Oct. 7, 1924. 1,510,704

N. C. RENDLEMAN

PROCESS AND MACHINE FOR MAKING METALLIC STRUCTURAL ELEMENTS

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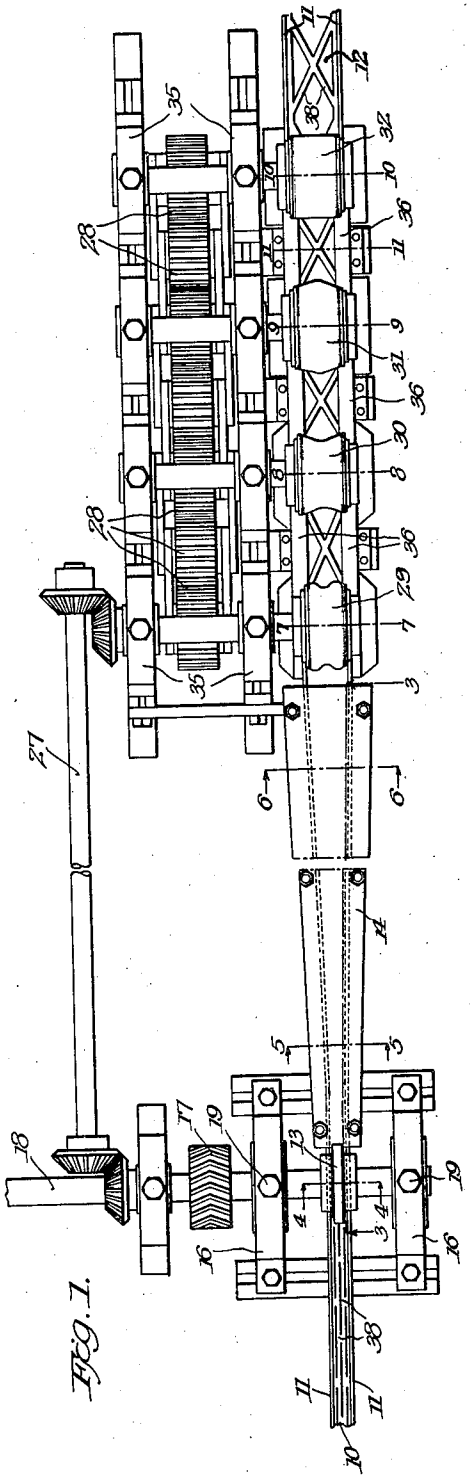


Fig. 1.

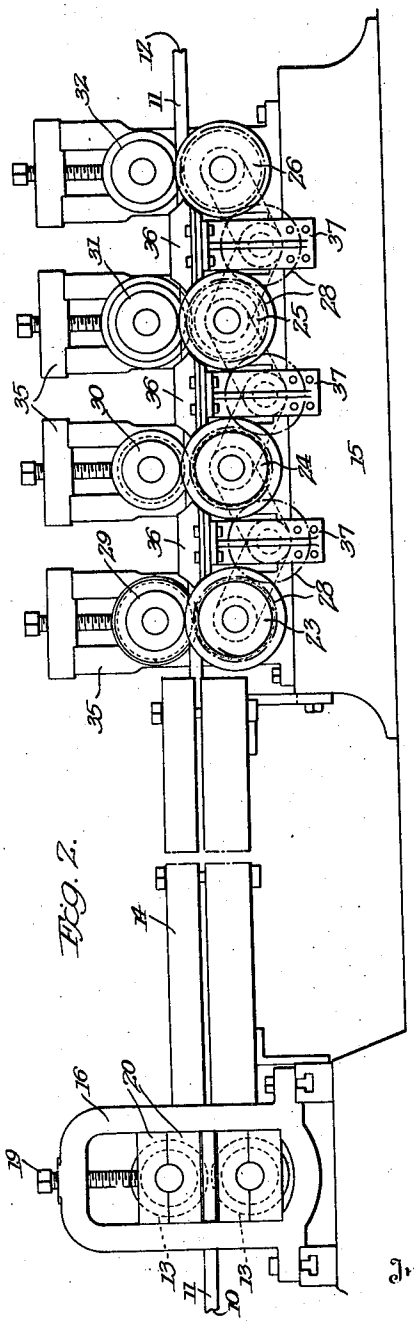


Fig. 2.

