Oct. 7, 1924. 1,511,186

N. C. RENDLEMAN

STRUCTURAL ELEMENT MANUFACTURE

Filed March 17, 1922 4 Sheets-Sheet 1

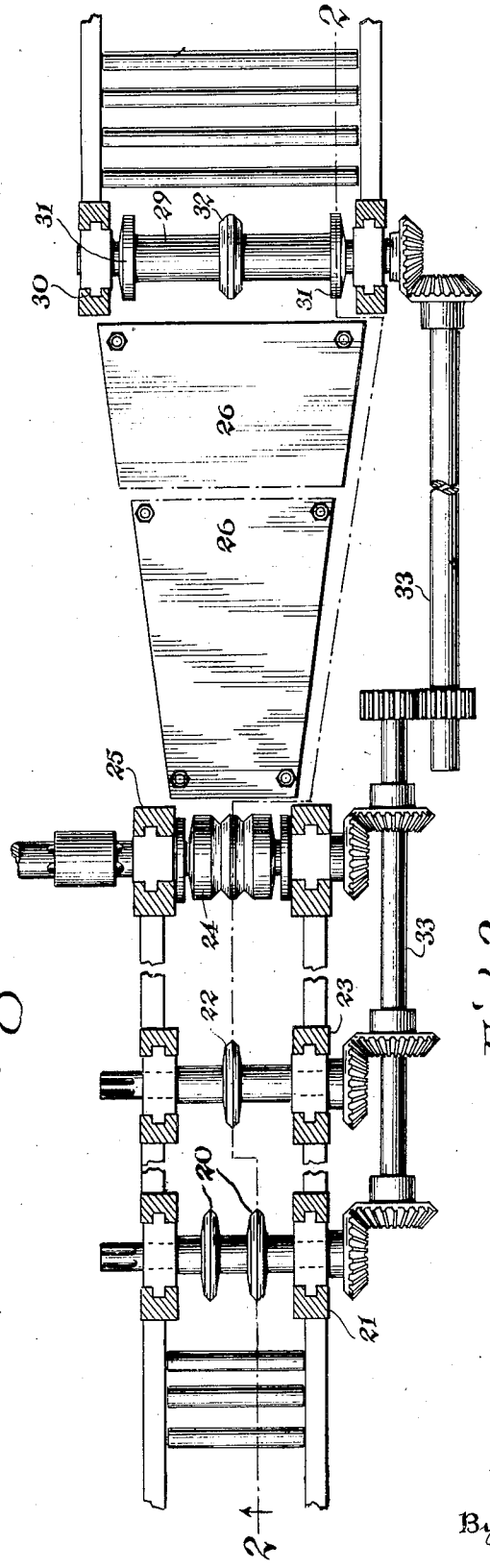


FIG. 1.

