April 16, 1935. W. M. McNEIL ET AL 1,998,422

ACOUSTICAL ROOF DECK

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Fig. 1

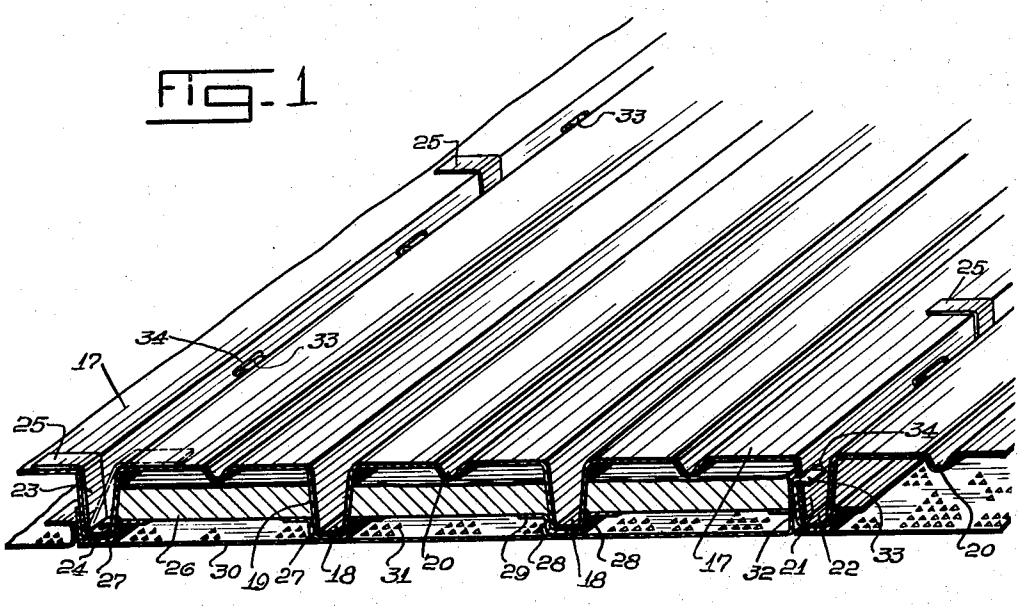


Fig. 2

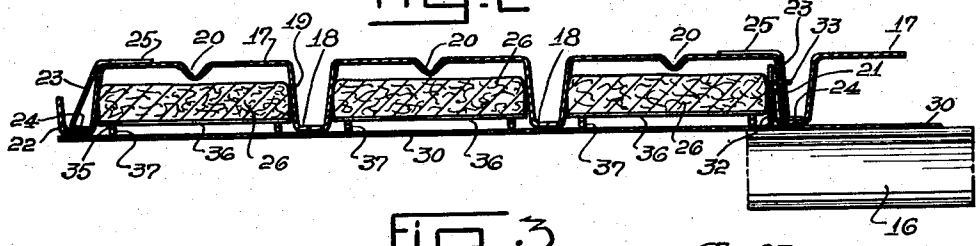


Fig. 3

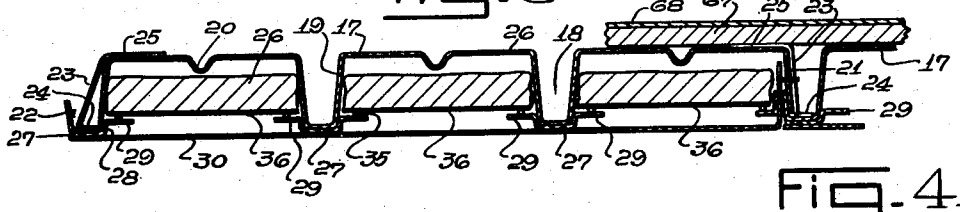


Fig. 4

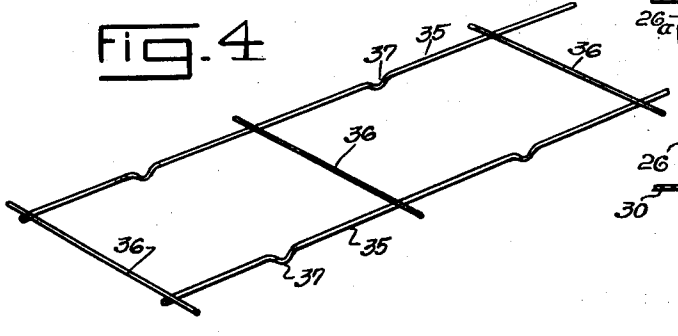
