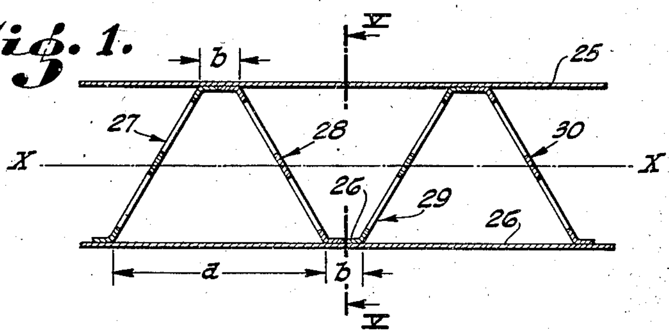
Sept. 4, 1945. E. P. BURKE 2,384,157

MULTITRUSSED UNIT

Filed April 3, 1942

Fig. 1.



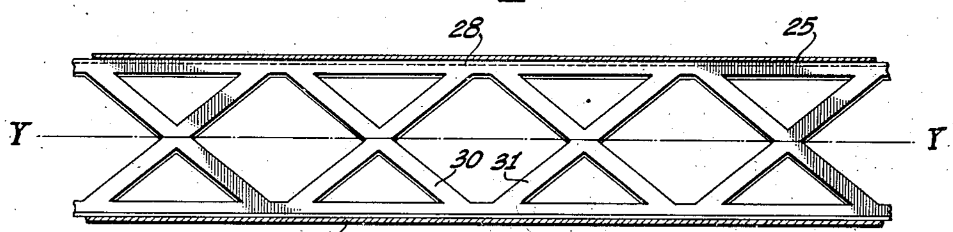


Fig. 2.

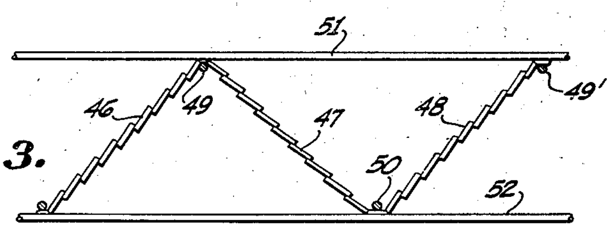


Fig. 3.

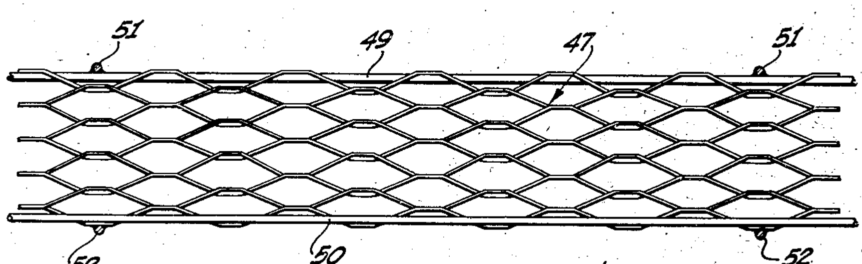


Fig. 4.

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MULTITRUSSED UNIT

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Application April 3, 1942, Serial No. 437,511

1 Claim. (Cl. 189—34)

This invention pertains to a multitrussed unit in the form of a panel, such panel being adapted for use as a roof slab, flooring unit, wall or partition unit, or wherever it is desired to employ a prefabricated structural unit which is capable of supporting loads. The panel unit of the present invention is herein termed a "multitrussed unit" in that it has shear members extending in a plurality of different directions so that the panel has an effective radius of gyration, section modulus and moment of inertia along both longitudinal and transverse axes. Moreover, the multitrussed panel unit of the present invention has an extremely high efficiency whereby large loads may be successfully imposed on and carried by the panel unit, per square inch of metal or other structural material employed in making the panel.

The particular arrangement of members embraced by this invention gives rise to a panel or structural panel unit which has rigidity and stiffness longitudinally, laterally and transversely and in its preferred form is capable of supporting or carrying greater loads per pound of metal employed in the panel than any other known construction.

It is an object of the present invention, therefore, to disclose and provide means and methods of utilizing structural materials such as the various metals in sheet, rod, angle iron or other preformed shape, in the formation of an effective multitrussed unit in panel form.

