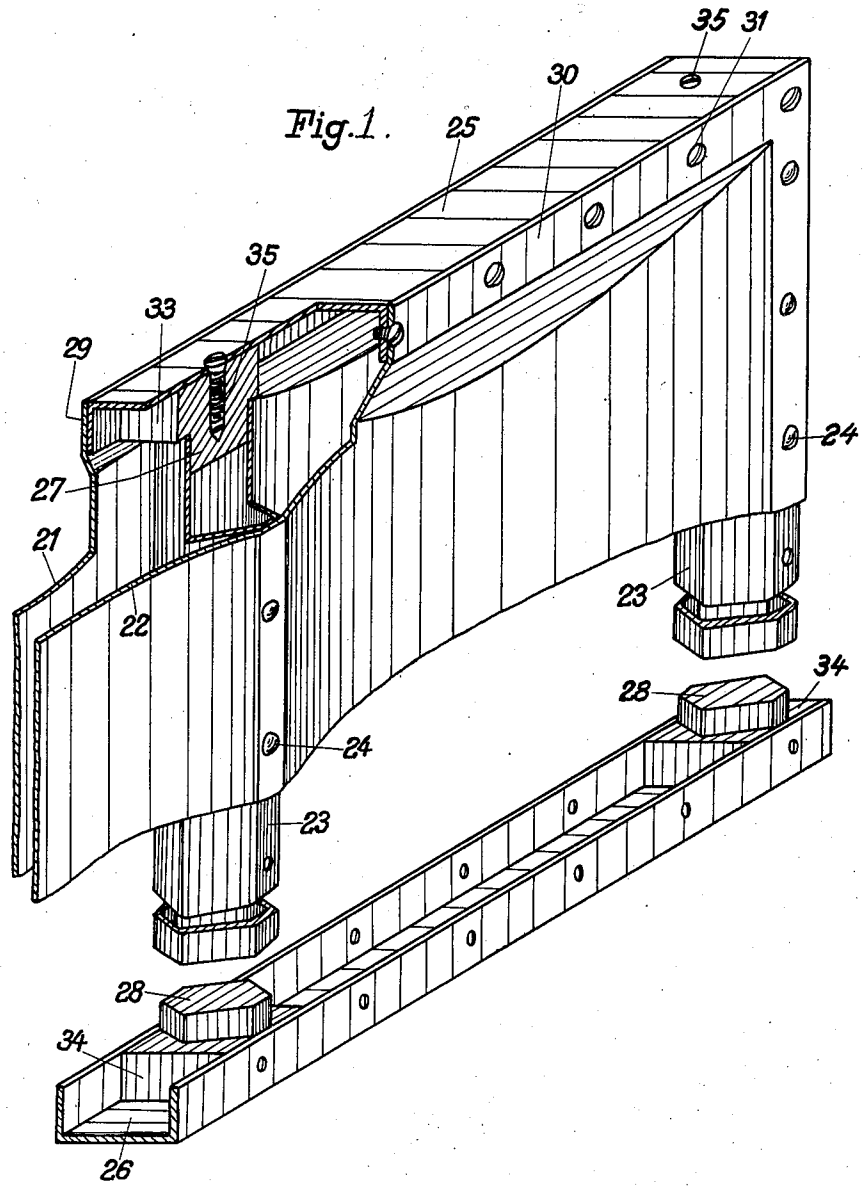
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STRUCTURAL MEMBER

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Fig. 1.



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Fig. 2.

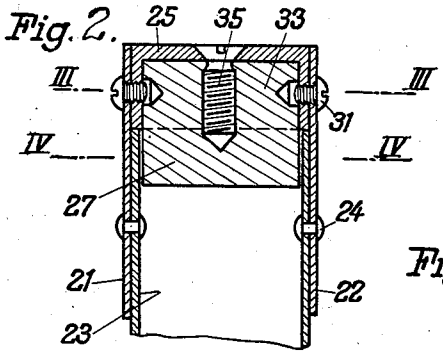


Fig. 3

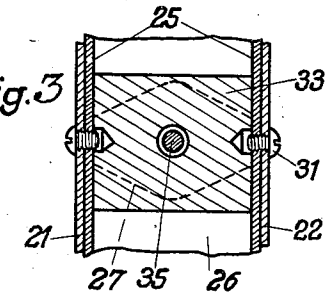


Fig. 4.

