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(58) Field of search
UK CL (Edition L) E1D DCG DF144 DLEG DLEP
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(54) Concrete slab and a method of fabricating a floor using the concrete slab

(57) A concrete slab has an axis (5) extending between first and second ends (6) of the slab and an upper face (3) having a first set of abutment surfaces (9) arranged to abut against engagement surfaces of an overlying concrete topping to prevent axial slippage at the interface between the slab and the topping.

The concrete slab (1) may be used to form a floor by positioning the concrete slab at the desired location in a building and then casting the concrete topping on top of the slab. The slab acts as shuttering for the concrete topping.

FIG.1.

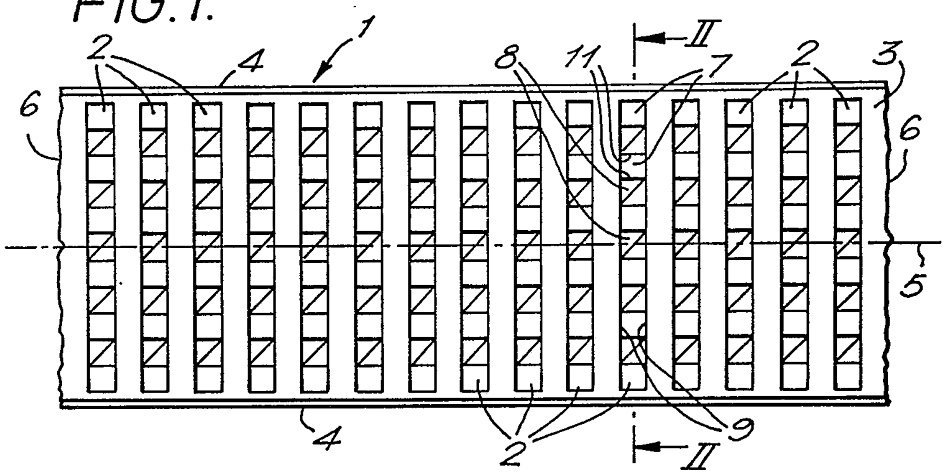
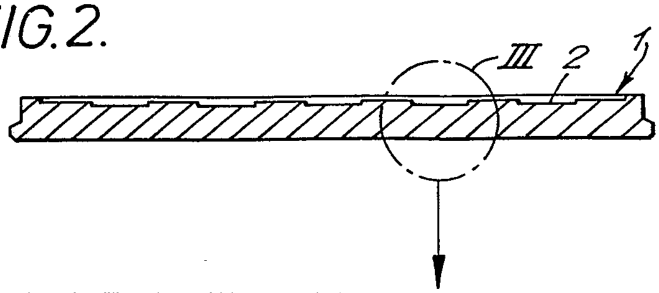


FIG.2.



The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

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FIG.1.

