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(54) **Metal deck for a composite floor and its production method**

(57) The invention relates to metal deck (1) for a composite floor having a profiled cross-section such that in use lower portions (2) of the deck alternate with higher portions (3), which higher and lower portions are connected by sloping portions (4).

According to the invention, above one or more portions of the deck a discontinuous reinforcement strip portion (10) is present that is connected to the deck. The invention also relates to a method for producing such a metal deck.

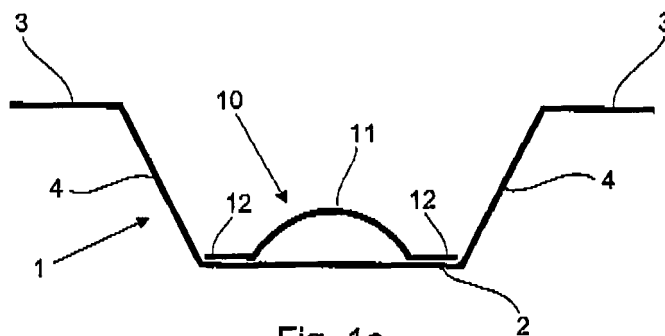


Fig. 1a

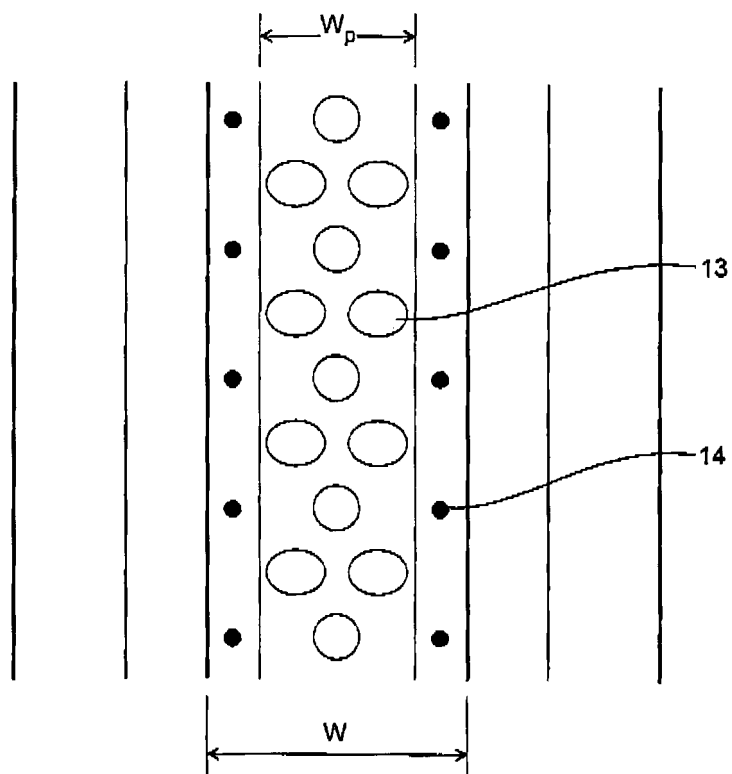


Fig. 1b

Description

[0001] The invention relates to a metal deck for a composite floor having a profiled cross-section such that in use lower portions of the deck alternate with higher portions, which higher and lower portions are connected by sloping portions.

[0002] Such metal decks are in widespread use to form composite floors, which are constructed by first placing the metal deck, on which subsequently concrete is poured. The metal deck usually has been profiled from a flat sheet in a trapezoidal shape, which may be supplemented by dovetail-formed portions. The main design characteristic for the profiled sheet is to provide sufficient stiffness and strength to enable the concrete decking to be poured in situ. Usually, the metal of the deck is steel.

[0003] After curing of the concrete the main purpose of the metal deck is to assimilate the tensile forces which are the result of the mass of the composite floor and the loads applied to the floor. The function of the concrete is to provide sufficient compression strength to counterbalance the weight of the floor and the applied loads, as well as to provide the required resistance to fire.

[0004] To provide an efficient floor-system, the metal deck and the concrete have to interact efficiently so as to transfer shear forces sufficiently.

[0005] At present, shear forces are transferred by equipping metal decks with indentations of various shapes and dimensions to entrap the concrete when it is cured. Shapes and patterns are applied in a wide variety, which have in common that the indentation is formed by a closed surface to entrap a 'concrete-bulge'. With such indentations, deformation, delamination or cracks will be limiting factors in the transfer of forces. Sudden failure of the construction due to failure of interaction between the metal deck and the concrete may be the result.

[0006] It is an object of the invention to provide an improved system for the transfer of shear forces between the metal deck and the concrete.