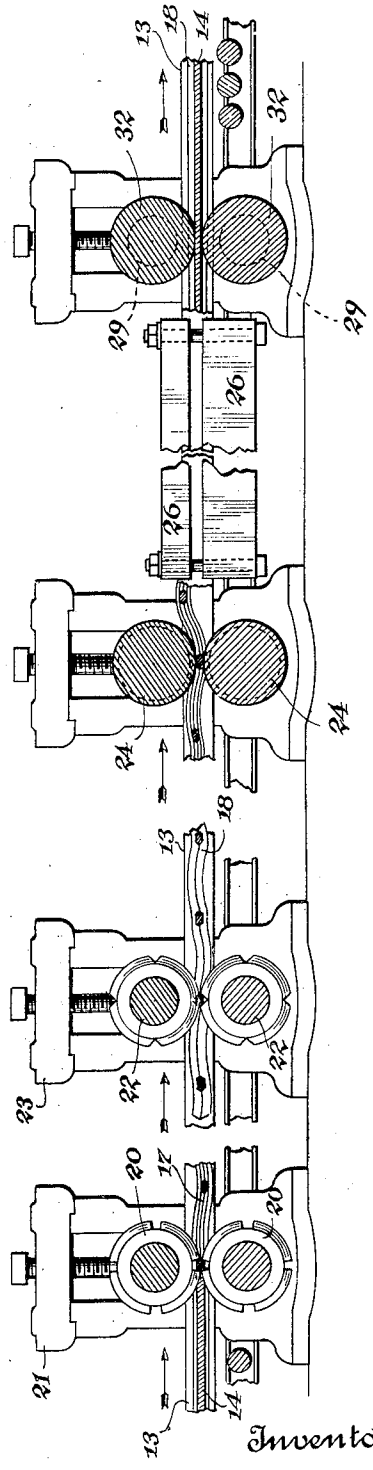


FIG. 2.

Inventor

Norman C. Rendleman.

By Emery, Booth, Janney & Varney
His Attorneys

Oct. 7, 1924. 1,511,186

N. C. RENDLEMAN

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Filed March 17, 1922 4 Sheets-Sheet 2

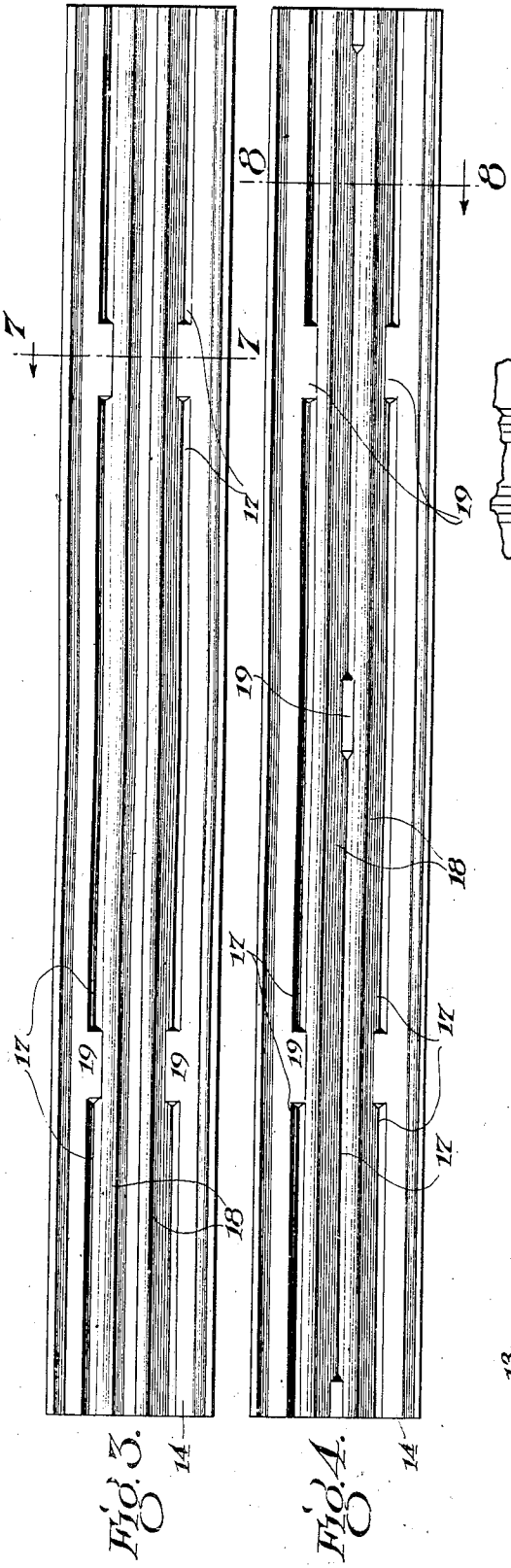


Fig. 3.

Fig. 4.