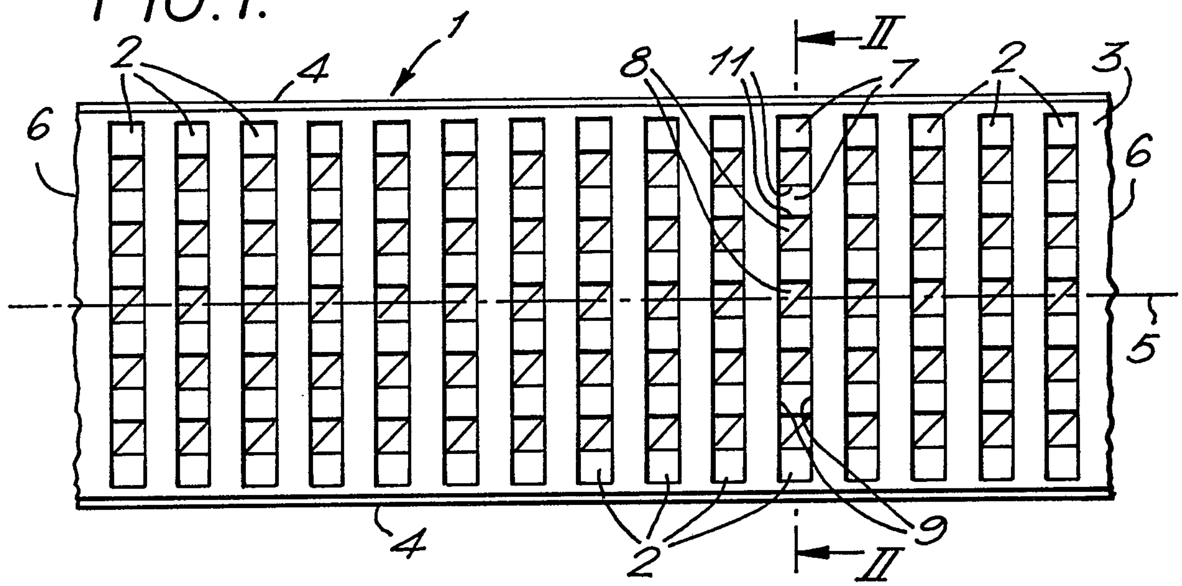


FIG.2.

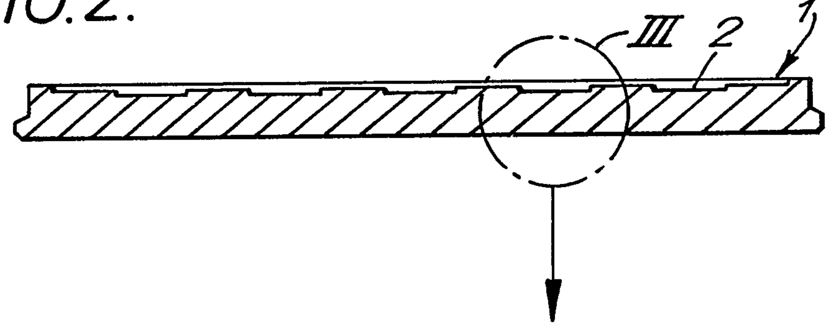
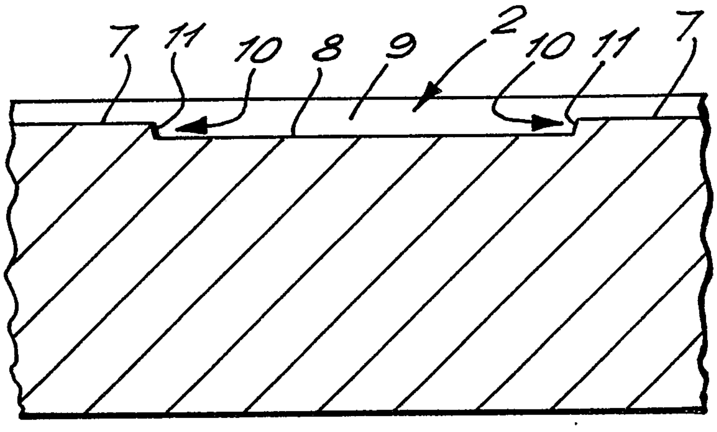


FIG.3.



CONCRETE SLAB AND A METHOD OF FABRICATING A FLOOR USING THE CONCRETE SLAB

The present invention relates to a concrete slab and a method of fabricating a floor by using the concrete slab.

According to a first aspect of the present invention, there is provided a concrete slab having (i) an axis extending between first and second ends of the slab and (ii) an upper face having a first set of abutment surfaces arranged to abut against engagement surfaces of an overlying concrete topping to prevent axial slippage at the interface between the slab and the topping.

The concrete slab may be used to form a floor by positioning the concrete slab at the desired location in a building and then casting the concrete topping on top of the slab. The slab acts as shuttering for the concrete topping. This simplifies the building process and makes the job of building the building quicker and cleaner. Furthermore, as soon as the concrete slab has been positioned in the building, the construction workers have a solid working platform, prior to the concrete topping being cast. Once the concrete topping has set, the construction workers again have a solid working platform. Another advantage is that the concrete slabs can be positioned in the building even when it is, for example, raining. Thus, construction is not delayed by poor weather.