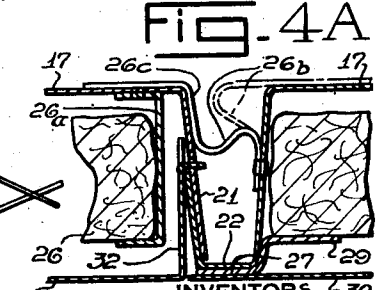


Fig. 4A



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ACOUSTICAL ROOF DECK

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Fig. 5

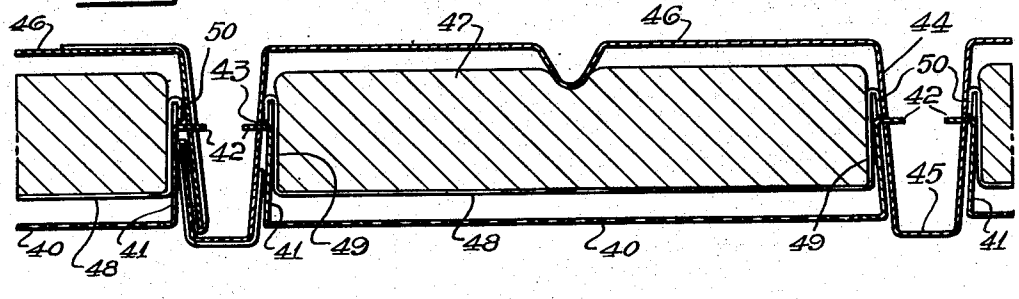


Fig. 6

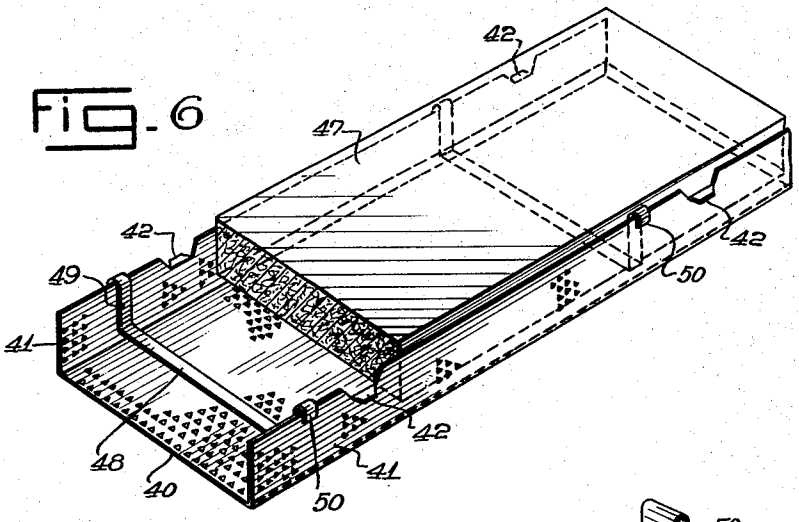
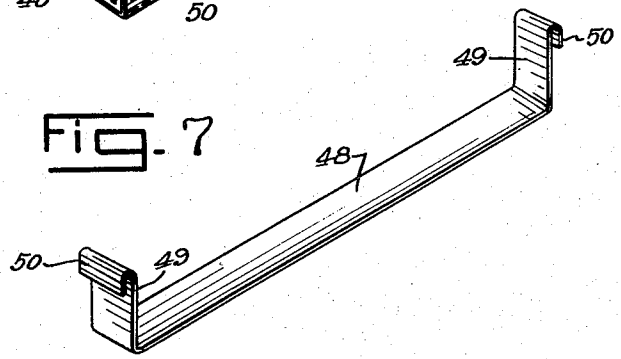