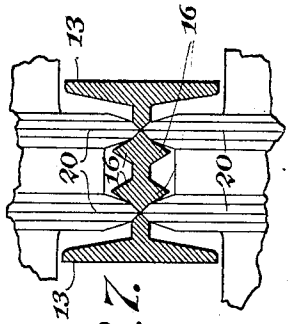


Fig. 7.

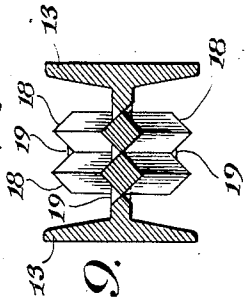


Fig. 9.

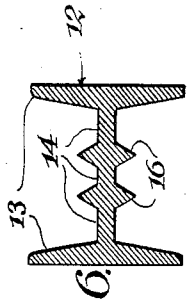


Fig. 6.

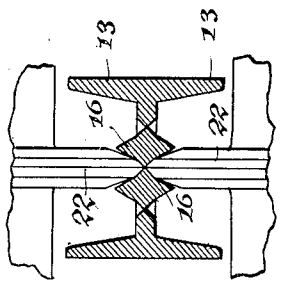


Fig. 8.

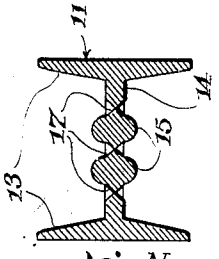


Fig. 5.

Inventor
Norman C. Rendleman.
By:
Emery, Booth, Janney & Varney
His Attorneys.

Oct. 7, 1924.

