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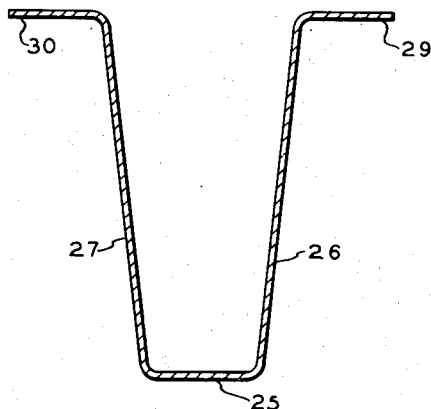
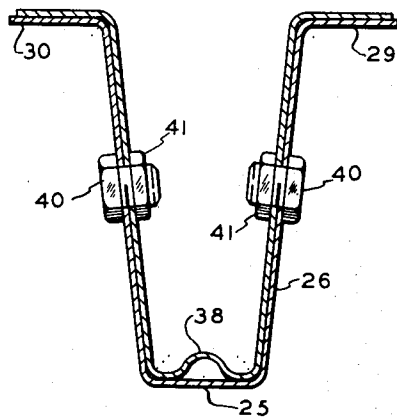
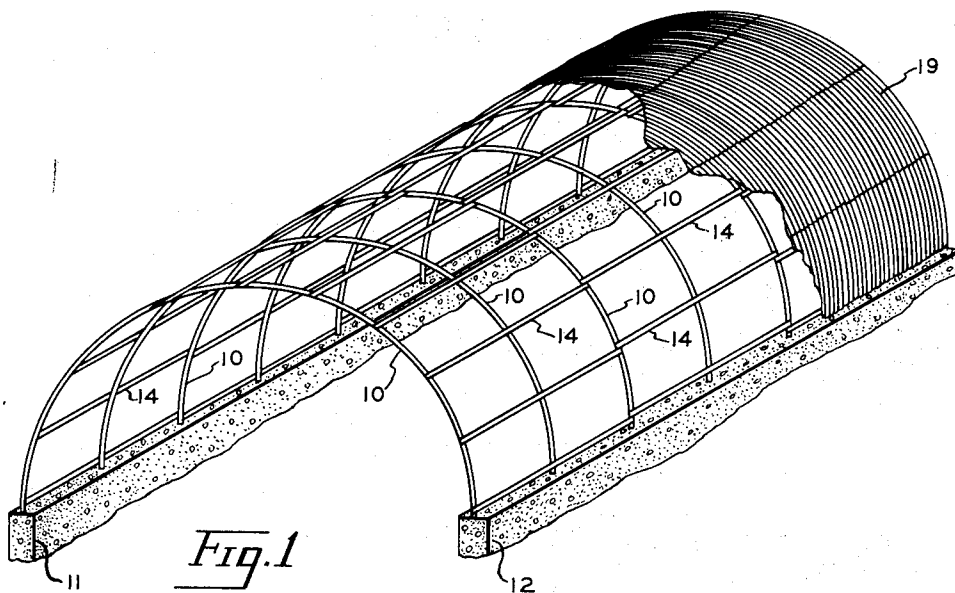
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2,717,060

ARCHED BUILDING STRUCTURES AND ELEMENTS FOR SAME

Filed April 6, 1951

2 Sheets-Sheet 1



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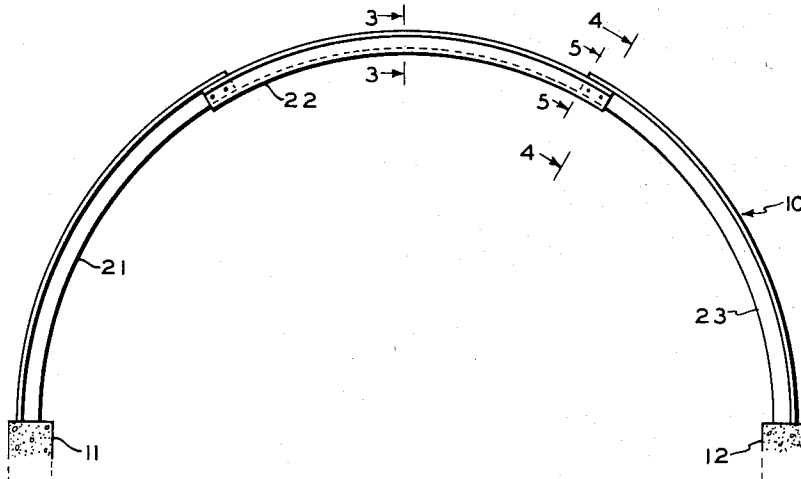


