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G. A. HUGHES

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STRUCTURAL BEAM

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Fig. 1.

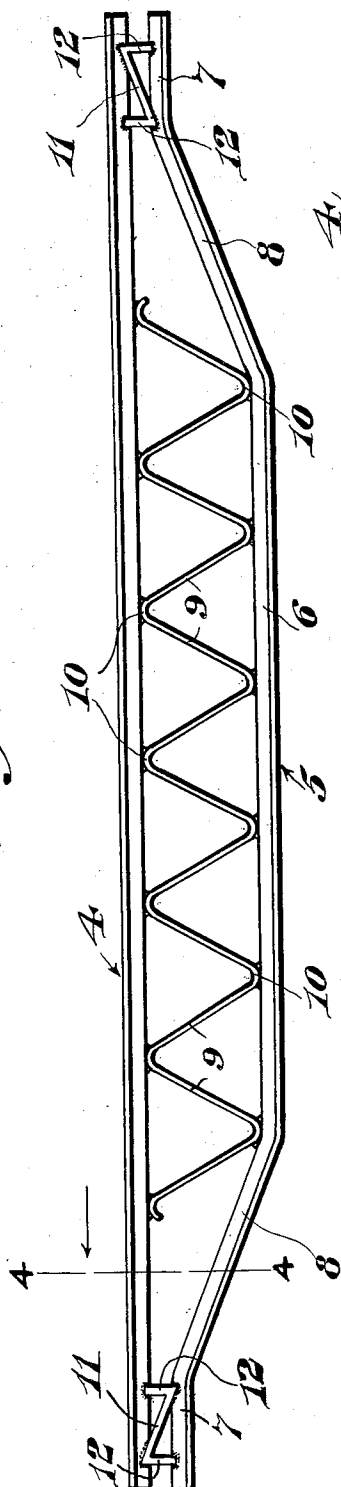


Fig. 2.

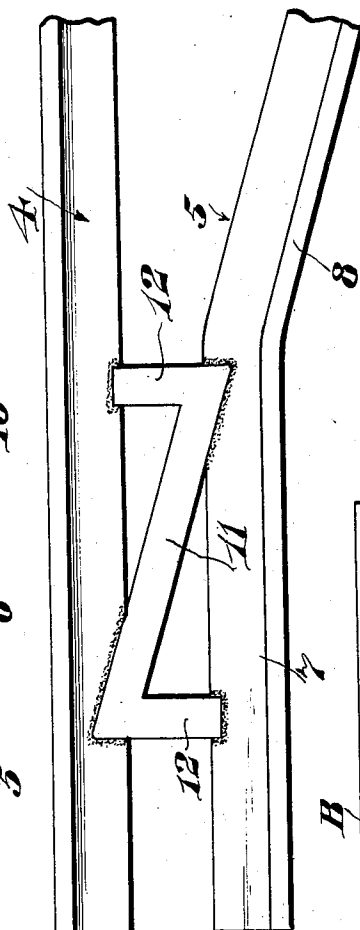


Fig. 3.

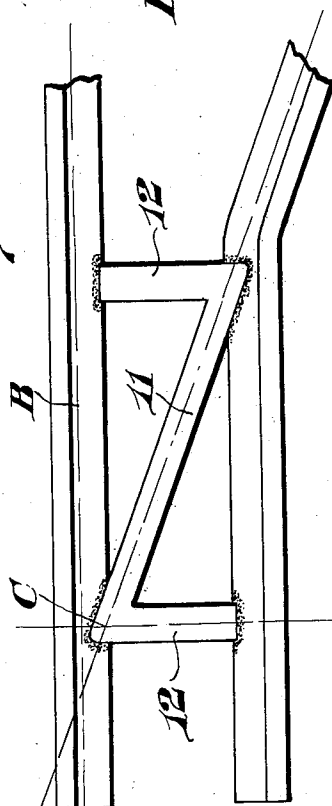
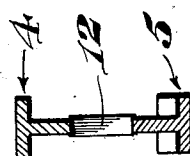


Fig. 4.



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## UNITED STATES PATENT OFFICE

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## STRUCTURAL BEAM

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3 Claims. (Cl. 189—37)

One of the objects of the present invention is to provide a joist structure preferably of the skeleton type with a novel connection between the chords, and particularly adapted for connecting the ends of the upper and lower chords, whereby great strength and rigidity is obtained with higher resistance to the stresses.

A further and important object is to provide a structure of this kind peculiarly adapted to a welding operation and in which the connector will be embedded in the material of the chords and very effectively welded thereto.

In the accompanying drawing:

Figure 1 is a side elevation of a preferred embodiment of the invention.

Figure 2 is a detail view on an enlarged scale and illustrating the embedment of the connector in the material of the chords.

Figure 3 is another and similar view on a smaller scale indicating the manner in which the stresses are transmitted.