Fig. 7



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ACOUSTICAL ROOF DECK

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Fig. 8

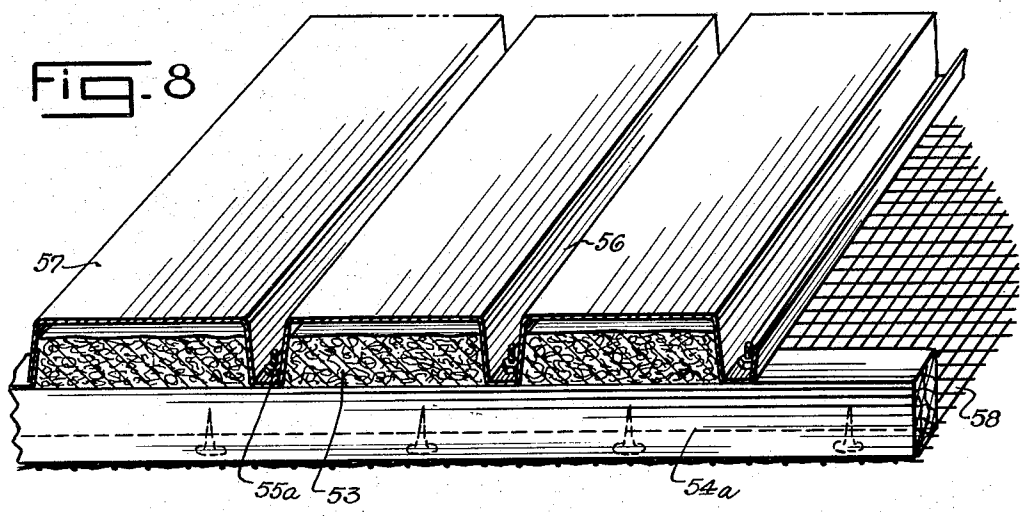


Fig. 9

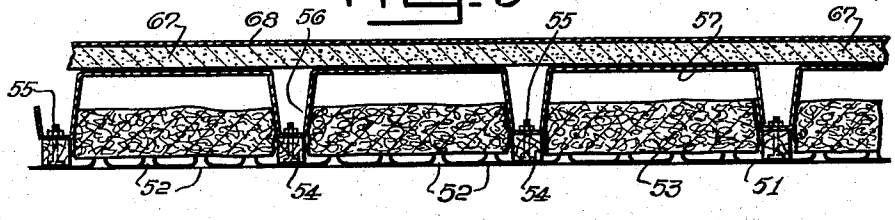


Fig. 10

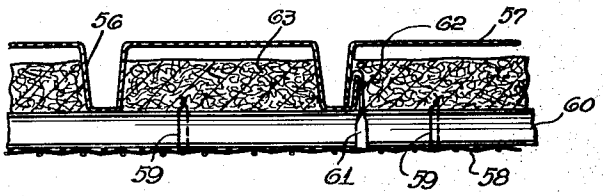
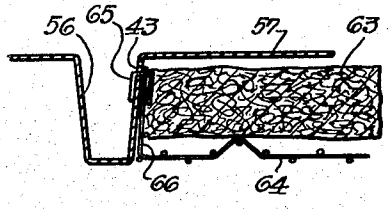


Fig. 11



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UNITED STATES PATENT OFFICE

1,998,422

ACOUSTICAL ROOF DECK

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Application April 6, 1932, Serial No. 603,554

10 Claims. (Cl. 108—13)

This invention relates to building constructions, and has reference more particularly to structurally strong roof decks having sound obsorbing means associated therewith.

In the co-pending application of Manske, Odenwaldt and Gibson, Serial No. 562,522, filed September 12, 1931, entitled "Roof and floor construction", now matured to Patent No. 1,900,721, a formed metal deck is described which is suitable for forming roofs and floors. When this metal deck is used as a roof, we have found it advantageous to combine sound absorbing materials on its lower face in order to produce a roof deck having combined structural strength and acoustical absorption. We have found that these sound absorbing materials, such as a perforated metal plate, can be secured to the roof deck in such a manner as to actually increase the structural strength of the latter.