[0007] It is another object of the invention to provide an improved metal deck for a composite floor to increase the shear forces between the metal deck and the concrete.

[0008] It is a further object of the invention to provide a method for producing an improved metal deck.

[0009] One or more of these objects is reached according to the invention by providing a metal deck for a composite floor having a profiled cross-section such that in use lower portions of the deck alternate with higher portions, which higher and lower portions are connected by sloping portions, wherein above one or more portions of the deck a discontinuous reinforcement strip portion is present that is connected to the deck.

[0010] With a discontinuous reinforcement strip portion according to this invention is meant a strip portion which has openings such that concrete poured on the strip portion will not be hampered in filling the space be-

tween the deck and the strip portion. With the discontinuous reinforcement strip portion according to the invention, a highly improved mechanical interlock between the metal deck and the concrete has been provided. This is mainly due to the multitude of edges formed by the openings in the discontinuous strip portion.

[0011] Preferably, the discontinuous strip portion is a perforated strip portion or a gauzy strip portion or a web-like strip portion. With each of these strip portions, the openings in the strip portion can be made such that the strip portion is permeable for concrete while at the same time strong enough to withstand shear forces.

[0012] The reinforcement strip portion can be present at different sites on the metal deck. A preferred place is above one or more of the lower portions of the deck. The reinforcement strip portion is now present at the largest distance from the neutral plane of the composite floor, where the shear forces are highest. However, it is also possible that the discontinuous strip portion is present above one or more of the corners formed by the sloping portions and the lower portions of the deck, or above one or more of the sloping portions of the deck. This may be advantageous for production reasons. It is also possible that the reinforcement strip portion is present above the higher portions of the metal deck, but here the shear forces will be lower, so the reinforcement strip portion at this position will be less advantageous.

[0013] According to a preferred embodiment the discontinuous strip portion has been produced as a separate reinforcement strip having continuous edge portions in its length direction for connecting the reinforcement strip to the metal deck. In this way it is easy to connect the reinforcement strip to the metal deck using customary connection means. Of course it is possible to use a fully discontinuous strip, but connecting a strip having openings to the metal deck is less easy.

[0014] Preferably the reinforcement strip has been made of metal, and the strip has been connected to the deck by spot welding, resistance welding or tacking. These connecting means appear to be best suited to connect the strip to the metal decking. Other connecting means, such as conventional welding, clinching or riveting will also be possible, but appear less suitable because they are time-consuming. Usually the metal of the reinforcement strip will be steel.

[0015] According to a preferred embodiment the discontinuous strip portion has a curved cross-section so as to form a tunnel together with the deck. The continuous edge portions, if present, can be placed directly against the deck so as to easily connect the reinforcement strip to the deck. The forming of the strip is very easy in this way.

[0016] Preferably, the reinforcement strip comprises one or two flanges along the edge portions of the strip. These flanges are provided so as to protect or shield the discontinuous strip when metal decks are stacked for storage or transport. Without flanges, the discontinuous strip could be compressed and damaged.

[0017] According to another embodiment of the invention, the discontinuous strip portion has been provided in a lower portion and/or a sloping portion of the deck, and a separate continuous strip has been connected under the discontinuous strip portion. The metal deck in this embodiment is in fact formed by the profiled sheet having lower, higher and sloping portions without the discontinuous strip portion, and the separate continuous strip connected to it under the discontinuous strip portion. In this way the metal deck according to the invention may be easier to produce than the metal deck according to the embodiments above, because a flat metal strip can be easily connected to the profiled sheet with perforated or otherwise discontinuous portion.

[0018] Preferably, the discontinuous strip portion is present in the lower portion of the metal deck and has a curved cross-section so as to form a tunnel together with the separate continuous strip. This embodiment is preferred for the same reasons as above.

[0019] According to a second aspect of the invention, the invention provides a method for producing a metal deck for a composite floor having a profiled cross-section such that in use lower portions of the deck alternate with higher portions, which higher and lower portions are connected by sloping portions, wherein a discontinuous reinforcement strip portion is present above one or more portions of the deck and is connected to the deck.

[0020] Using the method, the metal deck according to the first aspect of the invention is made.

[0021] According to a preferred embodiment, the reinforcement strip portion has continuous edge portions which are connected to the deck, or a continuous strip is connected below the discontinuous strip portion of the deck. The continuous edge portions or the continuous strip make it easy to connect the strip to the deck

[0022] Preferably, the reinforcement strip or the continuous strip is a metal strip which is connected by spot welding, resistance welding or tacking. This is the easiest way to produce the metal decks with reinforcement strip.

