May 23, 1967 S. A. FORSYTHE ETAL 3,320,704

ROOF DECK AND METHOD OF CONSTRUCTION

Filed May 21, 1964 2 Sheets-Sheet 1

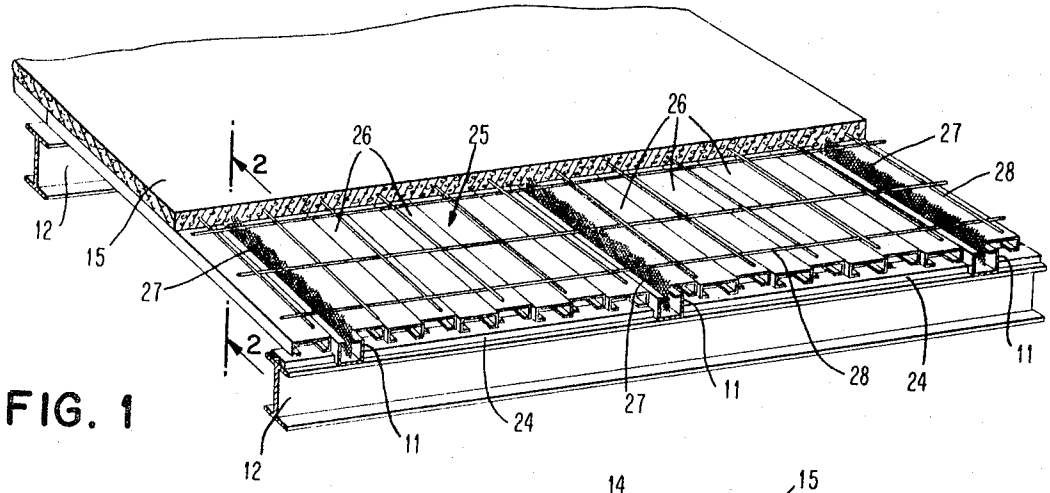


FIG. 1

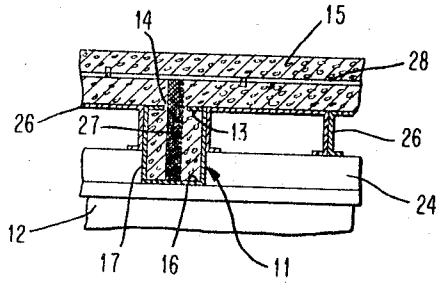
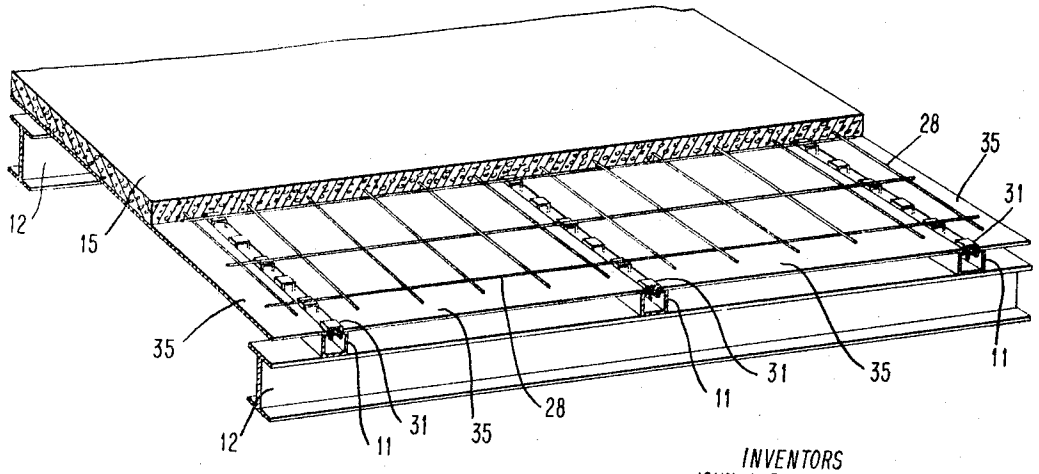