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Fig. 3.

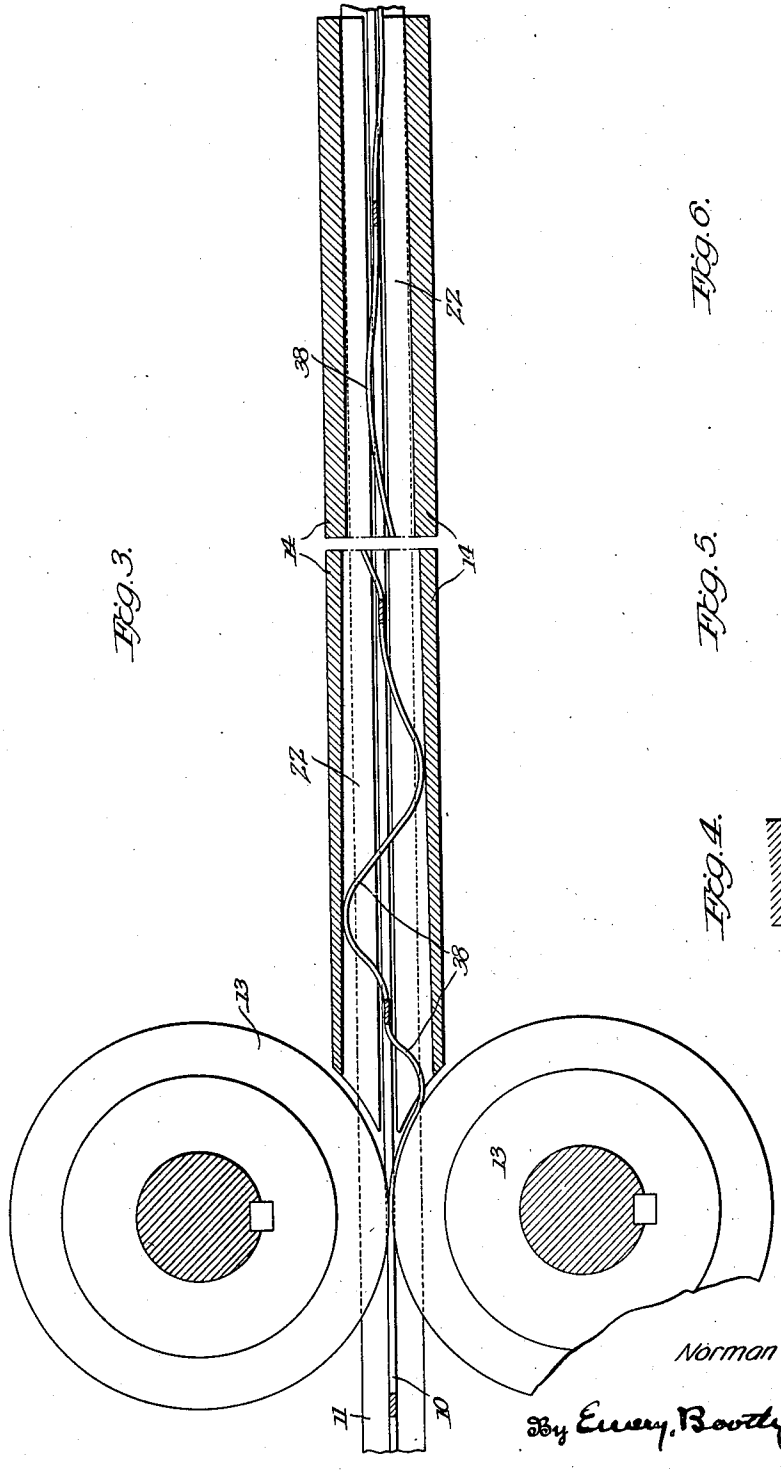


Fig. 6.

