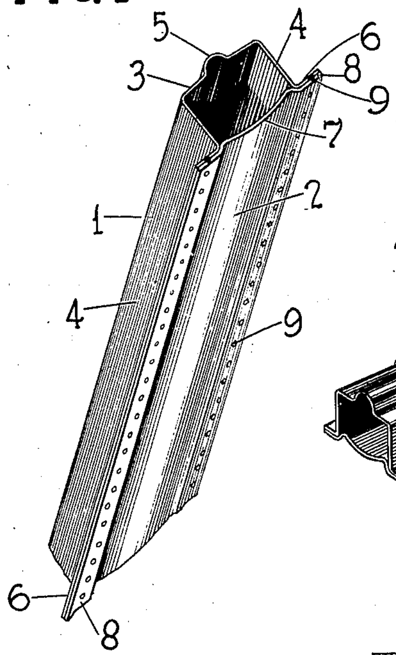
July 9, 1935. E. J. W. RAGSDALE 2,007,898

SHEET METAL STRUCTURE

Filed Sept. 30, 1931

FIG. 1



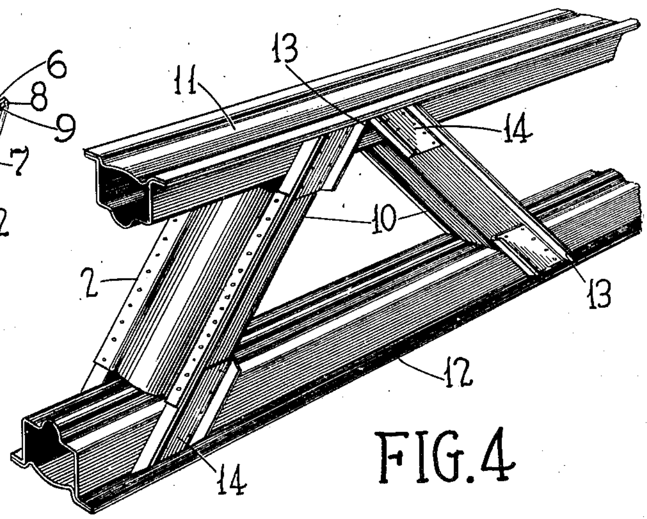


FIG. 4

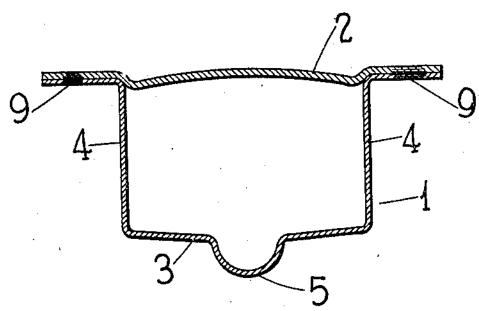


FIG. 2

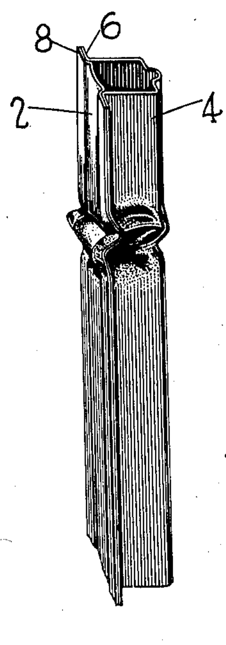


FIG. 3

INVENTOR.
EARL J. W. RAGSDALE

BY John P. Tarbox

ATTORNEY.

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SHEET METAL STRUCTURE

Earl J. W. Ragsdale, Norristown, Pa., assignor to Edward G. Budd Manufacturing Company, Philadelphia, Pa., a corporation of Pennsylvania.

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5 Claims. (Cl. 189—37)

The present invention relates to sheet metal structural elements and particularly to a hollow section sheet metal structural element and truss structure comprising the same, especially adapted to aircraft construction.

Its main object is the provision of a hollow or box section, beam element of increased strength in proportion to weight and balanced in its resistance to compressional strain, without undue complication in form and construction, and particularly adapted to construction from stainless steel in strip form by spot welding.

Another object is the provision of a truss or lattice girder fabricated of such hollow section elements in a manner to take best advantage of their structural characteristics and their amenability to incorporation in fabricated structures by spot welding.

Other objects and advantages of the invention will be apparent from a perusal of the following specification and the drawing accompanying the same.

In the drawing,

Fig. 1 is a perspective view of a preferred form of the beam element.

Fig. 2 is a transverse cross section of a modification.

Fig. 3 shows the result of compressional breakdown test.

Fig. 4 is a perspective view of a truss or lattice girder constructed of elements of the form shown in Fig. 1.

Referring to Fig. 1, this shows the preferred form of the beam element which is comprised of two sheet metal strips, a strip **1** of flanged, channel section, and a flanged arched cover strip **2**, both drawn from flat sheet material. The channel member in section, is of a form having a bottom **3** of greater width than the depth of the side walls **4**, with a longitudinal central bead **5** formed in the bottom exteriorly of the channel, and flanges **6** extending laterally outwardly from the top edges of the side walls. The cover strip **2** is arched at **7** and provided with flanges **8** offset upwardly of the ends of the arch, the width of the arch and the flanges being so proportioned that the cover strip will fit over the channel strip with the arch springing from the inner edges of the side walls of the channel and the flanges **8** registering with the flanges **6** in superposed relation. The two strip members being spot welded together through the flanges as indicated at **9**, form a rigid box beam or strut so balanced that when put under compressional break-down test it will crumble in a substantially straight line without buckling to one side or the other. An example of the result of such a test is depicted in Fig. 3.