1,511,186

N. C. RENDLEMAN

STRUCTURAL ELEMENT MANUFACTURE

Filed March 17, 1922 4 Sheets-Sheet 3

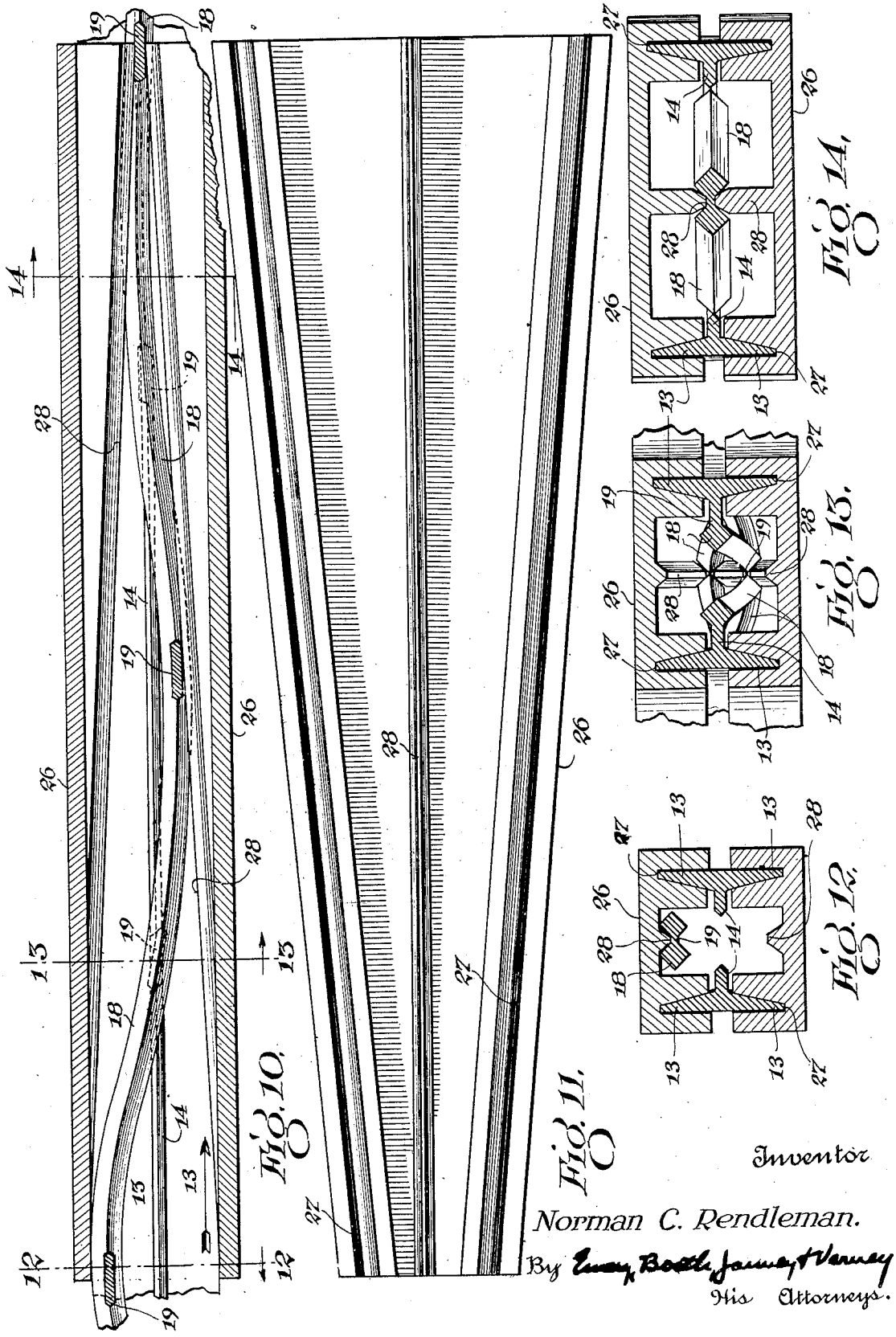


FIG. 10.

FIG. 14.

FIG. 15.

FIG. 12.

FIG. 11.

Inventor

Norman C. Rendleman.

By Emery, Booth, Jamieson & Varney

His Attorneys.

Oct. 7, 1924.

1,511,186

N. C. RENDLEMAN

STRUCTURAL ELEMENT MANUFACTURE

Filed March 17, 1923. 4 Sheets-Sheet 4

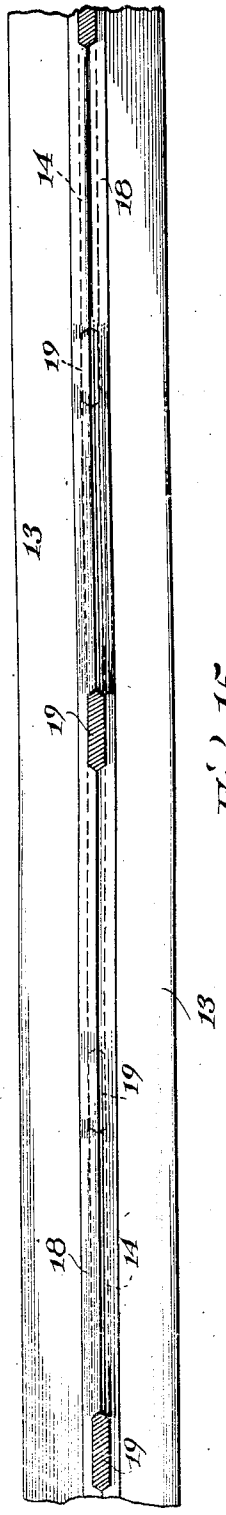


FIG. 15.

