Feb. 18, 1969

F. G. CACOSSA

3,427,771

ROOF DECK SYSTEM

Filed Feb. 11, 1966

Fig. 1.

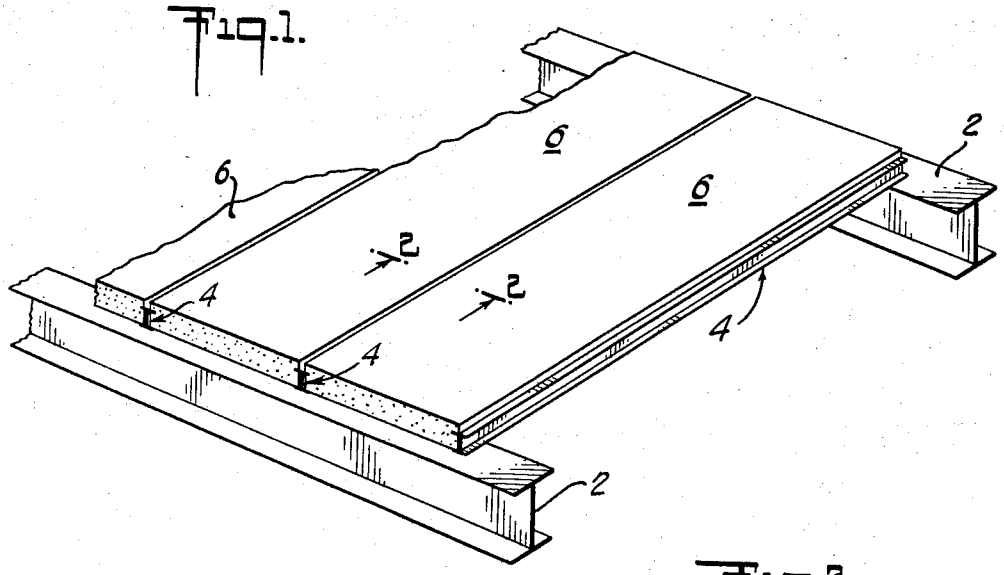


Fig. 2.

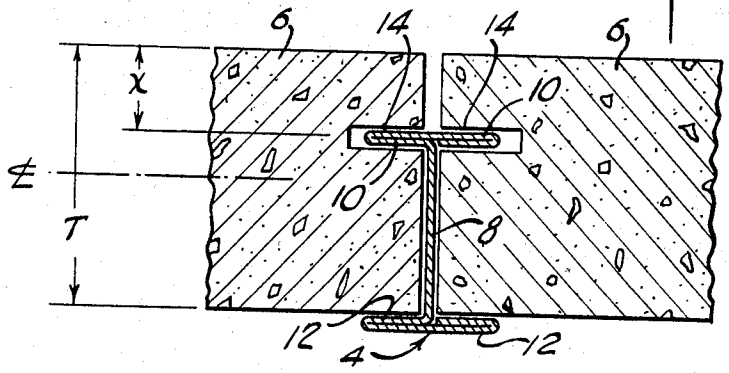
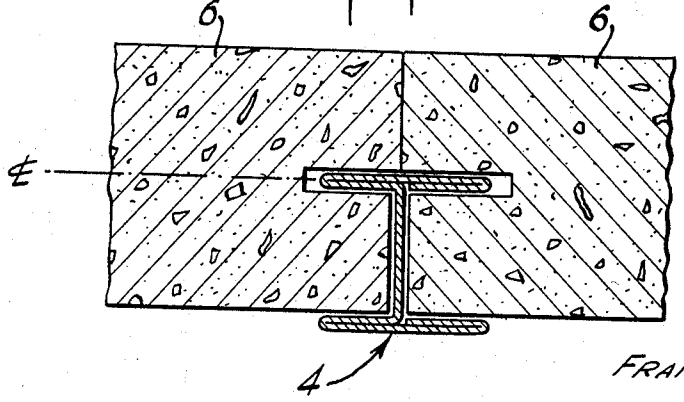


Fig. 3.



INVENTOR.
FRANK G. CACOSSA

BY Julian L. Tomaselli
ATTORNEY

United States Patent Office

3,427,771

Patented Feb. 18, 1969

3,427,771

ROOF DECK SYSTEM

Frank G. Cacossa, Livingston, N.J., assignor to The Flintkote Company, New York, N.Y., a corporation of Massachusetts

Filed Feb. 11, 1966, Ser. No. 526,897

U.S. Cl. 52—262 4 Claims

Int. Cl. E04b 5/10, 5/52, 1/40

ABSTRACT OF THE DISCLOSURE

A roof deck system in which metal I-beams are used together with panels made of a mixture of Portland cement and wood fibers. The upper flanges of the beams fit tightly into grooves cut into the edges of abutting panels, and the bottom edges of the panels rest on the bottom flanges of the beams. The edges of adjoining panels are close together so that grouting of the seams is not required. The roof deck has improved strength and ease of installation.