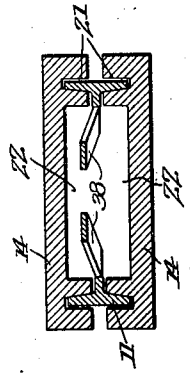


Fig. 5.

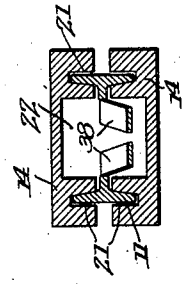
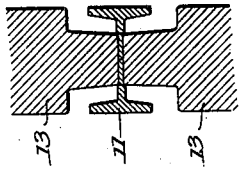


Fig. 4.



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Fig. 7.

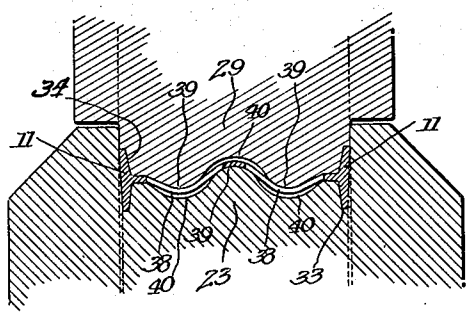


Fig. 8.

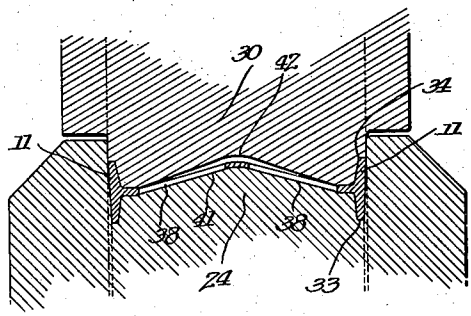


Fig. 9.

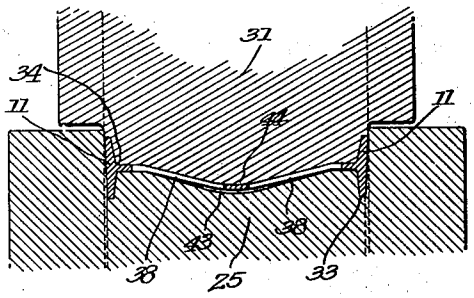


Fig. 10.

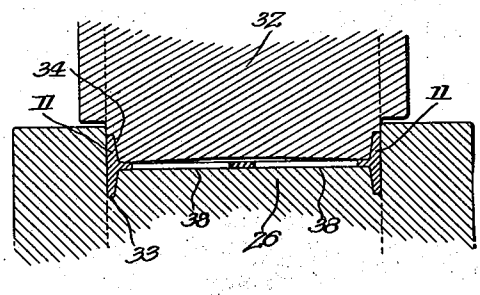
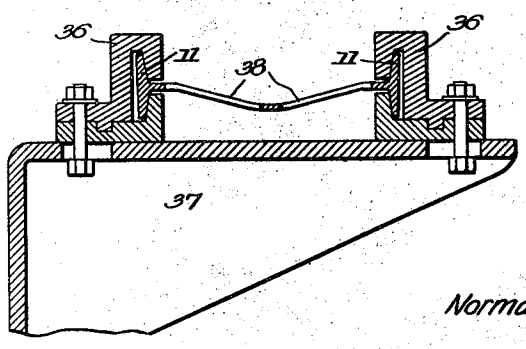


Fig. 11.



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UNITED STATES PATENT OFFICE.

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

PROCESS AND MACHINE FOR MAKING METALLIC STRUCTURAL ELEMENTS.

Application filed December 13, 1923. Serial No. 680,491.

