

March 20, 1945.

D. E. GILLUM ET AL

2,371,754

STIFFENED MATERIAL

Filed April 22, 1942

2 Sheets-Sheet 1

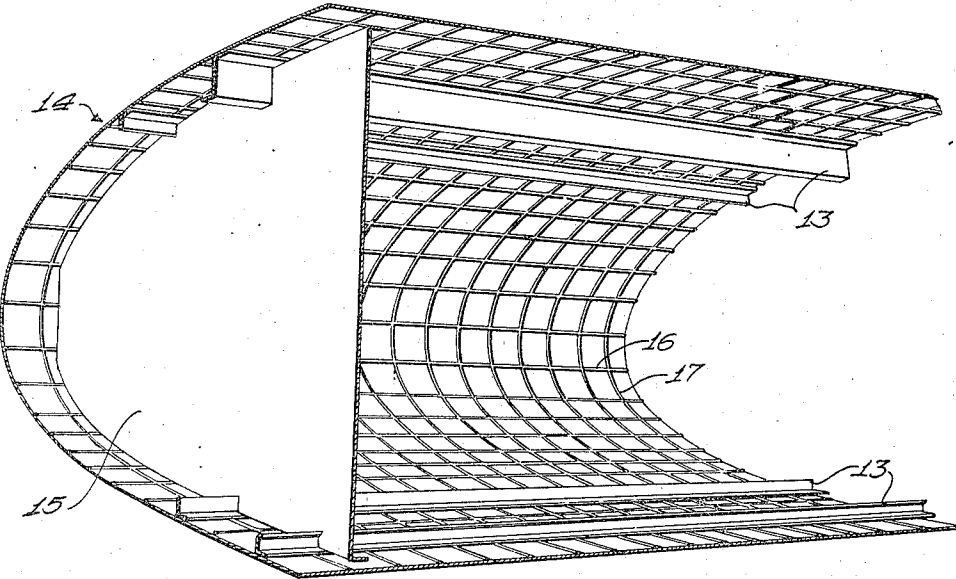


FIG. 1

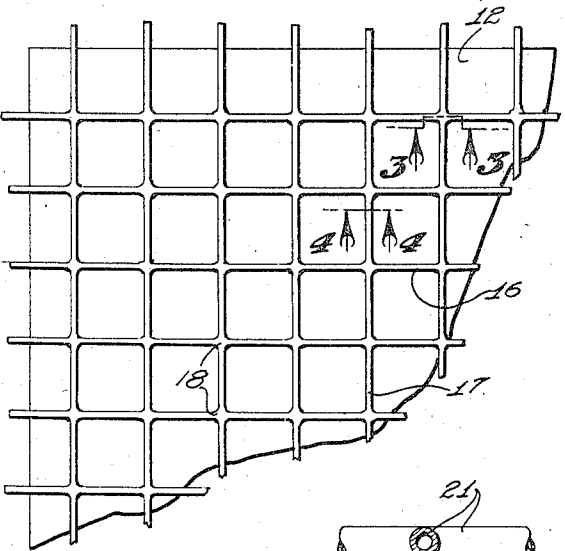


FIG. 2

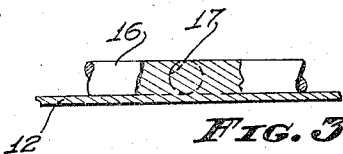


FIG. 3

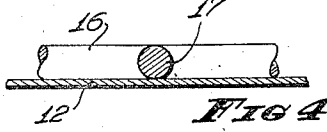


FIG. 4

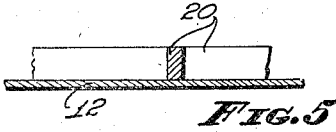


FIG. 5

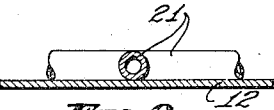


FIG. 6

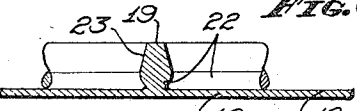


FIG. 7

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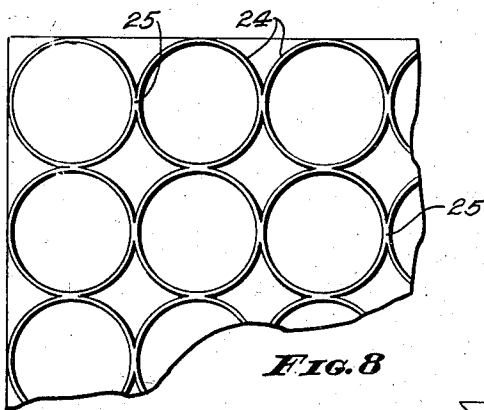
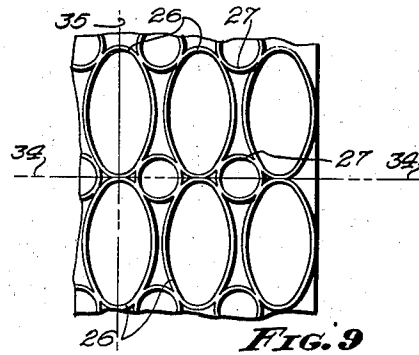
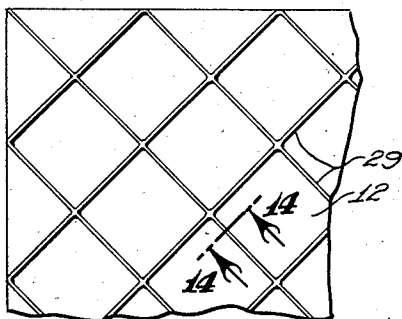
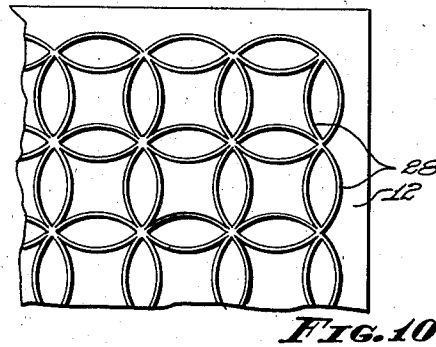