[0023] The invention also relates to a composite floor comprising the metal deck according to the first aspect of the invention and/or produced according to the method of the second aspect of the invention.

[0024] The invention will now be elucidated referring to the accompanying figures.

Fig. 1a shows a part of a metal deck according to the invention in cross section.

Fig. 1b shows the metal deck according to Fig. 1a in top view.

Fig. 2 shows an different embodiment of the metal deck according to the invention in cross section.

[0025] Fig. 1a shows part of a metal deck 1 for a composite floor having a trapezoidal shape, having a lower portion 2, higher portions 3 and sloping portions 4.

[0026] On the lower portion 2 of the metal deck 1 a reinforcement strip 10 has been placed, consisting of a

perforated track 11 having a width W_p and two edge portions 12 that are not perforated. The total width of the reinforcement strip is W , which can be equal to or smaller than the width of the lower portion 2 of the metal deck. Fig 1b shows the metal deck 1 with the reinforcement strip 10 in top view, with the perforations 13 in the perforated track visible. In the embodiment shown, the reinforcement strip 10 has been connected to the lower portion 2 of the metal deck by spot welds 14.

[0027] The perforated track 11 forms a curved tunnel together with the deck, as shown in Fig. 1a and 2, which tunnel is filled with the concrete when the composite floor is produced. The perforated track 11 is then present in the concrete, and will provide a very good mechanical interlock between the metal deck and the concrete, such that high shear forces can be transferred.

[0028] Fig 2 shows a different embodiment of a metal deck 1 with a reinforcement strip 20. Here, the reinforcement strip 20, which corresponds to the reinforcement strip 10 of Fig. 1, has been provided with flanges 25. These flanges are provided to enable stacking of the metal decks without damaging the perforated track.

[0029] Alternatively (not shown) the perforated track is a perforated portion of the sheet having a trapezoidal shape, and a separate continuous strip is connected to that sheet under the perforated track. The perforated track then has to be formed in an upward curve.

[0030] It will be apparent to the person skilled in the art that many other embodiments of the invention are possible. For instance, it is possible to place the reinforcement strip in the corners formed by the sloping portions 4 and the lower portion 2, or above the sloping portions 4 itself. Instead of a curved tunnel, the reinforcement strip can for instance form a rectangular or trapezoid or triangular tunnel together with the lower portion of the metal deck. The perforations in the track may be replaced by a gauze or a web. Instead of spot welding, the reinforcement strip can be connected to the metal deck for instance by resistance welding or tacking.

Claims

1. Metal deck for a composite floor having a profiled cross-section such that in use lower portions of the deck alternate with higher portions, which higher and lower portions are connected by sloping portions, **characterised in that** above one or more portions of the deck a discontinuous reinforcement strip portion is present that is connected to the deck.
2. Metal deck according to claim 1, wherein the discontinuous strip portion is a perforated strip portion or a gauzy strip portion or a web-like strip portion.
3. Metal deck according to claim 1 or 2, wherein the discontinuous strip portion is present above one or more of the lower portions of the deck.

4. Metal deck according to claim 1 or 2, wherein the discontinuous strip portion is present above one or more of the corners formed by the sloping portions and the lower portions of the deck. 5
5. Metal deck according to claim 1 or 2, wherein the discontinuous strip portion is present above one or more of the sloping portions of the deck. 5
6. Metal deck according to any one of the preceding claims, wherein the discontinuous strip portion has been produced as a separate reinforcement strip having continuous edge portions in its length direction for connecting the reinforcement strip to the metal deck. 10
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7. Metal deck according to claim 6, wherein the reinforcement strip has been made of metal, and the strip has been connected to the deck by spot welding, resistance welding or tacking. 20
8. Metal deck according to any one of the preceding claims, wherein the discontinuous strip portion has a curved cross-section so as to form a tunnel together with the deck. 25
9. Metal deck according to any one of the claims 6-8, wherein the reinforcement strip comprises one or two flanges along the edge portions of the strip. 30
10. Metal deck according to any one of the claims 1 - 5, wherein the discontinuous strip portion has been provided in a lower portion and/or a sloping portion of the metal deck, and a separate continuous strip has been connected under the discontinuous strip portion. 35
11. Metal deck according to claim 10, wherein the discontinuous strip portion is present in the lower portion of the metal deck and has a curved cross-section so as to form a tunnel together with the separate continuous strip. 40
12. Method for producing a metal deck for a composite floor having a profiled cross-section such that in use lower portions of the deck alternate with higher portions, which higher and lower portions are connected by sloping portions, **characterised in that** a discontinuous reinforcement strip portion is present above one or more portions of the deck and is connected to the deck. 45
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13. Method according to claim 12, wherein the reinforcement strip portion has continuous edge portions which are connected to the deck, or wherein a continuous strip is connected under the reinforced strip portion in the deck. 55
14. Method according to claim 12 or 13, wherein the reinforcement strip or the continuous strip is a metal strip which is connected by spot welding, resistance welding or tacking.
15. Composite floor comprising a metal deck according to any one of the claims 1 - 11 and/or produced according to the method of any one of claims 12 -14,