This invention relates to improvements in gypsum or portland cement decks to permit longer allowable clear spans and greater economy of construction for given design loads.

One of the most widely used forms of modular industrial roof decking comprises metal bulb-T sub-purlins supporting planks consisting of bonded wood fibers and Portland cement. Typically the joints between planks are grouted, and the deck is finally covered by roofing felt and asphalt. The main standard width of planks is 32 inches, and they are supplied in thicknesses ranging from one to three inches and lengths from 48 to 108 inches. A familiar plank of the character described is manufactured by The Flintkote Company under the trademark "Insulrock."

Well known advantages of Portland cement-wood fiber decks include high fire resistance rating, moisture and fungi resistance, light weight, acoustical and thermal insulation, and attractive appearance.

In the design of a modular deck system, the architectural engineer usually strives for maximum "clear spans" (the spacing of supporting joists running normal to the sub-purlins and plank lengths) in the interests of appearance and of simplicity and economy of construction. Starting with a standard plank width and a specified total design load per square foot from tables and calculations supplied by the manufacturer the engineer can develop various combinations of bulb-T sub-purlin specifications and allowable clear spans. Generally speaking, the longer the allowable span, the higher the weight and cost of subpurins per lineal foot. A criterion of the so-called "allowable span" is that the bulb-T sub-purlin will not deflect more than a certain fraction of the span under the total load; for purposes of this discussion that fraction may be considered to be between $\frac{1}{180}$ and $\frac{1}{240}$ of the span.

In present deck systems the overall live load carrying capacity has been considered without regard to any contribution to the beam strength of the deck planks themselves. Tests have shown that the load carrying capacity of a module of planking supported by bulb-T sub-purlins is not significantly greater than the load-bearing capacity of the bulb-T's alone. This evidences a lack of "composite action," or contribution, between the planks and supporting structure.

If a system is developed wherein its load carrying capacity reflects a cooperation between the supporting framework and deck planks to afford a capacity greater than that of the framework members alone, greater spans will be allowed and economy can be realized by using lighter sub-purlins.

In accordance with this invention a deck system is provided which attains the above-discussed objects and advantages as well as affording other incidental advantages. In brief, this invention resides in a light gauge metal sub-purlin having a broad I-shaped cross-section, in conjunction with a plank-edge construction wherein a longitudinal groove therein loosely receives an upper flange of the I and the lower corner edge rests on the lower flange. Tests have shown that this system can support loads, without exceeding the permitted deflection-to-span ratio, which are much greater than the capacity of the broad I-shaped sub-purlin itself. The groove in the plank edge preferably is slightly deeper than the width of each flange and extends approximately midway between the upper and lower plank surfaces. Therefore, adjacent planks are in closely spaced or abutting relation over the sub-purlins and the need for grouting is avoided. Also, better insulation is provided above the highly heat conductive metal sub-purlin, because half the thickness of the planking extends over the upper flanges thereof.

In the prior art, there have been several proposals to incorporate metal channel members with the edges of cementitious wallboard or planking for a variety of reasons. Typically a tongue and groove construction has been contemplated, involving incorporation of the metal reinforcement in the course of manufacture. However, the cost of manufacturing such structures is prohibitively high. It also has been known to support panels through means of metal channels at their edges, but this has been mostly in connection with non-load-bearing ceilings. In prior art load-bearing structures generally, all theory has necessarily concluded that the sole load supporting strength was attributable to the metal framework. This is specifically exemplified in the patent to Davis, No. 1,900,-805, wherein the flanges of an I-beam completely encompass the edges of adjoining gypsum board panels. No single prior art structure has afforded both the structural strength and the other advantages of the present invention.

The invenion will now be more specifically described by reference to the accompanying drawings, in which:

FIGURE 1 is a perspective view of a few sections of a roof deck system constructed according to this invention;

FIGURE 2 is a cross-section taken as indicated by lines 2—2 in FIGURE 1; and

FIGURE 3 is a similar cross-sectional view of a slightly modified embodiment of the invention.