FIG. 2

FIG. 3



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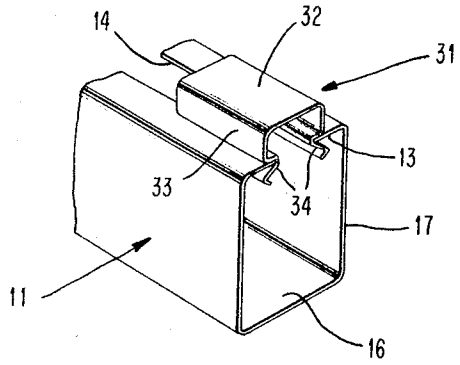
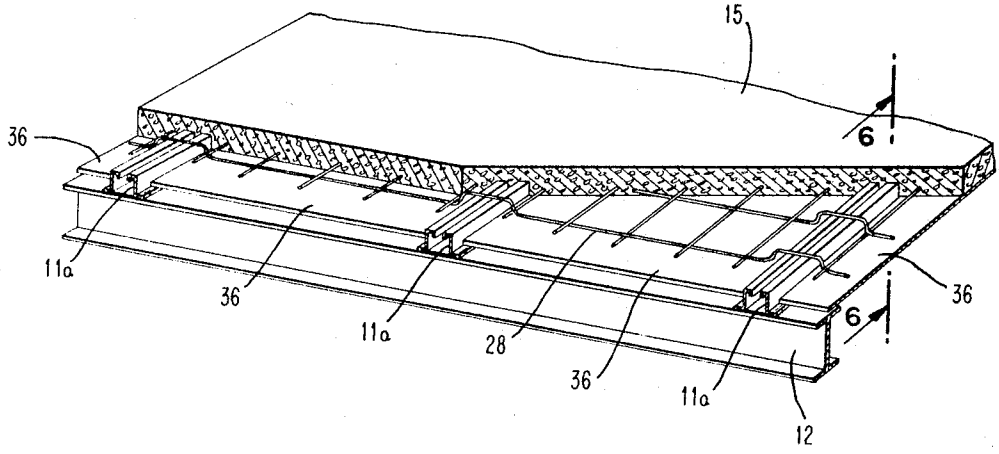


FIG. 4

FIG. 5



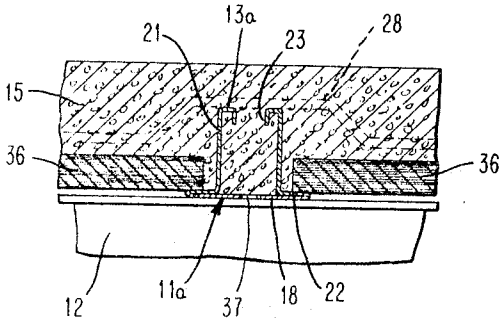


FIG. 6

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ROOF DECK AND METHOD OF CONSTRUCTION

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This invention relates to building construction, and more particularly concerns a roof deck and method of constructing it.

The conventional method of constructing a reinforced poured gypsum concrete roof deck is to weld a series of bulb-T sub-purlins on top of a series of I-beam purlins to form a grid. Gypsum formboards are placed on the flanges of the sub-purlins, and wire mesh is placed over the formboards and grid. Then gypsum concrete is poured over the assembly, the top of the gypsum concrete is screeded to form a smooth surface, and the gypsum concrete is allowed to dry.

It is an object of this invention to provide an improved roof deck, and a method of constructing it. It is another object to provide a roof deck that is stronger, less expensive, permits longer spans between main roof purlins, and is quickly and safely constructed.

Other objects and advantages of this invention, including its simplicity and economy, as well as the ease with which it may be adapted to existing equipment, will further become apparent hereinafter and in the drawings, in which:

FIG. 1 is a view in perspective and partly in section of a roof deck and form assembly constructed in accordance with this invention;

FIG. 2 is a view in section of the assembly of FIG. 1 taken as indicated by the lines and arrows 2—2 which appear in FIG. 1;

FIG. 3 is a view in perspective and partly in section of another embodiment of the roof deck of this invention;

FIG. 4 is an enlarged view in perspective of the sub-purlin and guide clip which form elements of the embodiment of FIG. 3;

FIG. 5 is a view in perspective and partly in section of another embodiment of the roof deck in the invention; and

FIG. 6 is a view in section of the roof deck of FIG. 5 taken as indicated by the lines and arrows 6—6 which appear in FIG. 5.