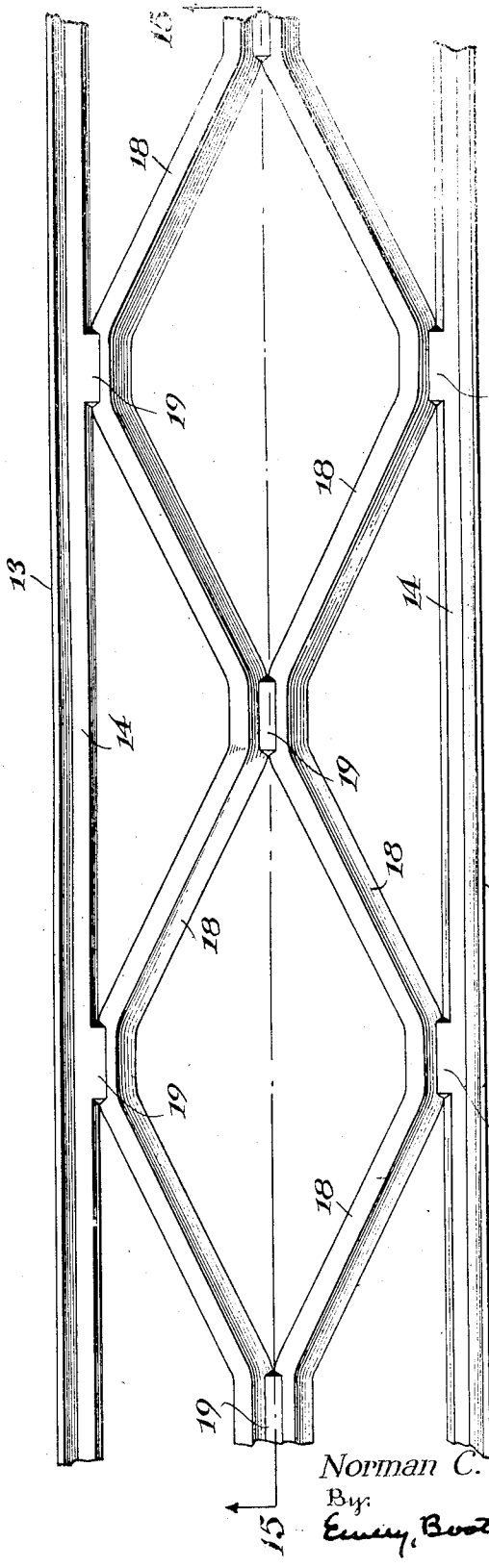


FIG. 16.

Inventor

Norman C. Rendleman.

By: Emery, Booth, Janney, & Varney

His Attorneys.

Patented Oct. 7, 1924. 1,511,186

UNITED STATES PATENT OFFICE.

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

STRUCTURAL-ELEMENT MANUFACTURE.

Application filed March 17, 1922. Serial No. 544,576.

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 Structural-Element Manufacture, 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 metallic beams, columns and other structural elements intended to carry or resist heavy loads or stresses, they being commonly rolled shapes such as I-beams, T-beams, channels, etc., and of the type having latticed, trussed or open webs.

In the accompanying drawings, wherein I have shown one embodiment and practise of my invention for purposes of illustration,

Fig. 1 is a plan view, partly in section, of suitable apparatus for slitting, rolling and expanding an I-beam or other flanged structural member;

Fig. 2 is a part side elevation and part vertical cross-section of the same on the line 2—2 in Fig. 1;

Fig. 3 is a plan view of the member after the first slitting operation;

Fig. 4 is a similar view after the second slitting operation;

Fig. 5 is a cross-section of a slitted I-beam having a suitable web to form oval or round lattice members;

Fig. 6 is a cross-section of an I-beam ready for slitting and having a web suitable for forming square or diamond shape lattice members;

Fig. 7 is a cross-section of an I-beam like that shown in Fig. 6 showing it being operated on by the first set of slitting rolls;

Fig. 8 is a similar view showing the operation of the second set of slitting rolls;

Fig. 9 is a cross-section of the same form of I-beam after the web rolling operation;

Fig. 10 is a vertical longitudinal mid-section of a suitable expanding die or guide showing the I-beam passing through;

Fig. 11 is a plan view of the lower expanding die or guide;

Fig. 12 is a cross-section of the expanding guide on the line 12—12 in Fig. 10, looking in the direction of the arrows;

Figs. 13 and 14 are similar cross-sectional views on the lines 13—13 and 14—14, respectively, in Fig. 10;

Fig. 15 is a longitudinal mid-section on the line 15—15 in Fig. 16 of the finished expanded latticed I-beam; and

Fig. 16 is a plan view.