*Fig. 2*

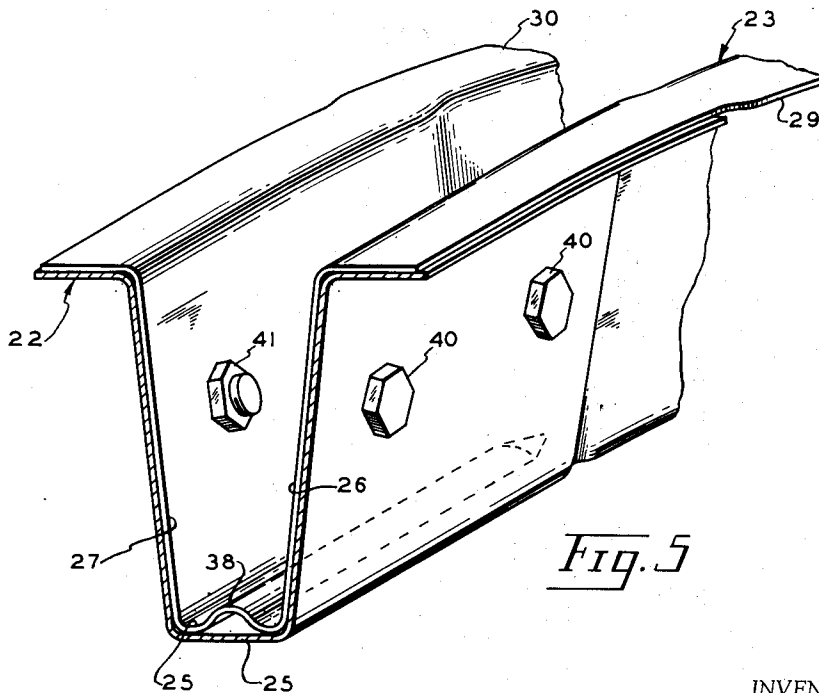


*Fig. 5*

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## ARCHED BUILDING STRUCTURES AND ELEMENTS FOR SAME

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Application April 6, 1951, Serial No. 219,711

8 Claims. (Cl. 189—1)

The present invention relates to improvements in arched rib buildings and to a novel telescoping arrangement connecting together the adjacent ends of arched rib members in such buildings and to improved arched rib members having one or both ends constructed to form a telescoping connection with a similar member.

In arched rib structures which may, for example, be substantially semicircular in cross section, the structure includes a skeleton framework of arched ribs which extend across from side to side of the building connected together by longitudinally extending purlins spaced about the periphery of the ribs. A covering may be attached to the purlins. The ribs are the main supporting members so that the strength of the framework and the building is dependent upon the strength of the ribs. It is customary to fabricate the various parts for arched rib structures and then assemble the parts in packages at the point of fabrication. These packages are shipped to the point of erection. The parts are arranged in the packages in such a manner that a set of packages will contain all of the parts for a building. These buildings are often thirty or forty feet wide which means that the ribs must extend through the arc having a diameter equal to thirty or forty feet. Obviously such a member is too bulky to be transported readily. Particularly when it is necessary to transport the parts a long distance or to a foreign country, it has been the general practice to make such arched ribs with an I-shape in cross section and to make the rib in about three parts. These parts are assembled in the field by arranging the segments on the ground and connecting the adjacent end of the segments together by means of splice plates bolted in place. The assembled rib is then swung up into position and fastened in place by means of the purlins. The plates or splice members extend part way along the ends of both segments and there is a tendency for such connections to constitute a zone of weakness which is a serious drawback in that the ribs are the main supporting members. Another important drawback is that the use of splice members increases the number of parts which in turn increases the chances of the parts being lost and not available at the site of erection. In theory, the assembling of the prefabricated parts into packages in such a manner that a set of packages provides all the parts for a building should assure that all parts are available at the site of erection. It has been found in practice that the more parts required, the greater the chances are that some of the parts will be missing. It happens all too frequently that when a crew starts to erect a building 99% of the parts will be available but that the building cannot be erected as a few parts are missing. This causes excessive erection delay, particularly where the site of erection is a great distance from the fabrication plant, as is usually the case when arched ribbed members are erected.