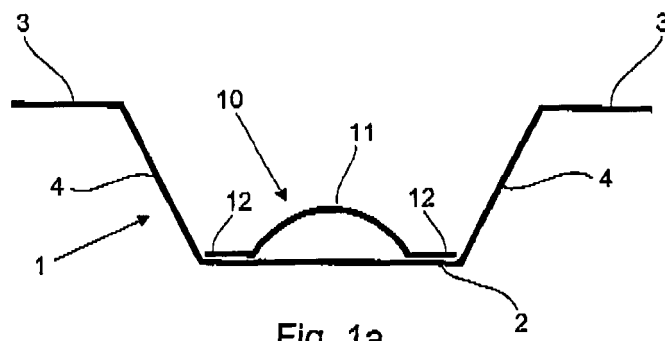


Fig. 1a

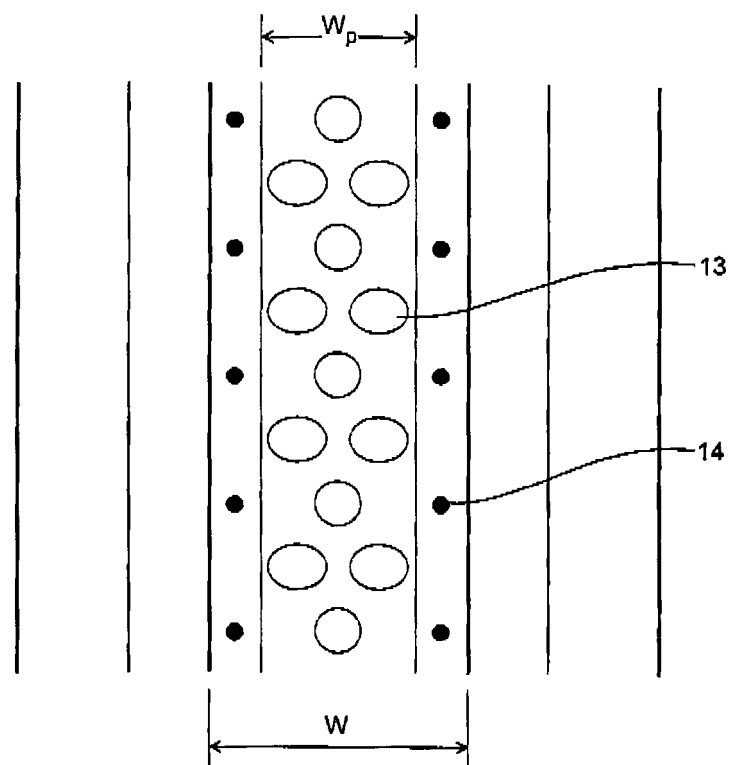


Fig. 1b

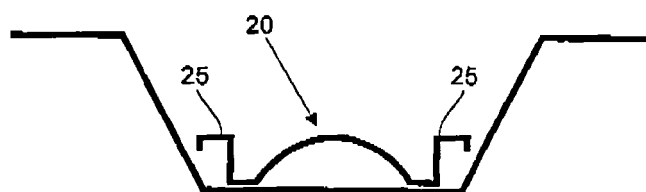


Fig. 2



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 05 07 7174

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 1 094 581 A (H. H. ROBERTSON COMPANY) 13 December 1967 (1967-12-13) * figure 16 *	1-10, 12-15	E04B5/40
X	----- US 3 397 497 A (SHEA YALE R ET AL) 20 August 1968 (1968-08-20) * figure 7 *	1-10, 12-15	
X	----- US 3 245 186 A (JENTOFT ARTHUR P) 12 April 1966 (1966-04-12) * column 7, lines 2-5; figures 4,10 *	1,3, 6-10, 12-15	
X	----- DE 19 54 684 A1 (SIEGENER AKTIENGESELLSCHAFT GEISWEID, EISENKONSTRUKTION, BRUECKENBAU, VE) 6 May 1971 (1971-05-06) * claim 6; figures 1-5 *	1,3,7, 12,14	
			TECHNICAL FIELDS SEARCHED (IPC)
			E04B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 1 December 2005	Examiner Rosborough, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 05 07 7174

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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01-12-2005

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