FIGURE 1 discloses in perspective a few modules of an overall roof deck system embodying this invention. Conventional joists **2** are spaced according to factors of design total loading and the strength of the system, as discussed previously. Cold rolled steel sub-purlins, generally indicated by the numeral **4**, spans the joists **2** and support planks or panels **6** of the type previously discussed, namely, comprising Portland cement and wood fibers. The spacing of sub-purlins **4** is dictated by the standard widths of the planks **6**. The planks contemplated for use in this system are one, two or three inches in thickness.

Referring to FIGURE 2, it will be seen that the sub-purlin **4** is I-shaped, comprising a web **8**, upper flanges **10**, and lower flanges **12**. The I-beam material comprises cold-rolled approximately .048 inch sheet steel, and it is bent as shown in FIGURE 2 to the final shape. The thickness of the planks **6** is indicated as T. At a distance x below the upper surface of the planks a groove **14** is cut therein. The width and depth of this cut can be the same or slightly greater than the thickness and width of each upper flange **10**. The tightness of fit between the upper flanges and the groove **14** has not thus far been indicated to be critical as an effect on capacity. The dimension x preferably is between $\frac{3}{8}$ and $\frac{5}{8}$ of the thickness T, it being preferable (as shown in FIGURE 3) to place the groove

14 and upper flanges 10 near the center of the plank thickness.

In preliminary tests conducted on the components of the system described, the planks 6 and sub-purlins 4 were tested for load capacity separately and then in assembled relation In ordinary metal bulb-T or channel sub-purlin systems, the load-bearing capacity of the assembled system (within allowable deflection ratios) is not significantly greater than the capacity of the sub-purlins. In the presently disclosed system, however, initial tests have indicated that the total load-bearing capacities of the components can be expected to be significantly additive.

By comparison to a conventional metal sub-purlin system designed to sustain a given design load and for a given allowable clear span, in the present system the weight of the sub-purlin is sufficiently less as to result in very substantial cost savings.

An additional advantage of this system is that over each sub-purlin there is a layer of insulation of thickness *x*, and any need for grouting is lessened or eliminated. If desired, as shown in FIGURE 3, the edges of the planking above the level of the grooves 14 can be designed to protrude slightly to achieve fully abutting relation.

It will be recognized that this system can be installed quickly and easily by workers at the installation site. The system furthermore does not require special, expensive manufacturing techniques to incorporate a metal structure in the deck planks.

Various departures from the specifically disclosed embodiments of this invention can be effected without departing from the scope thereof as defined by the following claims.

What is claimed is:

1. A roof deck system comprising, in combination, a plurality of beams each having a generally I-shaped cross-section and in which each of said beams is formed of relatively thin rolled and bent sheet metal resting upon spaced roof support members inclined at a substantial angle with respect to vertical, each of said beams having upper and lower pairs of flanges, a plurality of integral panels made of a mixture of cementitious and fibrous materials, each panel having a length and width which are substantially greater than its thickness, each of said

panels having a groove along an edge, the width of said groove being substantially equal to the thickness of one of said upper flanges of said beam, the depth of said groove being at least as great as the width of said upper flange of said beam, said panels being fitted together with grooved edges in substantial abutment with one another and with one of said beams between said edges with its upper flanges fitted into the grooves in the adjacent edges of said panels and substantially in contact with the walls of said grooves, and with the bottom edges of said panels resting upon said lower flanges of said beams.

2. A roof deck system as in claim 1 in which said fibrous material comprises wood particles and said cementitious material comprises portland cement.

3. A roof deck system as in claim 1 in which said groove is located in each of said panels in a plane between the centerline and the uppermost surface of said panel.

4. A roof deck system as in claim 1 in which said panels have one of said grooves in each of two opposed edges, with one of said beams engaging the groove at each of said edges, in which the distance from the bottom of each of said panels to the groove in its edge is approximately equal to the distance between the upper and lower flanges of said beam, in which said groove is located in each of said panels in a plane between the centerline and the uppermost surface of said panel.

References Cited

UNITED STATES PATENTS

968,512	8/1910	Prary	52—490 X
1,433,826	10/1922	Kane	52—490
1,857,490	5/1932	Barrett	52—435
2,093,108	9/1937	Davis	52—483
2,165,336	7/1939	Brogden	52—586 X
1,501,563	7/1924	Lawrence	52—573 X

FOREIGN PATENTS

1,068,482	2/1954	France.

ALFRED C. PERHAM, *Primary Examiner.*

U.S. Cl. X.R.

52—91, 488, 496, 497