It is an object of the present invention to provide an improved arched rib building structure including a plurality of elongated arched rib members having their adjacent

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ends connected together in a novel telescoping arrangement.

It is an object of the present invention to provide an improved structure including an arched rib made up of arched segments arranged end to end with the adjacent ends connected together in a novel telescoping arrangement.

It is an object of the present invention to provide an improved arched structural member that can be readily assembled with one or more similar members in end to end relationship without the use of separate splice plates to form an arched rib for a building structure.

It is an object of the present invention to provide an improved arched structural member having one or both end portions modified to fit into the end of a similar member that is the same as the major portion of the first mentioned member so that two or more members can be readily connected together in end to end relationship without the use of separate splice members and without modifying the members except for one of the end portions at each telescoping connection.

In accordance with the present invention, the arched members or segments are channel shape in cross section. The cross sectional shape may be a U-shape or a hat shape. These segments are connected together in aligned end to end relationship with one end portion of one segment fitting into an adjacent end portion of the adjacent segment. Thus, when the segments are assembled in the field to form an arched rib, the segments can be readily fitted together without the use of additional splice plates, channels or other extra members. The joint between the segments is as strong or stronger than the segments themselves and there are not the additional splice members which can be readily lost. The time required for assembly and erection is reduced and the resulting product is stronger, less cumbersome and better than those heretofore utilized.

These and other objects and advantages of the present invention will become readily apparent from the following description, taken with the accompanying drawings, in which:

Figure 1 is a cabinet view of an arched rib building structure embodying the principles of the present invention, portions of the covering have been removed to illustrate the construction;

Figure 2 is a side view in elevation of an arched rib of the building of Figure 1;

Figures 3 and 4 are enlarged sectional views taken along lines 3—3 and 4—4, respectively, of Figure 2; and,

Figure 5 is an enlarged fragmentary, cabinet view of a telescoping joint between arched rib members taken as indicated by line 5—5 on Figure 2.

Referring to the drawings, and particularly to Figure 1, the elongated arched rib building structure includes a plurality of similar, parallel arched ribs 10 spaced apart along the length of the building. The arched ribs extend transversely of the building with the opposite ends of the ribs supported on the foundation piers 11 and 12, at opposite sides of the building. The arched ribs are connected together by longitudinally extending purlins 14. As shown, each purlin 14 extends across part of the ribs with the adjacent ends of the purlins in overlapping relationship. Each purlin 14 is connected by screws or other means to each rib 10 across which the purlin member extends and preferably each purlin member is connected to each flange of each rib. The purlin members like the ribs are formed of metal and preferably are of the type adapted to present grooves for receiving nails for fastening the outer covering in place. The outer covering may be for example, corrugated metal sheets 19, a part of which is shown in Figure 1. The purlin member may be of the type shown in Figure 1 and

described in the specification of my copending application, Serial No. 142,171, filed February 3, 1950, now Patent No. 2,685,354, dated August 3, 1954.

The transversely extending ribs 10 and the longitudinally extending purlins 14 together constitute the skeleton framework which supports the collateral material, such as the outer covering and the inner covering, if any. The ribs are the main load supporting members with the purlins serving as bracing for the ribs so that the load supporting capacity of the building is dependent upon the strength and rigidity of the skeleton framework, particularly the strength and rigidity of the ribs 10. The building structure shown in Figure 1 is of the type shown and described in my copending application, Serial No. 219,712 filed April 6, 1951.