To all whom it may concern:

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

This invention relates to open web truss-like members formed by slitting and separating the intermediate portion of a structural member, such as an I-beam or other rolled shape, and aims to improve the means for performing the separating operation to expedite manufacture and promote uniformity in the product.

In the drawings, which show an illustrative machine adapted for producing open web flanged beams,

Fig. 1 is a plan view, and

Fig. 2 is a side view of the machine operating on an I-beam;

Fig. 3 is a longitudinal section of a portion of the machine on the line 3—3 in Fig. 1, drawn to a larger scale;

Figs. 4, 5 and 6 are cross-sections on the lines 4—4, 5—5 and 6—6, respectively, of Fig. 1;

Figs. 7, 8, 9 and 10 are cross-sections showing the shape of the finishing rolls, these views being taken on the lines 7—7, 8—8, 9—9 and 10—10, respectively, in Fig. 1; and

Fig. 11 is a cross-section through the guides between the finishing rolls, on the line 11—11 in Fig. 1.

The invention is applicable to the production of open web members from solid web members of a depth considerably less than that of the finished product. For example, as shown in Fig. 1, the I-beam 10 having flanges 11 may be formed into an open web trussed girder 12 of several times its original depth and correspondingly greater carrying capacity without any increase in its weight per foot.

The apparatus illustrated in the drawings (referring particularly to Figs. 1 and 2) comprises a pair of web rolling rolls 13 in combination with a spreader 14 and a train of rolls constituting a finished machine 15. The web rolling rolls 13 are mounted in suitable housings 16 and are driven at the same speed by gearing 17 from any suitable source of power, such as the shaft 18. The upper roll is adjustable vertically in the housings by means of the adjusting screws 19 which carry the upper set of journal bearings 20.

The spreader 14 preferably comprises upper and lower halves each of which is provided with grooves 21 to receive the flanges 11 of the beam. These grooves diverge gradually to separate the flanges and widen the slitted web portion as the beam passes through the spreader to the finishing machine 15. The mid space between the grooves of the spreader forms a trough 22 (see Figs. 3 to 6) for the slitted web portion, being narrow and deep at the receiving end near the rolls 13 and wide and shallow at the delivery end near the finishing machine 15. The spreader may be supported in any suitable manner across the space between the housings 16 and finishing machine 15.

The finishing machine comprises a series of passes preferably having grooved bottom rolls 23, 24, 25 and 26 driven from the shaft 18 at uniform speed by a suitable shaft 27 and gear train 28. Idler top rolls 29, 30, 31 and 32 cooperate with the bottom rolls, making four sets of rolls, each set having a pair of rolls consisting of one bottom roll and one top roll. The grooves 33 in the bottom rolls and end faces 34 of the idler rolls cooperating therewith (see Figs. 7 to 10) are progressively spaced slightly farther apart in the direction of the axis of each set so as to cause a slight separation of the flanges 11 as the beam passes through the finishing machine. The housings 35 that support the sets of rolls 23, 29; 24, 30; 25, 31; and 26, 32, and their driving gearing, are adjustable lengthwise on the bed of the finishing machine to suit the dimensions of the particular beam in process, as hereinafter explained.

Guides 36 (see Figs. 1, 2 and 11) are positioned between the sets of rolls to receive the beam from one set and guide it into the next set. These guides are made in pairs, one for each flange of the beam, and are adjustably supported on brackets 37 secured to the frame of the machine. These guides are preferably arranged at a slight

diverging angle in the horizontal plane for separating the flanges a trifle between successive roll passes.

The process of forming an open web trussed beam from a solid web beam, such as the I-beam 10 illustrated in the drawings, is first to slit the web of the beam with three parallel rows of slits of suitable length, preferably a length two or three times the depth of the beam, the slits of the middle row being staggered to overlap the ends of the slits of the outer rows, which are spaced alike, as shown in Fig. 1. The web is thereby cut into short strips or ties 38, connected at their ends to the solid web adjacent to the flanges and at their middles to each other. Preferably the middle points of the middle row of slits are spaced slightly in advance of the middle points of the spaces between the ends of the outer rows to counteract the tendency of the leading pairs of ties to elongate more than the trailing pair in each intersecting group.