It is a further object of the present invention to disclose and provide an arrangement of elements whereby panel units having an effective and appreciable radius of gyration, section modulus and moment of inertia both longitudinally and laterally, are obtained.

A still further object of the present invention is to disclose methods of utilizing existing structural materials such as wire, expanded metal lath, angle irons, straps, etc., to produce multitrussed panels characterized by lighter weight and greater strength than structures of the prior art.

These and other objects and advantages of the present invention will become apparent to those skilled in the art from the following detailed description of certain exemplary forms.

In order to facilitate understanding, reference will be had to the appended drawing which exemplifies certain forms which the present invention may assume.

In such drawing:

Fig. 1 is an end view of a form of multitrussed panel.

Fig. 2 is a longitudinal section taken along the plane V—V of Fig. 1.

Fig. 3 illustrates a relatively lightweight ceiling or partition panel employing expanded metal lath.

Fig. 4 is a longitudinal section through a portion of the light weight panel shown in Fig. 3.

The invention may be embodied in a great variety of panel units. Figs. 1 and 2 comprise an end view and a longitudinal sectional view respectively, of a modified form of panel unit in which the upper and lower panel planes comprise sheet metal as indicated at **25** and **26**. The intervening, angularly inclined truss portions, generally indicated at **27**, **28**, **29**, etc., may be made of punched metal as shown in Fig. 2, leaving the angularly inclined truss portions **30**, **31** and the like. The size and arrangement of the angularly inclined truss portions **30** and **31** may be varied greatly and the invention is not limited to the particular arrangement of truss portions illustrated in the drawing. The truss portions such as portion **28**, for example, may be perforated with circular cut-outs so arranged as to leave intervening web portions, which intervening web portions then constitute the diagonally inclined stress distributing portions similar to the members **30** and **31**. The various truss portions **27**, **28**, **29** and the like may be welded or riveted to the unit plane members **25** and **26**, or otherwise firmly attached thereto. It is to be understood that the webs of the portions such as **27**, **28**, **29**, etc. (herein referred to as truss portions) may be perforated, cut out, assembled from various straps, strips or elements, or in some cases, be imperforate.

The remarkable stability and characteristics of the panel unit of the character here disclosed will be appreciated from the following data concerning a panel unit having a depth of only 3 inches. The distance *a* was 5 inches and the distance *b* was 1 inch. The top and bottom panel unit sheets **25** and **26** were made of 12 gage metal (0.109''); the truss members **27**, **28** and the like were made of 16 gage metal (0.063''). This panel weighed only 11.6 pounds per square foot and along the x—x axis had a moment of inertia of 7.30 inches^4, a second modulus of 4.57 inches^3 per foot and a radius of gyration of 1.51''. Along the y—y or longitudinal axis the panel had a moment of inertia of 6.30 inches^4, a section modulus of 3.95 inches^3 per feet and a radius of gyration of 1.56''. The efficiency in the utilization of the metal may be represented by the section modulus divided by the weight, which efficiency was 0.390. In other words, a panel of this type, supported at its ends or sides only and uniformly loaded, and having a 10 foot span, even though it only weighted 11.6 pounds per square foot with a working stress of 16,000 pounds per square inch, would be able to support 486 pounds per square foot on axis x—x and 420 pounds on axis y—y. Particular attention is called to the fact that the radius of gyration about longitudinal and transverse axes was very high, the radius of gyration along one axis being not less than 60% of the radius of gyration along the other axis, and as a matter of fact, in the instant example constituted over 90% so that the difference in radius of gyration along different axes was less than 10%.

Attention is called to the fact that in the unit panels of the present invention, most of the structural material employed is positioned at a maximum distance from the neutral axis so that it is effectively placed at the extreme outside face planes of the unit panel. In this manner, the structural material, such as steel, employed in the construction of a unit panel is utilized to great advantage and for a given weight of steel the unit panel of this invention will have a much greater strength and will be able to support a much higher load than any structures known heretofore.

