Oct. 7, 1924. 1,510,703

N. C. RENDLEMAN

PROCESS OF MAKING STRUCTURAL ELEMENTS

Filed March 8, 1922 2 Sheets-Sheet 1

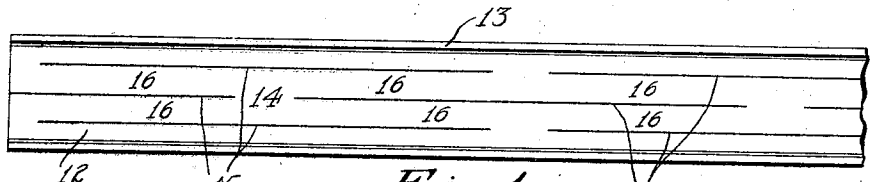


Fig. 1.

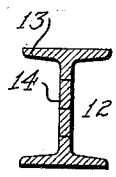


Fig. 2.

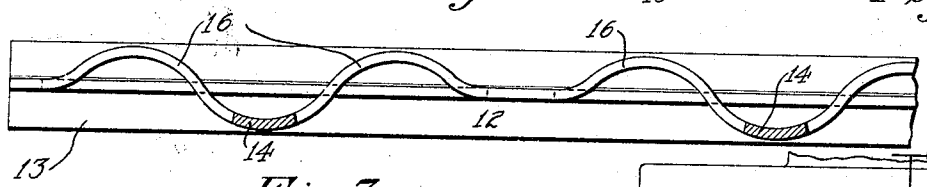


Fig. 3.

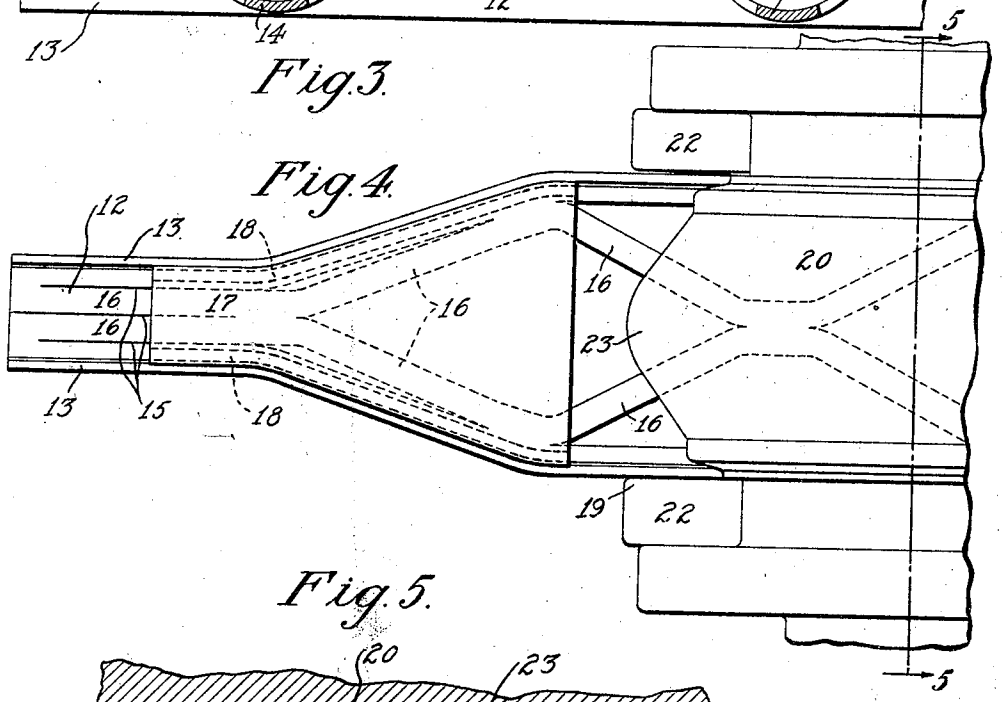
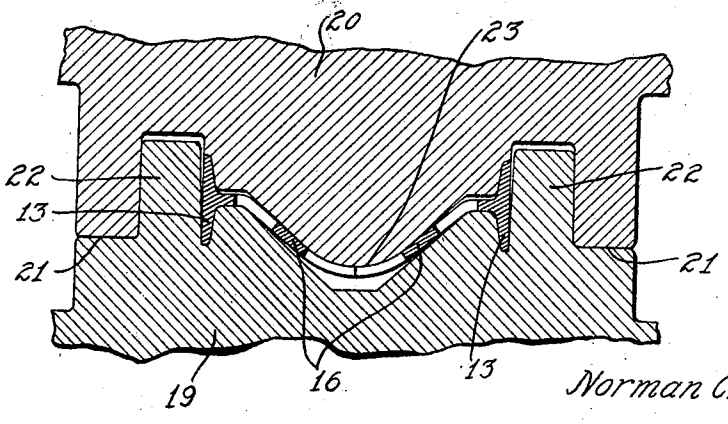


Fig. 4.