The ribs 10 are identical and only one rib will be described in detail. As shown more clearly in Figure 2, the arched rib extends through an arc of about 180° and may comprise three segments or members 21, 22 and 23, each extending through an arc of about 60°. These ribs are usually made having a diameter of, for example, 20, 30 or 40 feet, depending upon the width of the building. As shown, the segments of the rib are substantially of equal length but need not be. While the rib 10 and the segments or arched rib members making up the rib are shown as being uniformly curved about a single axis, the rib and the segments may be non-uniformly curved with the different members curved about different axes. The term "arched" as applied to the rib and rib members is intended to include both uniformly and nonuniformly curved members, unless otherwise stated. In addition, the members 21, 22 and 23 may be of equal length, as shown, or may have different lengths and different radii of curvature. For example, if the radius of curvature of members 21 and 23 is 20 feet, the radius of curvature of the center segment 22 may be 15 feet, or vice versa.

As shown more clearly in Figure 3, the arched rib 10 and each of the arched rib members 21, 22 and 23 is formed of sheet metal having in cross section a hat shape. The arched rib member includes an inner web portion 25 facing inwardly toward the center of curvature and a pair of spaced apart side web portions 26 and 27, each integrally joined along an inner edge to a respective edge of the inner web portion 25. The side web portions extend outwardly from the inner web portion and the side web portion 26 terminates in a laterally, outwardly extending flange 29 having an outer free edge. Similarly, the side web portion 27 terminates in a laterally outwardly extending flange 30 having an outer free edge. The flanges 29 and 30 are coplanar and are located in a plane parallel with the plane of the inner web portion. Each of the arched rib members has a cross sectional shape as shown in Figure 3 except for the one end portion of each of members 21 and 23 which is in telescoping arrangement with an end portion of the adjacent member 22. Member 22 has throughout its length the cross sectional shape shown in Figure 3.

As shown more clearly in Figures 2, 4 and 5, the adjacent ends of the rib members are in telescoping arrangement. The upper end of member 23 has a rib 38 formed in the inner web portion 25. The rib 38 is formed of metal displaced laterally outwardly from the inner web portion 25 and the rib 38 is of such a size that when the rib is formed, the respective side web portions 26 and 27 are moved inwardly toward each other a distance equal to twice the thickness of the metal or equal to the total thickness of the side web portions 26 and 27. This distance should be as nearly twice the thickness of the metal as is consistent with good manufacturing processes. When the rib 38 is formed, the side web portions and the flanges should be held so that when the rib end of the member 23 is placed inside of the end of rib member 22, the side web portions and flanges of the respective members will engage each other snugly in

parallel nesting or telescoping relationship as shown in Figures 4 and 5. The major portion of the arched rib member 23 has the cross sectional shape shown in Figure 3 except for that relatively minor portion at the end which is modified as shown in Figure 5.

The upper end portion of arched rib member 21 is similarly modified for telescoping arrangement within the adjacent end portion of segment 22. With this arrangement the members 21 and 23 are identical with the end portions of segment 22 not being modified. The member 22 may be longer or shorter than the other two members without deleteriously affecting the telescoping arrangement. For example, the member 22 may be curved about a radius of 15 feet and the members 21 and 23 may be curved about a radius of 20 feet with each member extending through an angle of about 60°. As shown, each member extends through an arc of about 60° plus half the length of each joint it makes with the other members. If desired, the arched rib members may be formed so that it is the opposite ends of member 22 which are modified with a rib 38 to telescope inside of the upper ends of members 21 and 23.

The telescoping ends are preferably connected together by bolts 40 and nuts 41. Preferably, there is provided a pair of bolts 40 on each side of the telescoping connection as shown in Figure 5, making a total of four bolts at each connection. With this telescoping arrangement, the joint is as strong or stronger than the remainder of the rib so that the strength and rigidity of the rib 10 depend on the properties of the major portion of the rib member that are between the telescoping connections.