An object of the invention therefore, is to provide an acoustical roof deck having combined structural strength and acoustical absorption.

Another object of the invention is to combine a sound absorbing, perforated metal plate with a roof deck in such a way as to increase the structural strength of the latter; also to improve building constructions in other ways hereinafter specified and claimed.

Reference is to be had to the accompanying drawings forming a part of this specification, in which

Fig. 1 is a perspective, section view showing our improved acoustical roof deck,

Fig. 2 is a sectional elevation through a modified form of the roof deck,

Fig. 3 is a sectional elevation through the roof deck shown in Fig. 1 with a modified form of supporting means for the sound absorbing pad,

Fig. 4 is a fragmentary perspective view of the wire frame for supporting the sound absorbing pads,

Fig. 4—A is a modified form of acoustical roof deck,

Fig. 5 is a sectional elevation of a further modified form of roof deck,

Fig. 6 is a perspective view of the removable sound absorbing element for the construction shown in Fig. 5,

Fig. 7 is a perspective view of a saddle supporting member for the sound absorbing pad of Figs. 5 and 6,

Fig. 8 is a perspective, sectional view of a further modified form of acoustical roof deck,

Fig. 9 is a sectional elevation of a further modified form of acoustical roof deck,

Fig. 10 is a sectional elevation of another form of acoustical roof deck, and

Fig. 11 is a fragmentary, sectional elevation of a still further modified form of acoustical roof deck.

The framework of a building may consist of I beams or channel beams not shown which support transversely extending roof purlins 16 which are preferably in the form of channel beams. The roof deck comprises a metal plate 17, preferably of steel, in which are formed a plurality of ribs or channels 18 in spaced, parallel relation. The channels 18 are preferably few in number and have upwardly flaring legs 19 which are preferably substantially parallel near one end of the deck plate to permit overlapping of the ends of the deck plates. A rib 20 is also rolled in the deck plate between each of the channels 18, said ribs extending from one end of the deck plate to a point several inches from the opposite end of the deck plate 17. The ribs serve to provide the flare of the legs 19 and therefore aid in the overlapping of the ends of the deck plate. One edge of the deck plate 17 is provided with a downwardly extending flange 21, and the opposite edge of said deck plate is provided with a downwardly extending L-shaped channel 22. The flange 21 of one deck plate is adapted to nest in or interlock with the L-shaped channel 22 of the adjoining deck plate. In order to maintain the adjoining roof decks in interlocking relation a strap 23 is provided with a laterally extending flange 24 which is spot welded to the upper surface of the bottom of channel 18. A laterally extending flange 25 is bent into the dot and dash position as seen in Fig. 1 and is bent in the opposite full-line position during assembly of the roof so as to lie flush against the top surface of the roof deck 17.

A sound absorbing pad 26 of mineral wool, vegetable fiber, hair felt, etc. is positioned between each of the channel ribs 18 below the deck plate 17. Channel runners 27 are spot welded to the bottoms of ribs 18 and have upstanding legs 28 terminating in outstanding ledges or flanges 29 which serve to engage the edges of the pad 26 and support said pad at a substantial distance above the bottoms of ribs 18. A perforated sheet or plate 30 of metal or other suitable material, is secured across the bottom face of the roof deck as by spot welding to the bottoms of runners 27. The plate 30 is preferably provided with triangularly shaped holes or openings 31 which are uniformly spaced across the entire face of said sheet, but said holes may be round, square, or any

other desired shape. The perforated plate 30 is preferably painted or enameled to present an attractive appearance and its bottom surface may be washed with water to clean the same when soiled if desired. The pad is spaced apart from the plate 30 and will not be wet by the wash water. The space between the pad 26 and the perforated plate 30 also produces a better overall sound absorbing efficiency than if the pad is laid directly on the perforated plate. At one edge, the plate 30 has an upwardly turned flange 32 which fits inside the flange of the channel 22 and has a plurality of outwardly extending lugs 33 extending above said flange into openings 34 formed in a leg of the channel 18. This arrangement of the edge of the perforated plate permits the convenient interlocking of adjoining deck plates. The perforated plates may rest directly on the beams 16 and be arc welded thereto.

