Oct. 7, 1924. 1,510,696

H. M. NAUGLE ET AL

STEEL JOIST MANUFACTURE

Filed Dec. 27, 1921 6 Sheets-Sheet 1

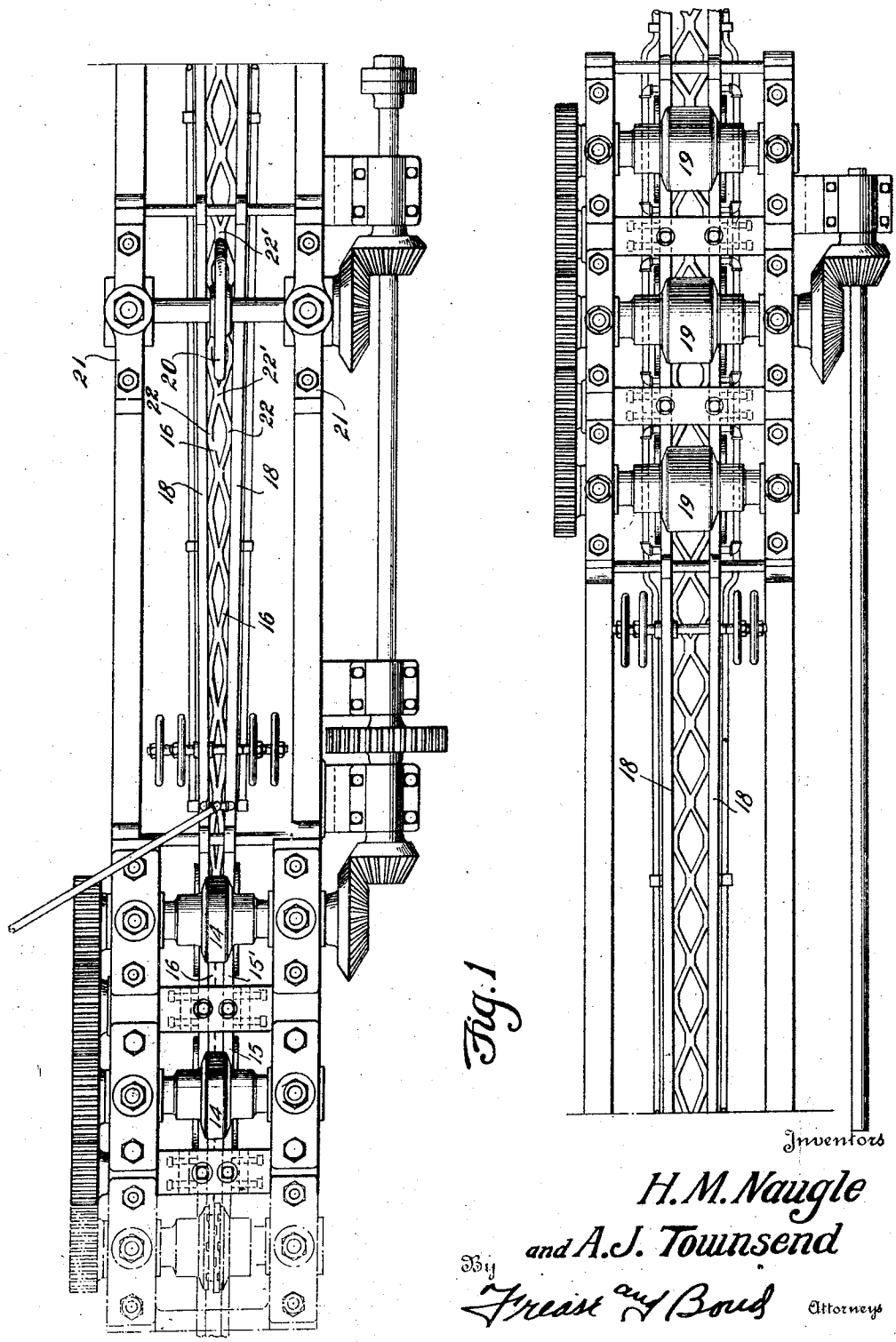


Fig. 1

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Filed Dec. 27, 1921 6 Sheets-Sheet 2