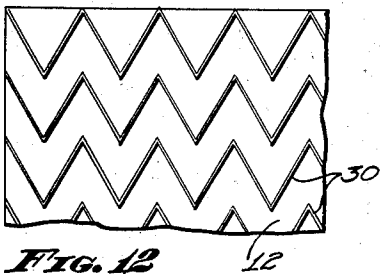
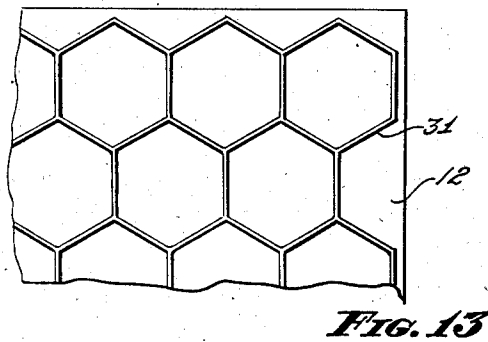
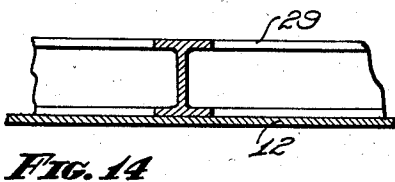
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STIFFENED MATERIAL

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Application April 22, 1942, Serial No. 440,040

6 Claims. (Cl. 189—34)

Our invention relates to stiffened material, and it is an important object of our invention to provide material that has a relatively low weight-stiffness ratio; i. e., has less weight for given stiffness.

Another object is to provide sheet metals that have their stiffness increased materially by wire applied to a side thereof.