The rolls 23, 29, of the first set of the finishing machine are advantageously formed with mating ribs 39 and grooves 40 constituting an open pass (see Fig. 7) for the web members which are thereby flattened into lengthwise troughs and ridges but are not reduced in thickness. The rolls 24, 30, of the second set are provided with a shallow sloping sided ridge 41 on the bottom roll and a mating groove 42 on the top roll forming an open pass for the web members, the troughs of which are thereby flattened out with a shallow ridge, as illustrated in Fig. 8; and the rolls 25, 31, of the third set have similar mating groove 43 and ridge 44, excepting that their positions are reversed to flatten out the web members and bend them into a shallow trough, as shown in Fig. 9. The last set of rolls, 26, 32, of the finishing machine are substantially cylindrical, the top roll being hollowed out slightly to relieve the web members of any pressure so that they emerge straight and flat.

Upon passing through the rolls 13 the slitted portion of the web forming these strips or ties is reduced and elongated, but as the rolls do not touch the outer edges of the web and flanges (see Fig. 4) the beam as a whole is not elongated. The effect of this rolling is to cause the slitted web portion to buckle up in serpentine form, thereby separating the ties 38 from the flanges except where the points of attachment, or bonds, occur, somewhat as shown in Fig. 3. As the beam passes through the spreader, the ties 38 are separated into a system of successive groups of diagonally arranged intersecting struts or cross bars which constitute the web truss members of the finished product.

Preferably the sets of finishing rolls are spaced apart lengthwise of the machine a distance equal to some multiple of the distance between successive groups of intersecting web members, in order that the intersection points or bonds where the ties meet or cross may be engaged in the bights of the finishing rolls simultaneously, thereby repeatedly straining them taut to straighten out any irregularities as the beam passes through the apparatus.

Open web truss beams and other structural members produced as described herein are of substantially uniform shape and dimensions, free from irregularities such as are inseparable from prior products produced by stretching the flanges apart, and stronger in proportion to their weight than integrally rolled structural members as heretofore made.

The invention is not restricted to the details of construction of the illustrative apparatus shown and described, but what I claim and desire to secure by Letters Patent is at follows:

1. The method of fabricating an open web truss element having integral longitudinal chord and transverse tie members which comprises passing a suitably slitted bar through rolls to reduce and elongate the slitted portion with respect to the bar as a whole, passing the rolled bar through a spreader to separate the longitudinal chord members and open out the transverse tie members and through sets of ribbed and grooved rolls with open passes for the web to flatten the ties and lay them in orderly arrangement.

2. The method of fabricating an open web truss element having integral longitudinal chord and transverse tie members which comprises passing a suitably slitted bar through rolls to reduce and elongate the slitted portion with respect to the bar as a whole, passing the rolled bar through a spreader to separate the longitudinal chord members and open out the transverse tie members, and straightening the tie members by pulling them between sets of rolls.

3. The method of fabricating an open web truss element having integral longitudinal chord and transverse tie members which comprises passing a suitably slitted bar through rolls to reduce and elongate the slitted portion with respect to the bar as a whole, passing the rolled bar through a spreader to separate the longitudinal chord members and open out the transverse tie members, and straightening the tie members by pulling them between sets of rolls engaging alternately the upper and under sides of the ties to bow them first one way and then the other.

4. The method of fabricating an open web truss element having integral longitudinal chord and transverse tie members which comprises passing a suitably slitted bar

through rolls to reduce and elongate the slitted portion with respect to the bar as a whole, passing the rolled bar through a spreader to separate the longitudinal chord members and open out the transverse tie members, and straightening the tie members by pulling them between sets of rolls having guiding grooves for the flanges and intermediate mating ribs and grooves engaging alternately the upper and under sides of the ties to bow them first one way and then the other, said guiding grooves being successively spaced further apart laterally to widen the element as it passes through.