Although specific terms are used in the following description for clarity, these terms are intended to refer only to the structure shown in the drawings and are not intended to define or limit the scope of the invention.

Turning now to the specific embodiments of the invention selected for illustration in the drawings, there is shown a roof deck comprising a series of sub-purlins 11 (designated 11*a* in FIG. 5 and 6) welded to the top of a series of I-beam purlins 12 to form a grid, sub-purlins 11 being hollow and having a pair of inwardly facing top flanges 13 forming a slot 14 therebetween, and gypsum concrete filling the sub-purlins 11 and extending through slots 14 and between sub-purlins 11 to form a monolithic structure.

Sub-purlins 11 (FIGS. 1–4) have a bottom wall 16 and a pair of side walls 17. Sub-purlins 11*a* (FIGS. 5–6) have a bottom wall 18 and a pair of side walls 21, with a pair of bottom flanges 22 extending outwardly from bottom wall 18, and a pair of downwardly extending flanges 23 depending from the inside edges of top flanges 13*a* which form slot 14 therebetween.

Referring now to the embodiment of the invention illustrated in FIGS. 1 and 2, there is shown a roof deck and form assembly which comprises a series of box section sub-purlins 11 welded to the top of a series of purlins 12 to form a grid, with sub-purlins 11 having the inwardly facing top flanges 13 forming slot 14 therebetween. Removable form supports 24, which may be one inch high plywood planks, are positioned on top of purlins 12. On top of supports 24, demountable forms 25 are positioned and extend between sub-purlins 11 and are in snug contact therewith. Forms 25 may be made of individual form elements 26, and may be 20 gauge aluminum stud channels covered with a non-sticky coating.

Cradles of expanded metal lath strips 27, which are corrugated, are vertically positioned in sub-purlins 11 and extend through slots 14. Wire mesh 28 is supported on the cradles of lath strips 27, and gypsum concrete 15 fills sub-purlins 11 and extends through slots 14 and on top of demountable forms 25 and imbeds wire mesh 28 and lath strips 27 to form a monolithic structure. Form supports 24 and demountable forms 25 are removable after the gypsum concrete hardens.

The method of constructing a roof deck in accordance with the present invention comprises the steps of connecting the series of sub-purlins 11 on top of the series of purlins 12 to form a grid, putting forms in place between sub-purlins 11, and pouring gypsum concrete 15 on top of the forms and sub-purlins 11 so that the gypsum concrete passes through slots 14 and fills the sub-purlins and covers the forms and sub-purlins, with the gypsum concrete in the sub-purlins and in the slots and on top of the sub-purlins and forms being one unitary element of the roof deck.

Referring to FIGS. 1 and 2, the method of constructing the roof deck shown comprises the steps of welding the box section sub-purlins 11 on top of the purlins 12 to form a grid. Form supports 24 are placed on top of purlins 12, and demountable form elements 26 are placed on top of supports 24 to make a demountable form 25 extending between the sub-purlins 11. The individual form elements 26 allow for different spacing between sub-purlins 11.

Next, cradles of expanded metal lath strips 27, which are corrugated, are placed in box section sub-purlins 11 so that the cradles extend upwardly through slots 14. Wire mesh 28 is placed on top of the cradles.

Gypsum concrete 15 is poured on top of forms 25 and into the sub-purlins 11 so that it passes through slots 14 and fills the box section and covers forms 25 and the top of sub-purlins 11 and imbeds wire mesh 28 and lath strips 27. The top of the poured gypsum concrete is screeded to obtain a smooth surface, and the gypsum concrete is allowed to harden.

After hardening, the form supports 24 are removed, thereby dropping forms 25 onto purlins 12. Forms 25 may be slid ahead into position in another section of roof deck to be constructed.