Still another object is to provide such stiffened sheet materials of steel, aluminum, etc., for use in aircraft, automobiles, railroad cars, and all other fabricated articles or machines embodying a surface or similar part thereof that is subject to vibration or bending influences.

Further objects reside in the provision of a material that is easily fabricated, relatively inexpensive to manufacture, easily used in assembling other articles, serviceable and of general superiority.

The following description merely describes and the accompanying drawings merely show embodiments or suggested forms, and are not to be taken as the only possible embodiments or forms.

In the drawings, like reference characters designate similar parts in the several views.

Fig. 1 is a perspective view of material made in accordance with the present invention employed, as a leading edge of an airplane wing.

Fig. 2 is a plan view of a portion of such material, broken away.

Fig. 3 is an enlarged section taken on the line 3—3 of Fig. 2.

Fig. 4 is an enlarged section taken on the line 4—4 of Fig. 2.

Fig. 5 is a view similar to Fig. 4, but showing a modified construction.

Figs. 6 to 13 are plan views of modified arrangements of the stiffening means.

Fig. 14 is a sectional view taken along the line 14—14 of Fig. 11, showing a still different cross sectional shape for the wire.

Referring more in detail to the drawings, the reference number 12 generally designates the sheet material, which in Fig. 1 is shown as the part of the skin of an airplane. The sheet material 12 may be of steel, aluminum, etc. In Fig. 1, stringers or strengthening members 13 are suggested, for reenforcing the wing 14. A bracing rib 15 is also indicated in that figure.

The stiffening means for the sheet material 12 is preferably wire, but it may be of any desired arrangement of wire running in directions at angles to each other. The wire may also be in the form of a mesh.

In Sheet I of the drawings, the wires are shown

forming rectangles and extend substantially parallel with the sides and ends of the sheet material.

It is believed clear that the present stiffened material may be formed by any of the following processes: seam welding, spot welding, brazing, cementing, arc welding, or the like.

Spot welding has been suggested in Figs. 2 to 4. Spot welding may of course be done by any suitable gang or gangs of spot welding electrodes. A suggested apparatus has been illustrated in our pending application Serial No. 445,822, filed June 4, 1942.

Longitudinal wires 16 are crossed by transverse wires 17 on the back of the sheet material 12. Upon the point of the crossing over of one wire by another sufficient heat and pressure are applied by the welding electrode to cause the two crossed wires to fuse at the cross-over and to cause extra material to flow into the corners formed by adjacent wires, thereby forming a thickened join 18. The join of the longitudinal and transverse wires is substantially in the same plane as adjacent portions of the wires, as shown in Figs. 3 and 4.

Of course, at the time of fusing the crossed wires together, the fused intersection is also welded to the sheet material.

Fig. 5 illustrates wires 20 of modified cross-section, to wit, rectangular. The rectangular wires 20 are welded together at their intersections and welded to the sheet metal 12 at such intersections, just as the round wire.

Fig. 6 shows tubular wires 21, which are utilized the same as the round, solid wires hereinbefore described. The tubular wires still further lower the weight-stiffness ratio of the finished material.

Fig. 7 illustrates solid wires 22 of irregular cross-section. Converging flat sides 23 increase the resistance of the wires 22 to bending. The top 19 of the wires 22 may be flat, while the curved bottom may be fused to the sheet material 12. Although there is the same amount of metal in the wire 22 as in a round wire having a diameter equal to the lower, curved portion of the wire 22, the cross section of the wire 22 has a considerably higher neutral axis than the neutral axis of round wire having a diameter equal to the lower, curved portion of wire 22. The wire 22, therefore, has more stiffness than round wire having the same amount of material.

Fig. 8 shows metal rings 24 that are simultaneously welded to each other and to the sheet material, as suggested at 25.

Fig. 9 illustrates ellipses 26 with smaller rings 27 connecting rows of the ellipses with each other.