Fig. 5.



Inventor:
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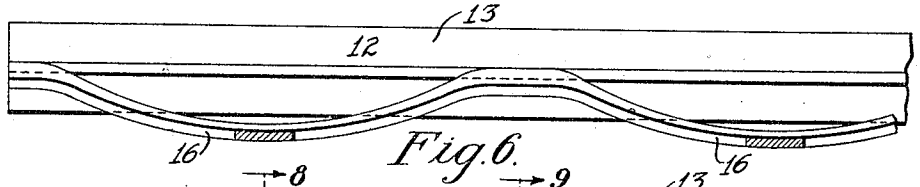


Fig. 6.

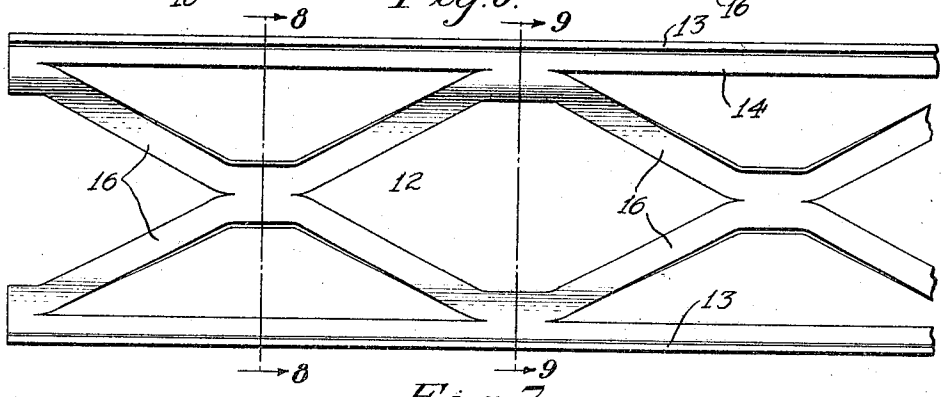


Fig. 7.

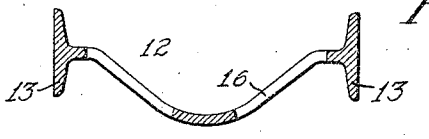


Fig. 8.

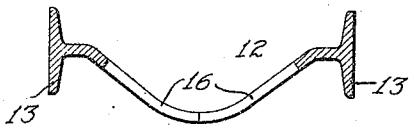


Fig. 9.

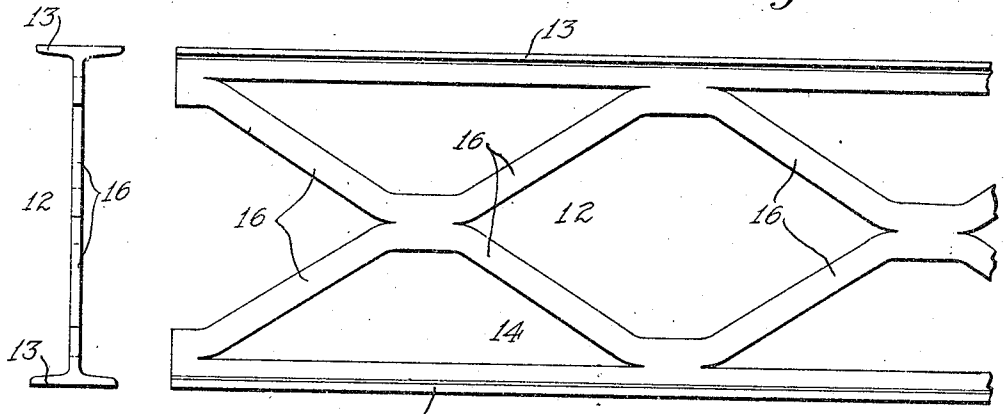


Fig. 11.

Fig. 10.

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UNITED STATES PATENT OFFICE.