FIGS. 3 and 4 show a roof deck which comprises a series of box section sub-purlins 11 welded to the top of a series of purlins 12 to form a grid. Guide clips 31 are positioned in slots 14 and extend upwardly therefrom.

Guide clips 31 are made of resilient material, and include a top wall 32 and side walls 33 which have a hook portion 34 which hooks around the opposed edges of flanges 13 of sub-purlins 11. Guide clips 31 are spaced along slots 14 of sub-purlins 11, and formboards 35 are positioned on top of flanges 13 and are aligned by guide clips 31 so that slots 14 are not covered by the formboard.

Gypsum concrete 15 fills the box section sub-purlins 11 and extends through slots 14 and covers formboards 35 and the sub-purlins to form a monolithic structure, and wire mesh 28 and the guide clips 31 are imbedded in the concrete.

The method of constructing the roof deck shown in FIGS. 3 and 4 comprises the steps of welding the sub-purlins **11** on top of purlins **12** to form a grid, placing guide clips **31** every three to four feet along the slot **14** of each sub-purlin **11**, and putting formboards **35** in place on top of top flanges **13** and aligning them with the guide clips 31 so that the slots **14** remain open. Then wire mesh **28** is placed over formboards **35** and the sub-purlins **11**, and gypsum concrete is poured on top of the assembly. The formboards **35** remain in place and become part of the roof deck.

The roof deck of FIGS. 5 and 6 comprises a series of sub-purlins **11***a* welded to the top of a series of purlins **12** to form a grid, formboards **36** positioned on top of bottom flanges **22** so that the formboards **36** are positioned between and supported by the sub-purlins **11***a*, and gypsum concrete **15** filling sub-purlins **11***a* and extending through slots **14** and covering the formboards **36** and sub-purlins **11***a* to form a monolithic structure. Wire mesh **28** is imbedded in the gypsum concrete above sub-purlins **11***a* and formboards **36**.

The method of constructing the roof deck illustrated in FIGS. 5 and 6 comprises steps of welding sub-purlins **11***a* to purlins **12**, putting formboards **36** in place on top of the bottom flanges **22** of sub-purlins **11***a* so that the formboards **36** are positioned between and supported by the sub-purlins **11**, placing wire mesh **28** over formboards **36** and sub-purlins **11***a*, and pouring gypsum concrete on top of the assembly. Weepholes **37** are spaced along the bottom of the sub-purlins to permit the escape of excess water.

The box section sub-purlins **11** and the high hat sub-purlins **11***a* are much lighter in weight than the conventional bulb-T sub-purlin, yet the roof deck of the present invention is considerably stronger than conventional roof decks wherein bulb-T sub-purlins are used. The pouring of the gypsum concrete into the hollow box section with its overhanging top flanges **13**, and through the slots **14** and over the formboards gives a composite action to the roof deck structure. There is an interlocking effect and the entire assembly is reinforced.

The greater strength of the roof deck of the present invention permits longer spans between sub-purlins than in conventional roof decks, making the inventive roof deck less expensive.

The demountable form embodiment of the invention shown in FIGS. 1 and 2 is much safer for the workman than the conventional roof deck. Conventionally, the workman had to step on the bulb-T sub-purlins while working on the roof since the plasterboard formboards would not support his weight, whereas in the roof deck of FIGS. 1 and 2, he may step on the demountable forms **25**.

Another advantage of the roof deck of FIGS. 1 and 2 is that it saves four pounds per square foot of dead weight in the roof, because it eliminates the use of a sheet rock formboard which weighs two pounds per square foot, and also permits the use of a slab of gypsum concrete which is one and one-half inches in height, instead of a two inch high gypsum concrete slab required by the bulb-T in order to prevent the bulb-T from projecting out of the slab, thereby saving another two pounds per square foot.

Demountable form elements **26** are an advantage because they may be placed individually so as to nest and fit themselves snugly between the sub-purlins to prevent the gypsum from pouring through. Also, the distance between sub-purlins may not be uniform and individual form elements allow for using the number of form elements which fit the space. However, demountable forms **25** may be one piece or may be laminated, or may be of honeycomb construction, if desired.