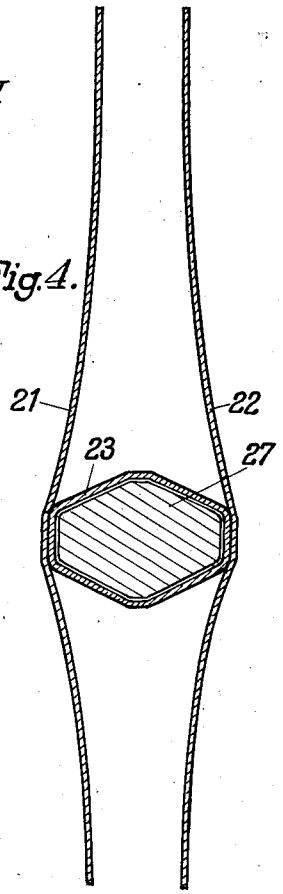
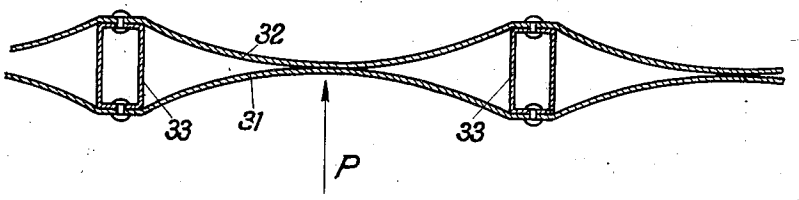


Fig. 5.



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UNITED STATES PATENT OFFICE

1,989,259

STRUCTURAL MEMBER

Emil Becker, Dessau, Germany, assignor to Hugo Junkers, Dessau, Germany

Application October 24, 1931, Serial No. 570,908
In Germany October 28, 1930

9 Claims. (Cl. 189—34)

My invention relates to structural members or elements of the kind described in Patent 1,895,667 of the United States, dated January 31, 1933, Ser. No. 343626, filed March 1, 1929, for "Structural member".

The members or elements described in the said patent comprise two sheet metal plates which are arched or bent to large radii and arranged with their convex faces facing each other, an abutment or a set of abutments between the convex faces, and means for holding the plates applied against the abutment.

It is an object of my invention to so design a member of the kind referred to that the abutment is dispensed with, and extra members, such as screws, rivets, or other elements for transmitting torsional forces, are also dispensed with. To this end, I provide supporting bars which are rigid against torsional forces and extend along the sides of the arched or bent portions of the plates. The bars are preferably tubular. To the ends of the bars, I connect blocks in such manner that the blocks are held against turning with respect to the bars. For instance, if the bar or its end is hollow and hexagonal in cross-section, a plug is formed on the block whose cross-section corresponds to that of the bar, so that the block is held against turning in the bar. On the edges of the element where the ends of the supporting bars are positioned, I place strips, for instance channel sections, and provide means, for instance, flat-sided heads on the blocks, for engaging between the flanges of the strips so as to operatively connect the blocks and strips for holding the blocks, and the bars to which the blocks are connected, against turning. In this manner, the bars are effectively braced against torsional forces by the blocks and the strips by simply inserting the blocks so that the unit including the bars and the sheet metal plates, on the one hand; and the body of the element, i.e. the unit including the strips and the blocks, on the other hand; are connected without using the aforesaid extra members, such as screws, etc.

The term "rigid" is here intended to mean "not undergoing substantial deformation under the stresses to which the structural member or element is normally subjected".

In the element described in the said patent the convex or channel-like plates are supported at their sides and at their convex central portions by abutments or other supporting members arranged wihin the elements. A force which acts on an arched portion at right angles to the central plane of the wall, is absorbed by the abutment or abutments at the central convex portions of its plates. Without such abutment means the force would deform or buckle one of the plates, or both plates to a considerable extent while the sides of the arched plate or plates would move nearer to each other, causing distortion or bending of the supporting bars at the sides of the arches. In short, the element without abutments would undergo a very marked deformation.