As discussed in my copending application Serial No. 219,712 filed April 6, 1951, entitled "Arched Rib Members and Buildings Including Same," the arched ribs preferably have in cross section a hat shape as shown and described. In this copending application, it is pointed out that the flanges 29 and 30 may terminate in downwardly turned lips having a depth up to twelve times the thickness of the metal. In order for the ends to telescope, the upper telescoping flanges must be flat, and this can be achieved by flattening the flanges 29 and 30 of the upper end portion of member 23 which fits inside of the end of member 22. The laterally outwardly extending free flanges 30 and 29 are preferred as they greatly increase the lateral stability of the ribs and present a number of advantages. Insofar as the present invention is concerned, the ribs may be channel shaped in cross section without the laterally outwardly extending flanges 29 and 30.

With the telescoping arrangement, the arched rib members may be quickly and accurately assembled to form an arched rib. It is not necessary to assemble the rib members in end to end relationship and then in addition fasten in place splice plates or splice channels as has been the practice heretofore. The number of parts is reduced by having the ends of the channel shaped arched rib members in telescoping relationship and maximum strength with the greatest ease of assembly is obtained with the present construction.

I claim:

1. An elongated arched rib member of sheet metal having in cross section a single channel shape including an inner web and a pair of side web portions extending outwardly from the two lateral edges of the inner web portion, the side web portions being equally spaced apart by the inner web throughout a major portion of the length of the member with the inner web of said major portion being flat and the inner web in at least one end portion of the member including a rib of inner web metal displaced outwardly a distance such that the side web portions of said one end portion are more closely spaced apart than the side web portions in said major portion by a distance equal to twice the thickness of the sheet metal, each side web portion in said one end por-

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tion being parallel with the respective side web portion in said major portion whereby the said one end portion will telescope inside of an end portion of another arched rib member that is the same cross sectional size as said major portion with the telescoping side web portions of the two members in snugly fitting parallel relationship with each other.

2. The elongated arched rib member claimed in claim 1 in which the inner web in only one end portion of the member includes the rib whereby only said one end portion will telescope with another member.

3. The elongated arched rib member claimed in claim 1 in which the inner web in each opposite end portion includes the rib whereby each end portion will telescope with another member.

4. The elongated arched rib member claimed in claim 1 in which the side web portions terminate in coplanar, laterally, outwardly extending flanges having free outer edges.

5. An elongated building structure including arched ribs laterally spaced apart along the length of the building structure and extending transversely of the building structure, each arched rib including at least two arched rib members formed of sheet metal having adjacent end portions connected together in telescoping relationship, each of the two members including an inner web and a pair of side web portions extending outwardly from the two lateral edges of the inner web, the side web portions throughout at least a major portion of the length of each member being equally spaced apart by the respective inner webs which are flat, one telescoping end portion of one member having the same cross sectional shape as the major portion and the inner web of the other adjacent end portion of the other member including a rib of inner web metal displaced outwardly a distance such that the side web portions of said other end portion are more closely spaced apart than the side web portions in the major portion by a distance equal to twice the thickness of the sheet metal and said other end portion snugly telescoping in said one portion with the telescoping side web portions of the two members in snugly fitting parallel relationship.

6. The building structure claimed in claim 5 in which said one member has the same cross sectional shape

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throughout its length and the said other member has the same cross sectional shape except in said other adjacent end portion.

7. The building structure claimed in claim 5 in which the arched rib members have in cross section a hat shape with each side web portion terminating in a laterally outwardly extending, free edge flange.

8. An elongated building structure including a plurality of longitudinally spaced apart, transversely extending arched ribs, each rib including a pair of outer arched rib members and an intermediate arched rib member, the pair of outer members each having an end portion telescoping inside of an adjacent end portion of the intermediate members, each member being formed of sheet metal and having in cross section a hat shape including an inner web and spaced side webs extending outwardly and terminating in coplanar laterally outwardly extending flanges, the inner web throughout the length of the intermediate member and the inner web throughout the length of each outer member except for the telescoping end portion being flat and equally spacing apart the respective side web portions, the inner web in the telescoping end portion of each outer member including a rib of outwardly displaced inner web metal of such size that the respective side web portions are more closely spaced apart than the side web portions joined by the flat inner web by a distance equal to twice the thickness of the metal, and the telescoping end portion of each outer member fitting inside the adjacent end portion of the intermediate member with the telescoping side web portions and flanges in snugly fitting parallel relationship.

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