In the form of construction shown in Fig. 1, it is necessary to use a pad which has sufficient rigidity that it will not sag down in the middle. When it is desired to use a softer and more pliable pad, a construction as shown in Figs. 2 and 3 may be used in which the pad is supported directly by a wire mat which is composed of longitudinal wires 35 and cross wires 36 welded thereto. The wires 35 may have depressed arcuate loops 37 formed therein which serve to space the pad 26 apart from the perforated plate 30 when the mat is interposed between the pad 26 and said plate 30. If desired, the wires 35 and loops 37 may rest upon the flanges 29 and thus support the pad apart from the plate 30.

In the modified form of invention shown in Fig. 4—A, one outer edge of one pad 26 may be carried by the lower flange of a channel member 26_a, the upper flange of which may be spot welded to the lower face of the deck plate 17. In order to lock adjoining roof decks together an L-shaped clip 26_b is spot welded to a leg of the channel 22. During shipment, the clip 26_b is in the dot and dash position shown in Fig. 4—A, and on erection, the clip is bent to the full-line position so that it lies flat against the upper surface of the adjoining deck with a naturally formed shoulder 26_c bearing against the downstanding flange 21 of said deck.

It should be noted that in the forms of the invention shown in Figs. 1 to 3, the welding of the perforated plate 30 to the ribs 18 greatly strengthens the roof structure. Where such great strength is not required, the form of construction shown in Figs. 5 to 7 can be used. In this construction, a perforated plate 40 has an upturned flange 41 at each edge and a plurality of outwardly turned lugs 42 are formed in each flange 41 which engage in registering slots or openings 43 formed in the legs 44 of channel ribs 45 of deck plate 46. The slots 43 are preferably punched in the deck plate 46 prior to the rolling of the ribs 45. The flanges 41 have sufficient flexibility that the lugs 42 can be snapped in place in the slots 43 by an upward movement of the plate 40. A sound absorbing pad 47 is supported a distance above the metal plate 40 by saddle straps 48 which have upwardly extending legs 49 at each end terminating in return bent flanges 50 which form channels for engaging the upper edges of flanges 41. The pads 47 are preferably laid on the straps 48 prior to the assembly of the perforated plate 40 with the roof deck.

In the form of construction shown in Fig. 9, a perforated plate 51 is provided with triangular or other shaped openings 52. One side of each of the blanks forming the openings 52 is not severed in the punching operation and the blanks are bent upwardly at a right angle to the plate 51 so that their upper edges support a sound absorbing pad 53. The plate 51 may be attached by nails, screws or the like to wooden nailing strips 54 which are attached by bolts 55 to channel ribs 56 formed on deck plate 57. The use of these nailing strips 54 serves to increase the available space for the pads 53 and provides a convenient attaching means for the perforated plates 51, at the same time serving to reinforce and strengthen the roof deck. If desired, nailing strips 54_a may be secured by means of bolts or the like 55_a to deck plates 57 transversely of the channel ribs 56 (Fig. 8), and a wire screen 58 may then be nailed or otherwise secured below the strips 54_a. This screen 58 may be painted to present a pleasing surface from below, and will serve to hide the rough details of construction while yet allowing sound waves to travel freely upwardly to be absorbed by pads 53, which are preferably disposed between ribs 56 and rest upon strips 54_a. The screen 58 (Fig. 10) may be attached by wires 59 to a furring channel 60 which in turn is attached by strap hangers 61 to the upturned roof deck flanges 62. Sound absorbing pads 63 are laid on the furring channels 60. Instead of the perforated plates 40, wire baskets 64 (Fig. 11) may be substituted which have wire attaching clips 65 welded to upturned flanges 66 formed on said baskets, said clips passing through the openings 43 and being bent downwardly to firmly attach the baskets to the roof deck.