Its increased strength and improved balance is evidenced by comparison with a hollow strut of similar shape but slightly larger dimensions with a trough member relatively slightly deeper and without the bead **5**, which under break-down compressional test buckled toward the bottom of the channel at a pressure of 40,000 pounds per square inch, while the novel form shown in Fig. 1, stood up in well balanced condition under the test and failed only at approximately 104,000 pounds per square inch with a decided vertical crumble and barely perceptible buckling of the cover member.

The modification shown in Fig. 2 is similar in all respects to that of Fig. 1 except that the cover strip **2** is of slightly heavier gauge metal, .020 of an inch as against .012 of an inch in the modification of Fig. 1. This variation is found to give a very well balanced construction, failing only at approximately 114,000 pounds per square inch with substantially vertical crumpling as in Fig. 3 and with no perceptible buckling of the cover member **2**. This is illustrative of the important advantage of the present novel structural form in permitting increase in thickness of the cover member **2** with consequent marked increase in strength when desired, without disturbing the quality of balance.

The present novel form of structural element lends itself readily to the fabrication of various forms of trusses due chiefly to the fact that the cover member **2** may be added at any convenient stage in the fabrication of the truss, after full advantage is taken of the accessibility of the flat side walls of the open channel member for joining other elements thereto, especially by spot welding. As an example of its amenability to such use, Fig. 4 shows a portion of a Warren trussed beam or spar in which the present element is used for both the chord and strut members. In this construction, the strut members **10** forming the web of the beam are each secured to the chords **11** and **12** through extensions **13** of the sides of the channel portion of the strut overlapping the side walls of the channel portion of the chords and spot welded thereto, the chord members being arranged as shown with the bottoms of their channel portions inward of the beam and the cover members **2** omitted to facilitate spot welding. In portions of the beam requiring added strength in the joints, this requirement is fulfilled by the use of outwardly flanged reinforcing gusset plates 14 overlapping the extensions 13 and a portion of the continuing side of the channel of the strut member, and spot welded thereto, all three thicknesses of metal where the gusset 14, extension 13 and the channel wall of the chord member overlap being welded preferably at the same time. The cover members 2 of the struts 10 are also omitted to facilitate welding of the gusset plate 14 to the side channel wall of the strut.

After the above described welding operations, the cover strips 2 of the various chords and struts are welded in place to complete the hollow box structure shown in Fig. 1, except that in portions of the truss under insufficient strain to require full strength struts, the cover strips are omitted. This amenability to graduations in weight and strength renders the present structural element particularly useful in aircraft construction and especially in the construction of wing spars where stresses vary greatly at different points along the spar.

It will be obvious that the invention lends itself to various other types of trussed structures than that herein shown and described, and it is to be understood that while the invention is here disclosed by the illustration and description of certain specific embodiments thereof, it is not limited to such specific embodiments but contemplates all such modifications and variants thereof as fall fairly within the scope of the appended claims.

What is claimed is:

1. A truss comprising chord members each in the form of a thin sheet metal channel beam having longitudinal flanges extending laterally outwardly from the edges of the channel at right angles to the sides of the channel, a longitudinal rib embossed in the bottom of the channel and an arched cover plate sprung between the sides of the trough and provided with flanges overlapping the flanges of the channel beam, the cover plate and channel beam being secured together by the overlapping flanges spot welded together, and a web lacing composed of struts of the same form as the chord members, each having the ends of the bottom channel and cover plate abutting the bottom of the channels of the chord members and the sides integrally extended to overlap the sides of the chord members and spot welded thereto.

2. A sheet metal truss comprising a pair of chords and a web lacing of strut members, each of said chords and strut members comprising a thin walled sheet metal box section having an embossed longitudinal rib, the chord members being arranged with their ribbed sides facing each other and the struts with their ribs in the plane of the ribs of the chords, the struts being fastened to the chords by integral extensions of the side walls of the strut box section overlapping the sides of the chord box sections and spot welded thereto.

3. A sheet metal truss comprising a pair of chords and a web lacing of strut members, each of said chords and strut members comprising a thin walled sheet metal box section having an embossed longitudinal rib, the chord members being arranged with their ribbed sides facing each other and the struts with their ribs in the plane of the ribs of the chords, the struts being fastened to the chords by integral extensions of the side walls of the strut box section overlapping the sides of the chord box sections and spot welded thereto, and a reinforcing angular gusset plate overlapping each extension and a portion of the side wall of which the extension is a continuation, and spot welded thereto.

4. A sheet metal truss comprising a pair of chords and a web lacing of strut members each of said chords and strut members comprising a thin wall sheet metal box section comprised of a channel having outwardly flanged side walls and a cap strip overlapping and secured to the flanges and closing the mouth of the channel, the chord members being arranged with their channel bottoms opposed to each other, and the struts with their channel side walls parallel to the channel side walls of the chords, the struts being fastened to the chords by integral extensions of the side walls of their channel cross sections overlapping the side walls of the chord box sections and secured thereto.

5. A sheet metal truss according to claim 4, in which the integral extensions of the side walls of the strut members are reinforced adjacent the joinder of the side walls of the struts with their bottom walls with outwardly extending flanges paralleling the axes of the struts.

EARL J. W. RAGSDALE.