In conventional construction of roof decks using bulb-T sub-purlins, the metal of the bulb-T expands and contracts in response to heat variations, and sometimes cracks the concrete slab, since the top of the bulb-T is within one-half inch of the top surface of the concrete. Such cracking does not occur with the roof deck of the present invention.

Sub-purlins **11** and **11***a* are lighter in weight than conventional bulb-T sub-purlins, and are therefore easier to handle and more quickly placed in position. Moreover, they are made of mild steel which is more easily welded to the purlins.

It is to be understood that the form of the invention herewith shown and described is to be taken as a presently preferred embodiment. Various changes may be made in the shape, size and arrangement of parts. For example, equivalent elements may be substituted for those illustrated and described herein, parts may be reversed, and certain features of the invention may be utilized independently of the use of other features, all without departing from the spirit or scope of the invention as defined in the subjoined claims.

What is claimed is:

1. A method of constructing a roof deck comprising connecting a series of sub-purlins on top of a series of purlins to form a grid, said sub-purlins being hollow and having a top wall with a pair of inwardly extending flanges forming a slot therebetween, putting forms in place between said sub-purlins, and pouring gypsum concrete on top of the forms and sub-purlins so that the gypsum concrete passes through said slots and fills the sub-purlins and covers the forms and sub-purlins, with the gypsum concrete in the sub-purlins and in said slots and on top of the sub-purlins and forms being one unitary element of the roof deck, allowing the gypsum concrete to harden, and moving the forms ahead into position in another section of roof deck to be constructed, said moving being done from on top of the grid.

2. A method of constructing a roof deck comprising the steps of welding a series of box section sub-purlins on top of a series of purlins to form a grid, said box section sub-purlins having a bottom wall and a pair of side walls and a pair of inwardly facing top flanges forming a slot therebetween, placing removable form supports on a section of said purlins, placing demountable forms on top of said supports and extending between said sub-purlins and in snug contact therewith, the sub-purlins being made of resilient material so as to give when the forms are pushed against the side walls, pouring gypsum concrete on top of the forms and into the sub-purlins so that the gypsum concrete passes through the sub-purlin slots and fills the box section sub-purlins and covers the forms and sub-purlins, with the gypsum concrete in the box section sub-purlins and in said slots and on top of the sub-purlins and forms being one unitary element of the roof deck, allowing said gypsum concrete to harden, removing said form supports and thereby dropping the forms onto the purlins, and moving the forms ahead into position in another section of roof deck to be constructed, said moving being done from on top of the grid.

3. A method of constructing a roof deck comprising the steps of welding a series of box section sub-purlins on top of a series of purlins to form a grid, said box section sub-purlins having a bottom wall and a pair of side walls and a pair of inwardly facing top flanges forming a slot therebetween, placing removable form supports on said purlins, placing demountable form elements on top of said supports to make a demountable form extending between said sub-purlins, placing cradles of expanded metal lath strips in the box section sub-purlins so that said cradles extend through said slots, placing wire mesh on said cradles, pouring gypsum concrete on top of the forms and into the sub-purlins so that the gypsum concrete passes through the sub-purlin slots and fills the box section sub-purlins and covers the forms and top of the sub-purlins and imbeds the wire mesh and lath strips, with the gypsum concrete in the box section sub-purlins and in said slots and on top of the sub-purlins and forms

being one unitary element of the roof deck, screeding the top of the poured gypsum concrete to obtain a smooth surface, allowing said gypsum concrete to harden, removing said form supports and thereby dropping the forms onto the purlins, and sliding the forms ahead into position in another section of roof deck to be constructed.

4. A method of constructing a roof deck comprising the steps of welding a series of box section sub-purlins on top of a series of purlins to form a grid, said box section sub-purlins having a pair of inwardly facing top flanges forming a slot therebetween, placing guide clips every three to four feet along the slot of each sub-purlin, putting formboard in place on top of said top flanges and aligning them with the guide clips so that said slots remain open, placing wire mesh over the formboards and sub-purlins, and pouring gypsum concrete on top of the formboards and sub-purlins so that the gypsum concrete passes through said slots and fills the box section sub-purlins and covers the formboards and sub-purlins, with the gypsum concrete in the box section sub-purlins and in said slots and on top of the sub-purlins and formboards being one unitary element of the roof deck.