Figure 4 is a section on the line 4—4 of Figure 3.

A skeleton beam is disclosed consisting of an upper chord member 4, a lower chord member 5. The upper chord member 4 is shown as straight throughout; the lower chord member has its main or body portion 6 spaced a greater distance from the top chord member than are its end portions 7, and said end portions 7 are connected to the intermediate portion 6 by inclined portions 8. The main intermediate portions of the upper and lower chords are connected by a suitable web shown in the form of a zigzag or serpentine rod 9, the knuckles of which are welded as illustrated at 10 alternately to the portions of the upper and lower chords, between which said web is located. As shown the chords are constructed of T-bars with the flanges thereof in opposition and it is to these flanges that the said web is welded.

The end portions of the flanges are slightly spaced apart and connectors or tie elements are interposed between the same. These tie elements are each of substantially Z-form, comprising an inclined bar 11 and parallel end bars 12. Preferably these connectors are of metal having a higher melting point than the metal of the chords. The result is that if the parts are electrically welded, the knuckles or bends of the connector as well as the free terminals of the end bars 12 will embed themselves in the metal of the chord flanges and at the same time be welded thereto, all as indicated in Figure 2. Moreover it will be noted that the parts are so placed that the inclined bars 11 constitute in effect continuations of the inclined portions 8 of the lower chord

member, while the end bars 12 act as vertical posts or columns between the upper and lower chords.

In the actual construction of these joists the connectors preferably have a higher carbon and manganese content than do the chords and therefore when the parts are placed together and an electric welding current is passed through them and transverse pressure is exerted on the ends of the chords to press them towards each other, the connectors heat much more rapidly than do the bars, but having a higher melting point than the bars, and while their contacting surfaces are caused to fuse, they are not materially upset and they are therefore embedded in the more yielding material of the chord bars. The result is a most effective fusion is obtained.

As examples of the results that have been obtained in tests of structures of this type, the following are given:

In each of the following tests the chemical analysis of the bars used showed a carbon content of .18 and a manganese content of .40.

Where the tie elements or connectors had a carbon content of .12 and of manganese .41, the welds resisted a pulling strain of separation ranging between 12000 and 13100 lbs. An increase of the carbon content to .15 and the reduction of the manganese to .30 made an effective resistance to a separation strain ranging between 18050 and 19000 lbs. A carbon content of .18 and of manganese .36 increased the resistance to the breaking strain by making the range from 20100 to 22040 lbs. Where the carbon and manganese contents were respectively .23 and .60, the bars withstood a strain of 24450 lbs. An increase of the carbon to .29 and the manganese to .63 increased the breakage resistance to a range varying between 27300 to 29860 lbs. and where the carbon content of the slugs was .33 and the manganese .65 the bars withstood a separating strain ranging from 28700 to 30800 lbs.

In addition the structural arrangement has decided advantages, as will be clear by reference to Figure 3. The diagonal portion 11 of the connector being in line or substantially in line with the adjacent inclined portion 8 of the lower chord, serves to carry the stresses from the bottom chord of the joists in a straight line indicated at A to a point where these stresses intersect the stresses in the top chord indicated by the line B. The said point of intersection is indicated at C. This point C, it will be noted, is directly over one of the perpendicular terminals 12, which thus acts as a perpendicular column beneath the point C, and therefore constitutes a support at

this point. The other or inner terminal portion 12 also acts as a perpendicular column between the top and bottom chords of the joists at a point between the point C and the middle of the joist and this stiffens the top chord and reduces its unsupported length, thereby offering material resistance to the compression stresses in the top chord which tend toward buckling the same.

- 10 It has furthermore been demonstrated that the structure can be much more easily and effectively assembled in its completed form and eliminates much uncertainty in the welding operation, thereby producing a more dependable connection at less cost since it employs less material and less labor in production.

From the foregoing, it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art without further description and it will be understood that various changes in the size, shape, proportion and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

What I claim, is:

1. A joist structure comprising spaced metallic chord members and a metallic connector between

the chord members having a higher melting point than the chord members, said connector being embedded in and welded to the chord members.

2. A joist structure comprising upper and lower spaced metallic chords having their intermediate portions spaced a greater distance apart than their end portions, the lower chord having inclined portions between its said intermediate portion and its ends, a substantially Z-shaped connector unit connecting the corresponding end portions of the upper and lower chords, said connectors having a higher melting point than that of the chords and having their bends or knuckles and their terminals embedded in and welded to the chords, the inclined bars of the connectors being substantially in line with the inclined portions of the lower chord and the ends of said connectors acting as substantially perpendicular supporting columns between the chords.

3. A structural member comprising spaced metal elements, and a connector interposed between the spaced elements and comprising a metal piece having a higher melting point than that of the metal elements, said connector having portions embedded in the spaced elements and welded to the same.

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