According to my invention the central abutments are eliminated altogether by bracing the elements in another way. In the novel element according to this invention the plates are only supported at the sides of their arched portions, without any support at their central convex faces, by bars, preferably tubes, which are rigid against torsion. The ends of the bars are rigidly connected to braced strips, also rigid, at the ends of the element.

If now a force directed as described acts on the arched portion of a plate, it will again attempt to move the sides of the arch nearer together but the sides are now anchored by the bars which are rigid to distortion stresses and will not yield. The sides of the arch are consequently held in fixed position and prevent any appreciable buckling and deformation of the arch. The element possesses adequate strength notwithstanding the elimination of the abutments at the convex faces.

It will be understood that the member or element described in the said patent is improved in several ways according to the present invention. Firstly, it is rather difficult to build the abutments into the hollow members or elements, the more so as this requires very accurate workmanship which is hard to obtain in view of the comparatively thin sheet metal from which the plates are made. The element according to the present invention is therefore simplified not only in design but also in manufacture. Secondly, the initial cost of the novel element is reduced in proportion to its simplification, and thirdly a not unconsiderable saving in weight is obtained.

In the drawings affixed to this specification and forming part thereof various elements embodying my invention are illustrated diagrammatically by way of example.

In the drawings

Fig. 1 is a perspective illustration of an element, partly broken open, with tubular bracing bars of polygonal cross section at the sides of its arches, and braced strips of channel section at its ends,

Fig. 2 is a cross section of the element in Fig. 1 along the axis of one of its bars,

Figs. 3 and 4 are sections on the lines III—III and IV—IV, respectively, in Fig. 2, and

Fig. 5 is a longitudinal section of an element having bars of rectangular section and arches which are not spaced apart.

Referring now to the drawings, 21 and 22 are the two side plates of the element which, like the plates described in the said patent, are bent to large radii and arranged with their convex faces facing each other, as best seen in Fig. 4, but without the abutments inserted between the convex faces, as described in the patent, and 23 are the bars extending along the sides of the flat arches. The bars are here shown as tubes of hexagonal section but obviously might also be tubes of elliptical, or other suitable section, or of a section having straight and curved faces in combination, for instance, cylindrical tubes with flat sides for the reception of the sides of the arches.

At the sides of their arches, the plates 21 and 22 are connected to the bars 23 by any suitable means, for instance, rivets 24, as shown. 27, 33 and 28, 34 are blocks the inner portions 27 or 28 of which are shaped in conformity with the cross section of the bars 23, in the present instance, hexagonal, and the outer portions 33 or 34 of which are square for connection to a channel strip 25 at the upper and 26 at the lower end of the element. It will appear that the plates 21 and 22 are secured to the two parallel opposite flat faces of every bar by the rivets 24, and that the blocks engage in the hexagonal, or otherwise non-cylindrical, ends of the bars with their hexagonal inner portions or plugs 27, 28, and in the channels 25, 26 with their square outer portions or heads 33, 34. The channel strips are connected to the heads of the blocks by any suitable means such as screws 35 and the ends 29, 30 of the plates 21, 22 are flat and connected to the flanges of the sections 25 and 26 by screws 31. At the lower end of the element, the plates 21 and 22 have been broken away to show the bars 23 and the blocks 28, 34 in the lower channel section 26 but it is understood that the plates are secured to the lower section 26 in exactly the same manner as to the upper section 25.

By dispensing with the abutments between the convex inner faces of the plates 21, 22, I may also design the element in such manner that the convex inner faces engage each other as shown in Fig. 5 instead of being spaced apart as shown in the other figures. In Fig. 5 bars 33 of rectangular section at the ends of the arches in the plates 31, 32 are shown by way of example. The strength is by no means reduced in this element on the contrary, it is increased, as a force P acting centrally on the arch of the plate 31 is partly transmitted to the plate 32 so that the plate 31 and the bars 33 are relieved of a portion of the stress.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

In the claims affixed to this specification no selection of any particular modification of the invention is intended to the exclusion of other modifications thereof and the right to subsequently make claim to any modification not covered by these claims is expressly reserved.

