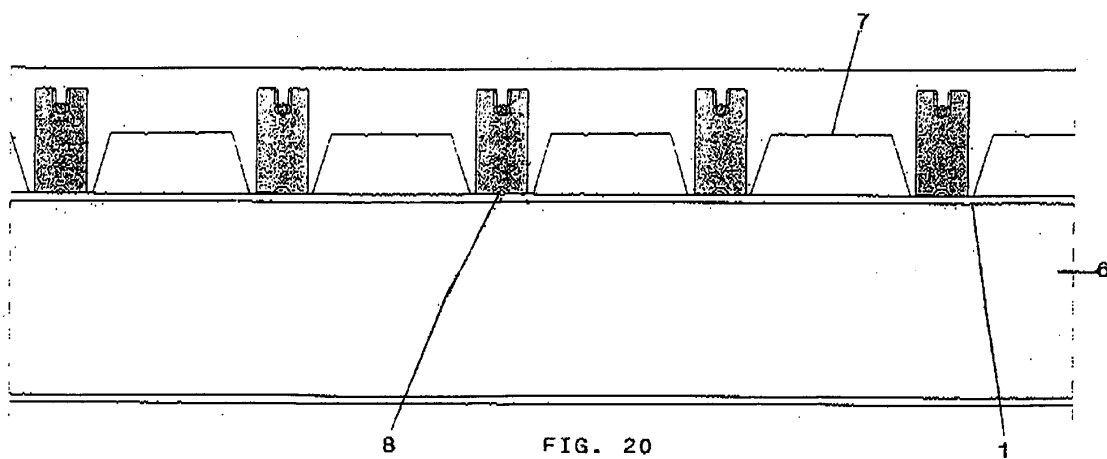


FIG. 20

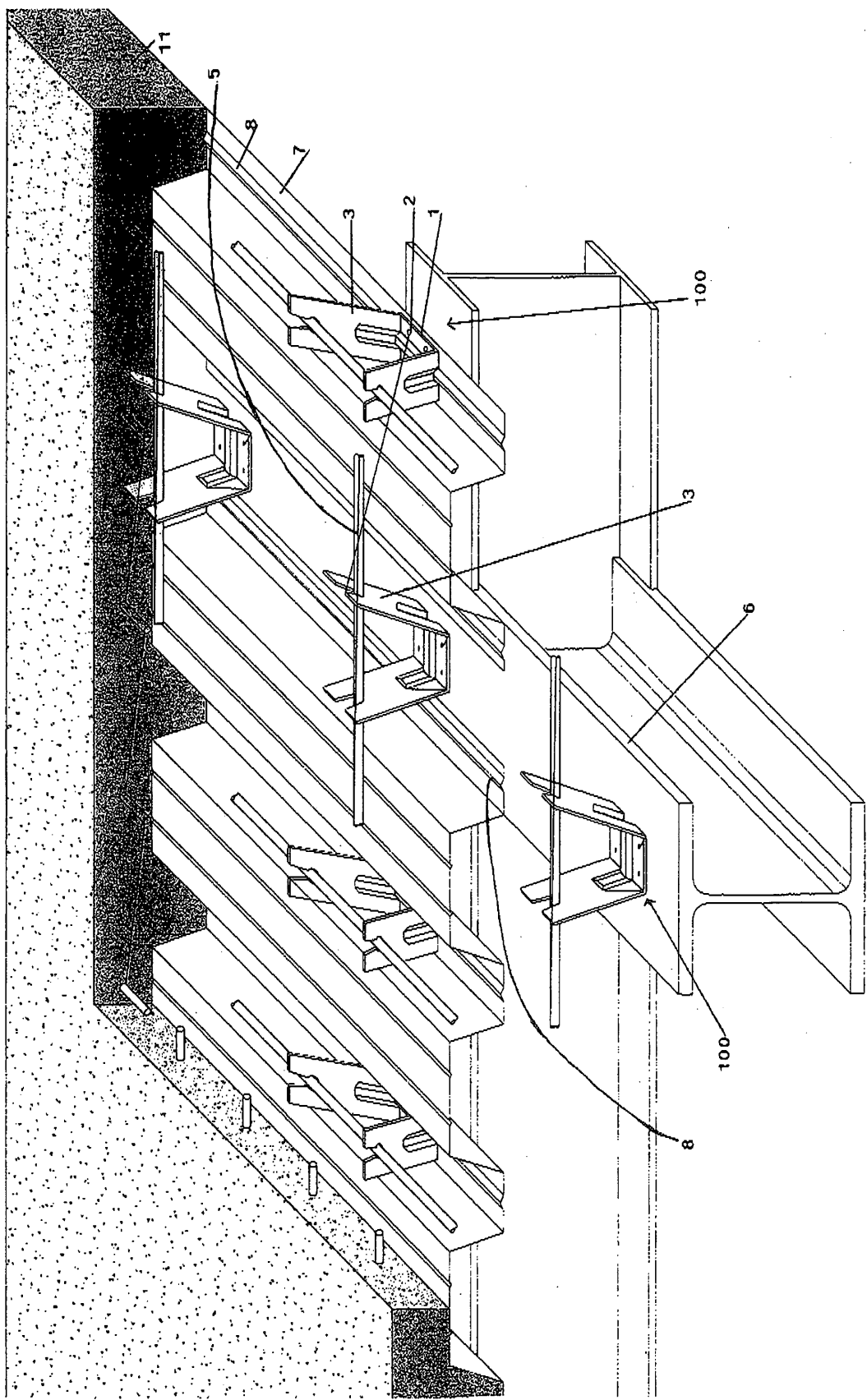


FIG. 21

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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