Preferably, each abutment surface of the slab is a side surface of a recess, instead of a side surface of a projection. Consequently, because the shape of the topping conforms to the shape of the upper face of the slab, each engagement surface of the topping will be a side surface of a projection.

Because the abutment and engagement surfaces interlock with one another, the slab and concrete topping function as a single unit and not as two separate units that are capable of sliding axially relative to one another. The resistance to axial flexing of the slab/topping unit that forms the floor is substantially the same as the resistance to axial flexing of a corresponding floor cast entirely in situ.

Usually, each abutment surface is substantially perpendicular to the plane of the slab. This provides good interlocking between the abutment and engagement surfaces.

Preferably, the abutment surfaces are substantially uniformly distributed along the axial length of the slab. This is most easily achieved by having a regular pattern of the abutment surfaces which repeats itself in the direction of the axis of the slab.

Whilst the upper face of the slab may have a single recess that defines all of the abutment surfaces (e.g. a recess which is grid shaped in plan view), it is preferable that the upper face of the slab has a plurality of recesses. Each recess may define a single abutment surface or an opposed pair of abutment surfaces. The second option is more efficient at preventing axial slippage between the slab and topping.

Each abutment surface may extend at least 80% or 90% of the distance between the side edges of the slab. In this way, the slip resisting forces are not excessively concentrated at the middle portion of the width of the slab.

In preferred embodiments, the abutment surfaces are substantially parallel to one another and are also substantially perpendicular to the axis of the slab.

The upper face of the slab may have a second set of abutment surfaces arranged to abut against engagement surfaces of the concrete topping to prevent slippage transverse to the axis of the slab at the interface between the slab and the topping. Usually, each of the second set of abutment surfaces is substantially parallel to the axis of the slab and/or is substantially perpendicular to the plane of the slab.

As with the first set, it is preferable that each of the abutment surfaces of the second set is a side surface of a recess, instead of a side surface of a projection. Consequently, each of the engagement surfaces of the topping which correspond to the second set of abutment surfaces of the slab will be a side surface of a projection.

A recess may provide one or more of the first set of abutment surfaces and one or more of the second set of abutment surfaces. For example, each recess may have an abutment surface of the first set which has a top or bottom edge which incorporates a plurality of steps, each step forming an end of a respective one of a plurality of abutment surfaces of the second set. Preferably, the steps are alternately upwards and downwards. This ensures that the recess does not excessively weaken the slab. Preferably, the steps are substantially uniformly spaced apart along the top or bottom edge, with the spacing being substantially the same as the width of the recess. Furthermore, if the steps are formed in the bottom edge and the upper face has a plurality of recesses, each recess may be spaced from its neighbouring recess or recesses by a spacing which is substantially the same as its own width.

To avoid excessively weakening the slab, it is preferable that the recesses are no deeper than 25% (or even 20% or 10%) of the depth of the slab.

According to a second aspect of the present invention, there is provided a method of fabricating a floor at a desired location in a building, comprising positioning at the desired location a concrete slab having (i) an axis extending between first and second ends of the slab and (ii) an upper face having a first set of abutment surfaces; and casting concrete on top of the slab to form a concrete topping having engagement surfaces against which the abutment surfaces of the slab abut to prevent axial slippage at the interface between the slab and the topping. The present invention also includes the resulting floor.

The invention will now be described by way of a non-limiting example with reference to the accompanying drawings, in which:-

Figure 1 is a plan view of a concrete slab in accordance with the present invention;

Figure 2 is a section along the line II-II of Figure 1; and

Figure 3 is an enlargement of zone III of Figure 2.

A precast planar concrete slab 1 is extruded by a slide-casting machine which incorporates a profiler that produces recesses 2 in the upper face 3 of the slab. Because the slab is produced in a factory remote from the site of the building in which it is to be incorporated, the slab can be manufactured with high precision.