5. A method of constructing a roof deck comprising the steps of welding a series of sub-purlins on top of a series of purlins to form a grid, said sub-purlins having a bottom wall and a pair of side walls with a pair of bottom flanges extending outwardly from the bottom wall and with a pair of top flanges extending inwardly from the top of the side walls, a pair of downwardly extending flanges depending from the inside edges of the top flanges and forming a slot therebetween, putting formboards in place on top of said bottom flanges so that the formboards are positioned between and supported by the sub-purlins, placing wire mesh over the formboards and sub-purlins, and pouring gypsum concrete on top of the formboards and sub-purlins so that the gypsum concrete passes through said slots and fills the sub-purlins and covers the formboards and sub-purlins, with the gypsum concrete in the sub-purlins and in said slots and on top of the sub-purlins and formboards being one unitary element of the roof deck, allowing the gypsum concrete to harden, and moving the forms ahead into position in another section of roof deck to be constructed, said moving being done from on top of the grid.

6. A roof deck and form assembly comprising a series of sub-purlins connected to the top of a series of purlins to form a grid, said sub-purlins being hollow and having a pair of inwardly facing top flanges forming a slot therebetween, removable form supports positioned on said purlins, demountable forms on top of said supports and extending between said sub-purlins and in snug contact therewith, and gypsum concrete filling the sub-purlins and extending through said slots and between said sub-purlins and on top of the demountable forms to a monolithic gypsum slab to form a monolithic structure having composite action between the sub-purlins and the slab, said

form supports and demountable forms being removable after the gypsum concrete hardens.

7. A roof deck and form assembly comprising a series of box section sub-purlins welded to the top of a series of purlins to form a grid, said sub-purlins having a pair of inwardly facing top flanges forming a slot therebetween, removable form supports positioned on said purlins, demountable forms on top of said supports and extending between said sub-purlins and in snug contact therewith, cradles of expanded metal lath strips which are corrugated and vertically positioned in the box sections and extend through said slots, wire mesh supported on said cradles, and gypsum concrete filling the sub-purlins and extending through said slots and between said sub-purlins and on top of the demountable forms and surrounding said wire mesh and said expanded metal lath strips to form a monolithic structure, said form supports and demountable forms being removable after the gypsum concrete hardens.

8. A roof deck comprising a series of box section sub-purlins welded to the top of a series of purlins to form a grid, said sub-purlins having a pair of inwardly facing top flanges forming a slot therebetween, guide clips positioned in said slots and extending upwardly therefrom, formboards positioned on top of said top flanges and aligned by said guide clips so that said slots are not covered by said formboards, gypsum concrete filling the box section sub-purlins and extending through said slots and covering said formboards and sub-purlins to form a monolithic structure, and wire mesh imbedded in said gypsum concrete above the sub-purlins and formboards.

9. A roof deck comprising a series of box section sub-purlins welded to the top of a series of purlins to form a grid, said sub-purlins having a pair of inwardly facing top flanges forming a slot therebetween, cradles of corrugated expanded metal lath strips vertically positioned in the box sections and extending through said slots, gypsum concrete filling the box section sub-purlins and extending through said slots and between said sub-purlins to a monolithic gypsum slab to form a monolithic structure having composite action between the filled sub-purlins and the slab, and wire mesh supported on top of said cradles and imbedded in said gypsum concrete above the sub-purlins.

References Cited by the Examiner

UNITED STATES PATENTS

1,570,814	1/1926	Wooley	52—687
1,786,751	12/1930	Heeren	52—335
2,006,070	6/1935	Di Stasio	52—724 X
2,233,054	2/1941	Heeren	52—338 X

FOREIGN PATENTS

806,391	6/1951	Germany.
590,605	4/1959	Italy.

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