NORMAN C. RENDLEMAN, OF DORMONT, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO JONES & LAUGHLIN STEEL CORPORATION, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

PROCESS OF MAKING STRUCTURAL ELEMENTS.

Application filed March 8, 1922. Serial No. 542,055.

To all whom it may concern:

Be it known that NORMAN C. RENDLEMAN, a citizen of the United States, and resident of Dormont, in the county of Allegheny and State of Pennsylvania, has invented an Improvement in Processes of Making Structural Elements, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

My invention aims to provide improved structural elements, such as beams, columns and truss members, having latticed or open webs and intended to carry or resist heavy loads or stresses. A further aim is to improve the manufacture of such elements from solid web shapes.

In the accompanying drawings, wherein I have shown one embodiment or practise of my invention for purposes of illustration, Fig. 1 is a side view and Fig. 2 is a cross-section of an I-beam of suitable shape, showing the web formed with rows of slits according to the practise preferred for floor beams;

Fig. 3 is a longitudinal mid-section of the same after the web rolling operation;

Fig. 4 is a plan view of a suitable expanding die and straightening roll, showing the beam in process of treatment;

Fig. 5 is a vertical cross-section on the line 5—5 in Fig. 4, showing the shape of the rolls and their manner of operating upon the beam;

Fig. 6 is a longitudinal mid-section and Fig. 7 is a plan view of the beam after the expanding and roll-straightening operation;

Figs. 8 and 9 are cross-sections of the same on the lines 8—8 and 9—9, respectively, in Fig. 7;

Fig. 10 is a side view; and

Fig. 11 is an end view of the finished beam.

In the particular embodiment of the invention selected for illustration herein and shown in the drawings, referring particularly to Figs. 1 and 2, an I-beam 12 of suitable cross-sectional shape, comprising marginal flanges 13 and a web 14 is utilized as the metal blank or stock from which the improved structural element is produced, but other shapes, bars or strips may be successfully utilized, depending upon the form of the finished article desired.

The entire operation is advantageously performed upon the beam 12 or other shape as it comes from the finishing pass from the rolling-mill, and without reheating. This results in economy of fuel and labor, and gives a better product since the metal is not subjected to possible deterioration by repeated heating.

The hot beam, if rolled in usual manner, is first subjected to the action of a suitable shear, which forms in the web 14, series of slits or lines of weakness 15 dividing it into narrow strip portions 16 connected intermediately to each other and to the marginal flanges 12. As shown in Figure 1, there are three parallel rows of slits, the slits in adjacent rows being in staggered relation to one another, but the number and arrangement may be varied to suit the product desired.

After the formation of the slits the beam is passed between a pair of suitably shaped reducing rolls which operate principally upon the web, leaving the opposite flanges relatively free, and which rolls may be shaped to suit the cross-sectional shape desired for the strips 16. The effect of this rolling is uniformly to reduce and elongate the strip portions of the beam without substantially changing the length of the opposite flanges, and causes bows or undulations usually longitudinal in the strips 16 between the points where their ends are tied to the flanges, as shown in Fig. 3. In order to control these undulations, suitable guide 17 may be placed above and below the web portion of the beam at the discharge side of the roll pass, thus restraining the amplitude of the undulations.

Referring to Fig. 4, the guides 17 have flanges 18 along their side margins which engage between the flanges 13 and gradually diverge to spread the beam open. At the leaving side of the expanding guides or dies, see also Fig. 5, is a pair of straightening rolls 19, 20, between which the partly opened beam is drawn. The bottom roll 19 is driven by any suitable means, and the top roll 20 rides upon it and is driven by frictional contact on the supporting necks 21.

As shown in Fig. 5, the bottom roll is grooved to receive the flanges 13 and is provided with collars 22 to hold them straight, while the top roll is cut away so that it merely bears against the edges of the flanges 13 to retain them in the grooves of the bottom roll. The top roll has a convex projection 23 around its middle which engages the undulating ties 16 and bends them down and pulls them out in a straight trough or transverse sag connecting the side flanges 13, see Figs. 6 and 7. The diameters of the ends of the roll 20 and the supporting necks 21 are so chosen with reference to the diameter of the convex portion 23 as to maintain the peripheral speed of the convex portion about the same as that of the I-beam as it passes through the rolls.