The slab 1 can be manufactured with different lengths and widths. A typical maximum width would be 2.4m and a typical overall depth would be 75mm or 100mm. Each recess 2 extends nearly all of the way between the side edges 4 of the slab and is transverse to (perpendicular to) an axis 5 that runs between the ends 6 of the slab.

Each recess 2 has a width of 100mm and its depth varies along its length in a step-wise manner between a depth of 4 to 6mm and a depth of 8 to 12mm. In Figure 1, for the sake of illustration only, the deeper portions (depth 8 to 12mm) of the bottom surface of each recess are marked with a diagonal line. The portions that are not so marked have the shallower depth of 4 to 6mm.

Figure 2 is a cross-section through a typical recess 2. Figure 3 is an enlargement of zone III of Figure 2. The shallower portions of the recess 2 are labelled with numeral 7 and the deeper portions are labelled with numeral 8. The recess 2 has a pair of opposed side abutment surfaces 9 which are transverse to (perpendicular to) the axis 5 and to the plane of the slab 1. By virtue of the shallower and deeper portions 7, 8 of the recess 2, the bottom edge of each side abutment surface 9 incorporates a plurality of steps 10. These steps 10 enable the recess 2 to incorporate a large number of side abutment surfaces 11 which are parallel to the axis 5 and perpendicular to the plane of the slab.

In use, the concrete slab is transported from the factory where it has been slide cast to the site of the building in which it is to be incorporated. The building may be of the steel frame type. The ends 6 of the slab 1 are positioned on the appropriate supporting steel members of the steel frame of the building.

Once a plurality of slabs 1 have been positioned next to each other, ready to form a floor of the building, a concrete topping is cast in situ on top of all of the slabs 1. The concrete of the concrete topping forms projections which project into the recesses 2 of the slabs. The abutment surfaces 9, 11 of the recesses 2 and the engagement surfaces provided by the projections of the concrete topping abut against each other to mechanically lock together the slabs and the topping. The side abutment surfaces 9 serve to prevent slipping of the topping relative to the slab 1 in directions parallel to the axis 5. The side abutment surfaces 11 serve to prevent slippage between the slab and the concrete topping in directions perpendicular to the axis 5. Thus, the slab and the topping are keyed together in such a way that there is no slippage in any direction at the interface between the two components. The resulting floor therefore acts as an integral unit and is better at resisting flexing than two superimposed components that are not keyed together. Because the concrete topping is poured over a number of slabs 1, it serves to connect together the slabs 1 to form a floor in which the various components act together to support each other. Most of the reinforcement required by the floor (the assembled slabs and concrete topping) can be incorporated in the slabs when they are slide cast in the factory. Generally speaking, the only reinforcement that will be needed on the building site will be a wire mesh that may be simply placed on top of the slabs 1 before the concrete topping is poured. The wire mesh serves to prevent shrinkage cracking of the topping as it dries.

For a concrete slab 1 of overall depth of 75 to 100mm a recommended minimum thickness for the concrete topping is 60mm.

If the concrete topping is poured over a number of slabs 1, the resulting floor slab system is particularly efficient at transmitting horizontal forces to shear resisting elements of the steel frame of the building.

We have conducted tests on a slab system (concrete slab with concrete topping) in accordance with the present invention. Because of the effectiveness of the mechanical locking together of the slab and topping, as achieved by the interengaging projections and recesses, the slab and topping behaved as a single integral unit and no failure occurred at the interface between the slab and the topping during the test. The failure mode was characteristic of an integral slab system.

To achieve this good result, it was significant that the recesses 2 of the slab 1 were uniformly spaced along the length and across the width of the slab. This ensured that the slab and topping were locked together across the entire upper face 3 of the slab. It should be noted that the mechanical interlocking provided by the interengaging recesses and projections is in addition to the surface bonding of the slab to the topping.