The inventive thought of the present invention may also be applied to the production of lightweight, rigid panel units adapted for use in the construction of thin partitions within a building or for soffits and the like. Figs. 3 and 4 exemplify a structure composed essentially of expanded metal, such as the ordinary expanded metal lath which has been deformed into a plurality of ribs having the inclined faces **46**, **47**, **48** and the like. Wires or rods **49**, **50**, **49′** and the like are welded to the apices of the ribs thus formed in the continuous sheet of expanded metal lath and transversely extending rods or bars **51** are then attached, in spaced relation, to the apices lying in a panel unit face or plane. Similar transversely extending, longitudinally spaced bars **52** are attached to the apices of the opposing panel unit face. Transversely extending bars **51** and **52** may be welded directly to the longitudinally extending rods **49** and **50** through openings in the expanded wire mesh or they may be welded directly to the mesh. As shown in Fig. 4, the transversely extending members **51** and **52** are preferably in the same transverse plane, although this is not essential.

It will be noted that the expanded metal lath forms longitudinally extending trusses **46**, **47**, **48** and the like, and as best shown in Fig. 4, such metal lath has substantially continuous, diagonally extending, stress distributing portions or members leading from one panel unit face to the other. The resulting structure is remarkably strong and rigid. For example, using an expanded metal lath weighing 2.5 lbs. per square yard so as to form a panel unit having a depth of 0.75 inch, the longitudinally extending wires **50** being spaced a distance of 2 inches in each panel unit face, the wires **51** being spaced a distance of 8 inches in each panel unit face, it was found that the resulting structure weighed only 0.5 lb. per square foot, had a moment of inertia along the transverse axis of 0.0051, a section modulus of 0.0135, a radius of gyration of 0.3750 and an efficiency of 0.0270. On the longitudinal or $y—y$ axis, the moment of inertia was 0.0012, the section modulus was 0.0034 and the radius of gyration was identical to that along the $x—x$ axis, namely, 0.3750.

The multitrussed partition unit illustrated in Figs. 3 and 4, may be placed in a vertical position and plaster applied directly thereto from both sides, thereby giving rise to a thoroughly reenforced rigid partition.

Numerous modifications can be made, as those skilled in the art will appreciate. Bars, rods, channels, angles, wires and other forms of structural material may be employed in constructing the panel units. Smaller and lighter panel units such as those illustrated in Figs. 3 and 4, could be made continuously or in continuous lengths and then cut to desired widths. Heavier panel units could be made from prefabricated partitions or could be assembled from sheets, prefabricated trusses and the like.

The multitrussed panel units of the present invention can be used not only as floor slabs, ceiling slabs, soffit structures, walls and partitions, but may also be employed as a reenforcing in monolithic structures, such as walls, beams or girders.

It is to be noted that in all of the forms of the invention, the truss portions or webs lie in planes inclined to the face planes, so that high resistance to shear (resistance to relative movement of face planes in the direction of such planes) is attained, and the unit will not collapse. The connecting means, such as the truss portions **27**, **28**, **29** are inclined sufficiently to the plane of the faces to resist such shear, or relative movement between the face planes, substantially solely by compressive and tensile strength of the webs or truss portions and not by bending.

Attention is also called to the fact that stability and strength of the preferred forms of units made in accordance with this invention is due, in part at least, to the fact that eccentricity has been minimized. In the preferred forms of the present invention, therefore, center planes passing through the webs of adjacent longitudinally extending members will intersect in a line which is spaced from the center or neutral axis of the face plane member a distance not in excess of four times the thickness of such face plane member. When these particular proportions are maintained, remarkable rigidity and strength will be observed in the unit panel.

Various changes, modifications and adaptations will occur to those skilled in the art, many forms of the invention being possible, the precise form being determined by available materials, job to be done by the unit, conditions to be overcome, etc. All changes coming within the scope of the appended claim are embraced thereby.

I claim:

A portable, multitrussed unit having spaced face planes, comprising: a sheet of expanded metal deformed into a plurality of individually plane truss portions, each truss portion lying in a plane at an angle to contiguous truss portions, each plane truss portion including stress distributing members composed of said expanded metal and lying at an angle to horizontal and vertical planes through said unit; longitudinally extending elements connected to said truss portions and within the internal angle at apices formed by adjacent truss portions; and a plurality of longitudinally spaced, transversely extending face members attached to upper edge areas of the truss portions to connect the same, center planes passing through adjacent truss portions intersecting in a line which is spaced from the neutral axis of the face members a distance not in excess of four times the thickness of such face members above said apices.

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