In the particular embodiment of my invention selected for illustration and shown in the drawings, referring to Figs. 15 and 16, the latticed beam therein shown comprises top and bottom flanges 13, preferably connected by a diamond shape mesh or lattice work formed out of the web 14, which is advantageously provided (see Figs. 5 and 6) with longitudinal ribs, 15, 16. In the illustrated case, the beam is produced by a series of operations comprising, first separating the web adjacent and between the enlarged ribs in three series of staggered slits, cuts or depressions 17, as illustrated in Fig. 4; second, rolling the ribs to reduce and elongate them into suitably shaped ties 18, connected at suitable intervals alternately with each other and with the side margins of the beam by means of bonds 19 left between the ends of the slits, as illustrated in Figs. 9 and 10; and third, separating the side margins to draw out the elongated ties into the form of a lattice, as illustrated in Fig. 16.

Referring to Figs. 1 and 2, the apparatus illustrated in the drawings comprises a pair of slitting rolls 20 having two sets of slitters spaced to operate on the web 14 near its margins, and mounted in suitable housings 21. A second pair of slitting rolls 22, having a single set of slitters, is mounted in housings 23 in line with the housings 21 and positioned to operate on the mid-line of the web. The housings are separated from each other such a distance that the middle slits formed by the second set of slitters are spaced to overlap equally the ends of the outer slits formed by the first sets of slitters. All three rows of slits may be cut in a single slitting pass if desired, but the separation of the outer rows first followed by the separation of the middle row has practical advantages.

A pair of reducing rolls 24, suitably shaped and grooved to operate on the tie portions only of the web, is mounted in housings 25 on the leaving side of the second set of slitters to receive the blank from the

slitters and reduce and elongate the slitted portion of the web and shape the tie portions 18 to approximately final form. These rolls may be so shaped as to act on the flanges also, but to a lesser extent than the web members, if desirable.

The expanding dies or guides 26 are preferably located in the path of the beam as it emerges from the rolls 24 and are advantageously made in two parts, the lower being fixed and the upper removable to permit inspection and removal of the beam in case of a jam. Suitable means are provided for holding the top guide in place during the expanding operation. As shown in Figs. 10 to 14, the guides have diverging grooves 27 on each side to receive the flanges 13 of the beam or other shape and separate them as the beam passes through in the direction of the arrow in Fig. 10. The guides also may be provided with ramps or inclined guides 28 that bear upon the elongated web members 18 and gradually force them into the principal plane of the beam as the flanges 13 are separated.

A pair of flattening and straightening rolls 29, mounted in suitable housings 30, may be placed at the outlet from the expanding guides to help pull the beam through the guides. These rolls preferably have end flanges 31 that grasp the flanges and remaining margins of the web, and middle flanges 32 that conform to the space between the tie members, so as to flatten and straighten the beam preferably while it is still hot.

Suitable gearing 33 is provided for rotating the rolls and slitters in unison at any desired speed.

The several operations are preferably performed in succession as a continuous process, and may be advantageously performed upon the beam or other shape as it comes from the finishing pass of the rolling mill, and without reheating, thereby avoiding the expense and possible deterioration of the metal caused by repeated heating.

The rolling of the tie-members 18 to a compact cross-sectional form promotes the subsequent bending and spreading to regular latticed form, and produces a stiff and strong finished shape of uniform dimensions.

My invention obviously is not restricted to the particular embodiment and practise herein illustrated and described, and in the claims the term "latticed structural member" is intended to include beams, channels, rails, bars, flats and other shapes with and without flanges and having openings in the web formed between ties connecting the margins.

Having described one illustrative embodiment and practise of my invention, what I claim and desire to secure by Letters Patent is as follows:

1. The process of fabricating latticed structural elements that comprises subjecting an intermediate portion to interrupted slitting along its margins, rolling said intermediate portion to a compact cross-sectional shape, thereby reducing and elongating the strands formed between the slits, and separating the margins to open said strands.