5. Apparatus for spreading a beam or other structural element slitted to form cross ties bonded to the margins thereof, which comprises a pair of rolls having faces narrower than the beam width for reducing the slitted portion, a spreader for separating the flanges and guiding the slitted tie portion centrally, and finishing rolls having grooves for guiding and holding the flanges and mating spaced crowned and recessed portions between the grooves for bending the tie portion into troughs, followed by flattening rolls.

6. Apparatus for spreading a beam or other structural element slitted to form cross ties bonded to the margins thereof, which comprises a pair of rolls having faces narrower than the beam width for reducing the slitted portion, a spreader for separating the flanges and guiding the slitted tie portion centrally, and a plurality of sets of finishing rolls having grooves for guiding and holding the flanges and mating spaced crowned and recessed portions between the grooves for bending the tie portion into troughs, the guide grooves of successive sets of finishing rolls being spaced slightly further apart, followed by flattening rolls.

7. Apparatus for spreading a beam or other structural element slitted to form cross ties bonded to the margins thereof, which comprises a pair of rolls having faces narrower than the beam width for reducing the slitted portion, a spreader for separating the flanges and guiding the slitted tie portion centrally, and finishing rolls having grooves for guiding and holding the flanges, between which are cooperating circumferential projections and depressions providing a narrow curved space between them of a lateral width approximately equal to the depth of the web portion of the element.

8. Apparatus for spreading a beam or other structural element slitted to form cross ties bonded to the margins thereof, which comprises a pair of rolls having faces narrower than the beam width for reducing the slitted portion, a spreader for separating the flanges and guiding the slitted tie portion centrally, and finishing rolls having grooves for guiding and holding the flanges, between which are cooperating circumferential projections and depressions providing a narrow curved space between them of a lateral width approximately equal to the depth of the web portion of the element, successive finishing rolls having the relative positions of the projections and depressions reversed and the height and depth thereof slightly diminished.

9. Apparatus for spreading a beam or other structural element slitted to form cross ties bonded to the margins thereof, which comprises a pair of rolls having faces narrower than the beam width for reducing the slitted portion, a spreader for separating the flanges and guiding the slitted tie portion centrally, and finishing rolls having grooves for guiding and holding the flanges, between which are cooperating circumferential projections and depressions providing a narrow curved space between them of a lateral width approximately equal to the depth of the web portion of the element, successive finishing rolls having the guide grooves spaced slightly further apart and the height and depth of the projections and depressions slightly diminished.

10. Apparatus for spreading a beam or other structural element slitted to form cross ties bonded to the margins thereof, which comprises a pair of rolls having faces narrower than the beam width for reducing the slitted portion, a spreader for separating the flanges and guiding the slitted tie portion centrally, and finishing rolls having grooves for guiding and holding the flanges, said rolls having circumferential projections and mating grooves therefor to form the tie portion of the web into predetermined form.

11. Apparatus for elongating the tie portions of a slitted member, spreading the member to take up the extra length of the tie portion, bowing the ties and flattening the spread member.

12. Apparatus for elongating the tie portions of a slitted member, spreading the member to take up the extra length of the tie portion, bowing the ties first to one side of the finished product and then to the other and flattening the spread member.

13. In a process of the character described having three rows of slits, staggering the slits so as to produce ties and bonds in intersecting groups, the length of the leading ties being slightly less than that of the trailing ties in each group.

14. In a process of the character described having three rows of slits, staggering the slits so as to produce ties and bonds in intersecting groups, the outer slits being disposed in pairs with their middle points

slightly in advance of the middle points of the spaces between the ends of the slits of the middle row, the length of the leading ties being slightly less than that of the trailing ties in each group.

15. Apparatus of the character described for the purpose set forth comprising means for rolling the slitted web only to form elongated connecting ties, means for spreading the flanges to separate the ties, and means for flattening the ties into the median plane of the element.

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

NORMAN C. RENDLEMAN.