This arrangement of ellipses and rings may be prefabricated and such prefabricated arrangement welded upon a face of the sheet material 12 for strengthening purposes. It will be noted that there are considerably more wires crossed by the broken line 34 than by the broken line 35, thus the direction of greatest rigidity can be controlled, for there is greater resistance to bending along the line 34 than along the line 35. By this arrangement, the sheet material is stiffened in one direction more than the other.

Fig. 10 shows series of rosettes 28 which may be prefabricated and such prefabrication layed upon the sheet 12 and welded in place.

Fig. 11 is similar to the arrangement shown in Figs. 1 and 2, but showing a diagonal arrangement of wires 29 upon the sheet 12.

Fig. 12 shows angularly bent wires 30 that are layed adjacent each other and welded in place upon the sheet material 12. This arrangement can be used to control the direction of greatest rigidity as in the case of the form in Fig. 9.

Fig. 13 shows a hexagonal form 31 that is prefabricated and then applied to the sheet 12 and welded in place.

Fig. 14 shows a modified I-beam construction that may be used for the wires. This figure is taken along the line 14-14 of Fig. 11.

It is to be understood that the word "wire" in the present description and in the hereunto appended claims shall include both drawn material and extruded material and different cross sectional shapes, and shall include both solid and hollow forms. Moreover, "welded" shall be taken to include not only spot and seam welding which comprises joining together by fusing abutting surfaces with or without the addition of extra metal, but also brazing, cementing and arc welding.

Any of our present materials may be produced by mass production methods, and such material have many uses in the fabrication of aircraft, automobiles, railroad cars, etc.

While we have illustrated and described what we now regard as the preferred embodiment of our invention, the construction is, of course, subject to modifications without departing from the spirit and scope of our invention. We, therefore, do not wish to restrict ourselves to the particular form of construction illustrated and described, but desire to avail ourselves of all modifications that may fall within the scope of the appended claims.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. An article of manufacture comprising a section of sheet metal presenting a continuously unbroken surface at one side thereof, and a reinforcing and vibration reducing web of wire ele-

ments on the other surface thereof, said elements being in individually complete units of a closed, curved shape in plan view and presenting continuously curved perimeters, integrally joined to one another and to the sheet metal surface at spaced points along the perimeters thereof.

2. As an article of manufacture, a skin covering for airplanes and airships, consisting of a single layer of sheet metal presenting an external unbroken surface, and reinforcing wire elements in individually complete geometrical units of a closed, curved shape in plan view and disposed with their perimeters in touching relation and welded to one another and to the other surface of the plate at said touching points.

3. An article of manufacture, consisting of sheet metal, and reinforcing wire elements disposed against a surface of said sheet metal in individually complete units of a closed, curved shape in plan view and presenting curved perimeters in touching relation at spaced points therearound, and substantially integrally joined at said spaced touching points to one another and to the sheet metal.

4. An article of manufacture, consisting of sheet metal, and a surface layer of peripherally touching individually complete wire elements in individually complete units, said units being of closed, curved shape in plan view and being alternately of ovate and circular form in successive rows, the circular units being disposed between the smaller ends of the ovate units, and all of said units being substantially integrally joined to one another and to the sheet metal at the points of touching of the units.

5. An article of manufacture comprising a sheet metal layer and reinforcing elements consisting of wire-like ribs presenting cross sectionally thereof rounded basal edges substantially integrally joined to and across a surface of said sheet metal layer, and straight side edges converging from said rounded basal edge to a free edge.

6. An article of manufacture comprising a sheet metal member, and wires arranged in individually complete, and elongated units of a closed curved shape in plan view, and disposed on the metal member with the elongations extending substantially in the same direction on the sheet metal member to provide greater resistance to bending on a line transverse to the elongations than parallel with the elongations, and the wires being substantially integrally joined to one another and to the sheet metal member at a side thereof.

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