The rolls 19 and 20 are relatively shaped, having suitable cut away portions to permit the bond portion only of the ties to be pressed from one side into generally uniformed sagged position, leaving the connecting ties free to be tensioned across from bond to bond and in a manner that will permit them to be laid flat and substantially open and by subsequent rolling or flattening thereof.

Further flattening of the tie members forming the web and spreading of the side flanges to finished width may be accomplished as preferred or as determined by the particular shape of the beam or other section being operated upon. The illustrative I-beam may be finished by passing it from the straightening rolls to flattening guides, dies or rolls which bend without injuriously stretching the ties 16 and spread the flanges to the finished form shown in Figs. 10 and 11. If found necessary or desirable the beam may be subjected to further rolling and straightening operations, either hot or cold, until the right finish is attained.

Structural elements manufactured or fabricated by the practice of my invention are stronger, lighter and cheaper than so-called "metallic lumber" and may be advantageously used for floor beams, columns, bridge and roof trusses and girders, reinforcing elements for concrete structures and many other purposes which will be apparent to builders and engineers.

My invention obviously is not restricted to the particular embodiment thereof herein illustrated and described, but may be practised upon a variety of shapes, and for any purpose wherein an open work or latticed web is advantageous or useful.

Having disclosed one illustrative means of practising my invention, what I claim and desire to secure by Letters Patent is as follows:

1. Manufacturing structural members by slitting an intermediate web-like portion to form ties connecting the margins, rolling said slit portion to elongate it, separating the margins and drawing the elongated slit portion around a convex roll to open out said ties in regular formations, and flattening said ties so that their center lines will be approximately in the principal median plane of the member to form an open web.

2. Manufacturing structural members by slitting an intermediate web-like portion to form ties connecting the margins, rolling said slit portion to elongate it, separating the margins and drawing the elongated slit portion around a convex roll to open out said ties in regular formations, the peripheral speed of said convex roll being maintained substantially the same as the linear speed of said member, and flattening said ties so that their center lines will be approximately in the principal median plane of the member to form an open web.

3. The method of fabricating a structural element which comprises slitting the metal of a suitable metallic shape between opposite marginal portions, rolling said slit portion to elongate it, bowing said elongated portion to free its members from local irregularities, and spreading the marginal portions and flattening said slit portion.

4. The method of fabricating a structural element which comprises slitting the intermediate portion of a suitable metallic shape to form two parallel rows of connecting members joined to each other at adjacent ends and to the margins of the element at opposite ends, rolling said connecting members to substantially finished cross-sectional shape, bending said connecting members transversely in a uniform curve, and separating the margins of the element to straighten out said connecting members to form a lattice connecting said margins.

5. The method of fabricating a structural element from a suitable metallic shape, which comprises slitting the metal between opposite marginal portions, rolling and bending said slit portion transversely to elongate and open it out, and spreading the marginal portions.

6. The method of fabricating a structural element which comprises rolling a suitable solid shape and while it is still at the elevated temperature incident to such rolling slitting and rolling to greater length the metal between opposite longitudinal marginal portions, bending said slitted and lengthened metal transversely in a regular curve to take up the slack in its length, and then spreading the margins to flatten said curve.

7. The method of fabricating a structural element which comprises slitting and rolling to greater length the metal of a suitable metallic shape between its opposite longitudinal margins without extending said marginal portions, thereby giving said rolled portion an undulatory form lengthwise of

the element, laterally bowing said rolled portion to straighten the undulations and separate the slit portions, and spreading the margins to flatten the bowed portions.

8. The process of making structural elements which comprises rolling a suitable webbed shape, forming in the web a plurality of rows of longitudinal slits, the slits in adjacent rows being in staggered relation, reducing and elongating the slitted portion of the web by rolling while hot and thereby forming connecting strands between the margins of the shape of suitable cross-sectional form, bending said slitted web transversely in the form of a trough composed of strands of equal cross-sectional area at all points lengthwise of the element, and then spreading the margins of the element and thereby flattening said trough into a uniform lattice of substantially straight members connecting said margins.

9. The process of making structural elements which comprises slitting the intermediate portion of a suitable shape to form two parallel rows of connecting members joined to each other at adjacent ends and to the margins of the element at opposite ends, rolling said connecting members to reduce and lengthen them, spreading said connecting members into a lattice of part cylindrical form, and separating the margins of the element to flatten said lattice and straighten said connecting members to form an open web connecting said margins.

In testimony whereof, I have signed my name to this specification.

NORMAN C. RENDLEMAN.