The overall slab system (slab plus topping) may be designed, for example, to Class 2 as set out in BS 8110 Part 1 1985 Section 4.3. Alternatively, designs can be to Class 1 or Class 3 as appropriate.

The different shrinkage and creep properties of the slab and topping may be taken into account at the design stage, e.g. when considering the prestressing requirements of the slab.

Apart from wire mesh being positioned on site for incorporation in the concrete topping, single wire bars may be incorporated in the topping in areas that are expected during use of the building to receive high loading or where it is required to ensure moment continuity from one slab to another slab.

CLAIMS

1. A concrete slab having (i) an axis extending between first an second ends of the slab and (ii) an upper face having a first set of abutment surfaces arranged to abut against engagement surfaces of an overlying concrete topping to prevent axial slippage at the interface between the slab and the topping.

2. A concrete slab according to claim 1, wherein each abutment surface of the slab is a side surface of a recess.

3. A concrete slab according to claim 2, wherein the upper face of the slab has a plurality of recesses.

4. A concrete slab according to any of claims 1 to 3, wherein each abutment surface is substantially perpendicular to the plane of the slab.

5. A concrete slab according to any of claims 1 to 4, wherein the abutment surfaces are substantially uniformly distributed along the axial length of the slab.

6. A concrete slab according to any of claims 1 to 5, wherein each abutment surface extends at least 80% of the distance between the side edges of the slab.

7. A concrete slab according to any of claims 1 to 6, wherein the abutment surfaces are substantially parallel to one another.

8. A concrete slab according to any of claims 1 to 7, wherein the upper face of the slab has a second set of abutment surfaces arranged to abut against engagement surfaces of the concrete

topping to prevent slippage transverse to the axis of the slab at the interface between the slab and the topping.

9. A concrete slab according to claim 8, wherein each of the abutment surfaces of the second set is substantially parallel to the axis of the slab and is substantially perpendicular to the plane of the slab.

10. A concrete slab according to claim 8 or 9, wherein each of the abutment surfaces of the second set is a side surface of a recess.

11. A concrete slab according to claim 10, wherein each recess provides one or more of the abutment surfaces of the first set and one or more of the abutment surfaces of the second set.

12. A concrete slab according to claim 11, wherein each recess has an abutment surface of the first set which has a top or bottom edge which incorporates a plurality of steps, each step forming an end of a respective one of a plurality of the abutment surfaces of the second set.

13. A concrete slab according to claim 12, wherein the steps are alternately upwards and downwards.

14. A concrete slab according to claim 12 or 13, wherein the steps are substantially uniformly spaced apart along the top or bottom edge, with the spacing being substantially the same as the width of the recess.

15. A concrete slab according to claim 3 and any of claims 12 to 14, wherein the steps are formed in the bottom edge and each

recess is spaced from its neighbouring recess or recesses by a spacing which is substantially the same as its own width.

16. A concrete slab according to any of claims 1 to 15, wherein each recess is no deeper than 25% of the depth of the slab.

17. A method of fabricating a floor at a desired location in a building, comprising positioning at the desired location a concrete slab according to any of claims 1 to 16; and casting concrete on top of the slab to form a concrete topping having engagement surfaces against which the abutment surfaces of the slab abut to prevent axial slippage at the interface between the slab and the topping.

18. A concrete slab substantially as herein described with reference to, or with reference to and as illustrated in, the accompanying drawings.

Patents Act 1977
xaminer's report to the Comptroller under Section 17 (The Search Report)

Application number

GB 9209186.7

Relevant Technical fields

(i) UK Cl (Edition L) E1D (DCG DF144 DLEG DLEP)

(ii) Int Cl (Edition 5) E04B

Databases (see over)

(i) UK Patent Office

(ii)

Search Examiner

D J LOVELL

Date of Search

12 MAY 1993

Documents considered relevant following a search in respect of claims 1-18

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 1420524 (KONCZ) Note Figure 3	1-5,7-11 17

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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