I claim:—

1. A structural element comprising two sheet metal plates bent to large radii and arranged with their convex faces facing each other, supporting bars for said plates, which bars are rigid against torsion and extend along the sides of the bent portions of said plates, blocks connected to the ends of said bars in such manner that the blocks are held against turning with respect to the bars, and strips placed on the edges of said member, where the ends of said bars are positioned, for holding said blocks against turning with said bars.

2. A structural element comprising two sheet metal plates bent to large radii and arranged with their convex faces facing each other, supporting bars for said plates which bars are rigid against torsion and extend along the sides of the bent portions of said plates, non-cylindrical end portions on said bars, blocks connected to the end portions in such manner that the blocks are held against turning with respect to the bars, and strips placed on the edges of said member where the ends of said bars are positioned, for holding said blocks against turning with said bars.

3. A structural element comprising two sheet metal plates bent to large radii and arranged with their convex faces facing each other, supporting bars for said plates which bars are rigid against torsion and extend along the sides of the bent portions of said plates, hollow non-cylindrical end portions on said bars, blocks connected to the end portions in such manner that the blocks are held against turning with respect to the bars, and strips placed on the edges of said member where the ends of said bars are positioned, for holding said blocks against turning with said bars.

4. A structural element comprising two sheet metal plates bent to large radii and arranged with their convex faces facing each other, supporting bars for said plates of non-circular cross-section, which bars are rigid against torsion and extend along the sides of the bent portions of said plates, blocks connected to the ends of said bars in such manner that the blocks are held against turning with respect to the bars, and strips placed on the edges of said member where the ends of said bars are positioned, for holding said blocks against turning with said bars.

5. A structural element comprising two sheet metal plates bent to large radii and arranged with their convex faces facing each other, tubular supporting bars of non-circular cross-section which are rigid against torsion and extend along the sides of the bent portions of said plates, blocks, a plug on every block, which plug is adapted to be inserted in one end of a tubular bar and is equipped with faces for holding it against turning in the bar, and strips placed on the edges of said member where the ends of said bars are positioned, for holding said blocks against turning with said bars.

6. A structural element comprising two sheet metal plates bent to large radii and arranged with their convex faces facing each other, tubular supporting bars of polygonal cross-section, which are rigid against torsion and extend along the sides of the bent portions of said plates, blocks, a plug on every block which plug is of polygonal cross-section and adapted to fit in one end of a tubular bar, and strips placed on the edges of said member where the ends of said bars are positioned, for holding said blocks against turning with said bars.

7. A structural element comprising two sheet metal plates bent to large radii and arranged with their convex faces facing each other, sup-

porting bars for said plates, which bars are rigid against torsion and extend along the sides of the bent portions of said plates, parallel faces at opposite sides of every bar at which faces the plates are connected to the bars, blocks connected to the ends of said bars in such manner that the blocks are held against turning with respect to the bars, and strips placed on the edges of said member, where the ends of said bars are positioned, for holding said blocks against turning with said bars.

8. A structural element comprising two sheet metal plates bent to large radii and arranged with their convex faces facing each other, supporting bars for said plates, which bars are rigid against torsion and extend along the sides of the bent portions of said plates, blocks connected to the ends of said bars in such manner that the blocks are held against turning with respect to the bars, strips of channel section placed on the ends of said member where the ends of said bars are positioned, and so arranged that the web of every strip forms one of the edges of the element and its flanges extend inwardly with respect to the element; and parallel faces on said blocks for engaging between said flanges.

9. A structural element comprising two sheet metal plates bent to large radii and arranged with their convex faces facing each other, supporting bars for said plates, which bars are rigid against torsion and extend along the sides of the bent portions of said plates, blocks connected to the ends of said bars in such manner that the blocks are held against turning with respect to the bars, strips of channel section placed on the ends of said member where the ends of said bars are positioned, and so arranged that the web of every strip forms one of the edges of the element and its flanges extend inwardly with respect to the element; flat end portions on said plates which are secured to said flanges, and parallel faces on said blocks for engaging between said flanges.

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