Regardless of the type of roof deck design used, we prefer to protect the upper surface of the roof deck with a layer of heat insulating material 67 which may consist of vegetable fiber boards, or boards of mineral wool, etc. This layer 67 is attached to the deck plates by asphalt emulsion or other suitable adhesive, and is covered by a weatherproof layer of material 68 which may be asphalt roofing, shingles, etc. and is preferably attached to the insulating layer 67 by asphalt emulsion or other adhesive.

We state in conclusion that, while the illustrated examples constitute practical embodiments of our invention, we do not wish to limit ourselves precisely to these details, since manifestly the same may be considerably varied without departing from the spirit of the invention as defined in the appended claims.

We claim as our invention:

1. In a building construction, a sheet metal deck having spaced, depending ribs, a perforated metal membrane rigidly secured to the bottom of said ribs so as to aid in imparting substantial longitudinal strength to said deck for supporting structural loads, and a sound absorbing medium between said deck and said membrane.

2. In a building construction, a sheet metal deck having spaced, depending ribs pressed from the plane of the deck into U-shaped form, the legs of said ribs having opening formed therein, metallic membranes supported between said legs in spaced, parallel relation to said deck, said membranes having supporting lugs engaging in said openings, and a sound absorbing medium between said deck and said membranes.

3. In a building construction, a sheet metal deck having spaced, depending ribs, said deck having substantial, longitudinal strength for supporting structural loads, a perforated metal membrane rigidly secured to the bottom of said

ribs so as to aid in imparting longitudinal strength to said deck, a sound absorbing material between said deck and said membrane, a heat insulating layer extending over said deck, and a protective covering extending over said layer.

4. An acoustical roof deck unit comprising a metallic sheet having spaced, parallel ribs formed on one face of said sheet, pads of sound absorbing material extending substantially parallel to said sheet between said ribs, a perforated metal membrane rigidly secured to the bottom of a pair of said ribs and substantially concealing said pad, said membrane imparting substantial longitudinal strength to said deck, and means for spacing said pad apart from said membrane.

5. An acoustical roof deck unit comprising a metallic sheet having spaced, parallel ribs formed on one face of said sheet to impart longitudinal stiffness to said sheet, pads of sound absorbing material extending between said ribs, said ribs having a plurality of openings, a U-shaped perforated sheet having up-turned legs extending between and closely abutting adjacent ribs, and saddle members supported by the upper edges of said legs and engaging said pad to secure said pad in position relative to said perforated sheet.

6. An acoustical roof deck unit comprising a metal sheet having outwardly pressed, U-shaped ribs, a perforated sheet extending across the lower edges of said ribs, U-shaped runners between said ribs and said perforated sheet, said runners having outstanding flanges extending into the space between said ribs, and sound absorbing pads supported by said flanges.

7. An acoustical roof deck unit comprising a metal sheet having outwardly pressed, U-shaped ribs, a perforated sheet extending across the lower edges of said ribs, U-shaped runners between said ribs and said perforated sheet, said runners having outstanding flanges extending into the space between said ribs, and a wire supporting frame extending between said pad and said flanges.

8. An acoustical roof deck unit comprising a metal sheet having an outstanding flange formed on one edge and a U-shaped flange formed on the opposite edge, said outstanding flange being adapted to seat in the U-shaped flange of an adjoining unit, an outstanding rib formed on said metal sheet between said flanges, a perforated sheet extending between said flanges, outstanding lugs formed on said perforated sheet and engaging in openings formed in said flanges, and sound absorbing pads between said perforated and metal sheets.

9. An acoustical roof deck unit comprising a metal sheet having an outstanding flange formed on one edge and a U-shaped flange formed on the opposite edge, said outstanding flange being adapted to seat in the U-shaped flange of an adjoining unit, an outstanding rib formed on said metal sheet between said flanges, a perforated sheet extending between said flanges, outstanding lugs formed on said perforated sheet and engaging in openings formed in said flanges, and a strap for interlocking the flanges of adjoining units.

10. In a building construction, a sheet metal deck having spaced, depending ribs, a foraminous membrane secured below said ribs, a wire spacing frame between said ribs and supported by said membrane, and a sound absorbing pad supported by said frame.

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