2. The process of fabricating latticed structural elements that comprises subjecting an intermediate portion provided with a longitudinal rib to interrupted slitting along its margins, rolling said rib to a compact cross-sectional shape, thereby reducing and elongating the strands formed between the slits, and separating the margins to open said strands.

3. The process of fabricating latticed structural elements that comprises subjecting an intermediate portion provided with a plurality of longitudinal ribs to interrupted slitting along its margins and between said ribs, rolling each rib to a compact cross-sectional shape, thereby reducing and elongating the strands formed between the slits, and separating the margins to open said strands.

4. The process of fabricating latticed structural elements that comprises rolling series of parallel slits in a strip between its margins, the sides of said slits being oppositely inclined, rolling the strip between said slits to form ties having side walls merging into the side walls of said slits and thereby elongating and compacting the rolled portion, and separating the margins to draw the ties across the intervening space.

5. The process of fabricating latticed structural elements that comprises rolling series of parallel slits in a strip between its margins, the sides of said slits being oppositely inclined, rolling the strip between said slits to form ties of compact shape having side walls merging into the side walls of said slits and thereby elongating and compacting the rolled portion, and separating the margins to draw the ties across the intervening space to form a laterally stiff and rigid connecting structure.

6. The process of fabricating latticed structural elements that comprises subjecting an intermediate portion provided with a plurality of longitudinal ribs to interrupted slitting along its margins and between said ribs, rolling each rib to a compact cross-sectional shape, thereby reducing and elongating the strands formed between the slits, and separating the margins to open said strands while guiding the connected middle portions thereof in the median plane of the elements.

7. The combination with reducing rolls adapted to operate upon an intermediate portion of a suitably slitted structural ele-

ment to elongate the same to a greater extent than the marginal portions thereof, of an expanding guide disposed in the path of said element as it emerges from said rolls to separate said marginal portions as said element is forced through said guide by said rolls.

8. An expanding guide for use in rolling latticed structural elements having diverging means for separating the margins thereof and converging means for flattening the medial portion thereof progressively as the rolling proceeds.

9. The combination with reducing rolls adapted to operate upon an intermediate portion of a suitably slitted structural element to elongate the same to a greater extent than the marginal portion thereof, of an expanding guide disposed in the path of said element as it emerges from said rolls having diverging means for separating said marginal portions and converging means for flattening said intermediate portion as said element is forced through said guide by said rolls.

10. The process of fabricating latticed structural elements that comprises rolling an intermediate portion of a suitably slitted structural element to elongate the same to a greater extent than the marginal portions thereof, and passing said element as it emerges from said rolls through an expanding guide to separate its margins and deploy said slitted and elongated intermediate portion into an open-work or lattice as said element is forced through said guide by said rolls.

11. The process of fabricating latticed structural elements that comprises rolling a lattice forming portion to elongate it with respect to the element as a whole and immediately passing the element through diverging guides to utilize the force exerted by the rolling operation to spread the element.

12. The process of fabricating latticed structural elements that comprises rolling a lattice forming portion to elongate it with respect to the element as a whole and while at the elevated temperature of rolling passing the element through spreading means utilizing the force exerted by the rolling operation to spread the element.

13. The process of fabricating latticed structural elements that comprises rolling a lattice forming portion to elongate it with respect to the element as a whole and thereby pushing the element through means for deflecting the margins of the element into divergent paths, whereby the force exerted by the rolling operation tends directly to spread the element.

14. The process of fabricating latticed structural elements that comprises rolling a lattice forming portion to elongate it with respect to the element as a whole and immediately passing the element through a spreading die and utilizing the direct thrust exerted by the rolling operation in conjunction with the spreading action of said die to spread the element.

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

NORMAN C. RENDLEMAN.