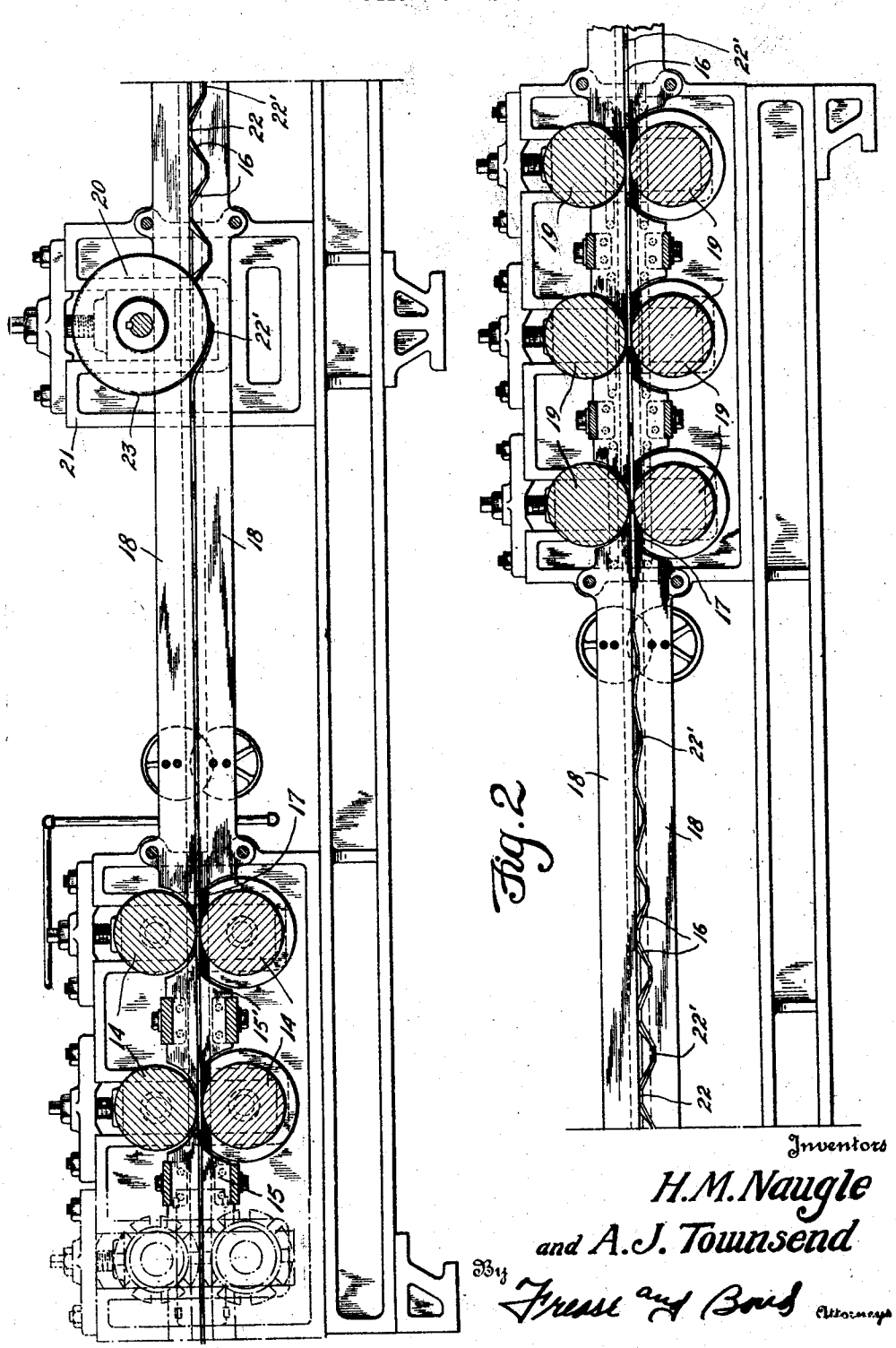


Fig. 2

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STEEL JOIST MANUFACTURE

Filed Dec. 27. 1921 6 Sheets-Sheet 3

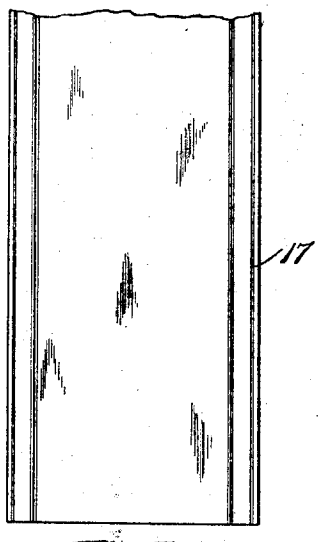


Fig. 3

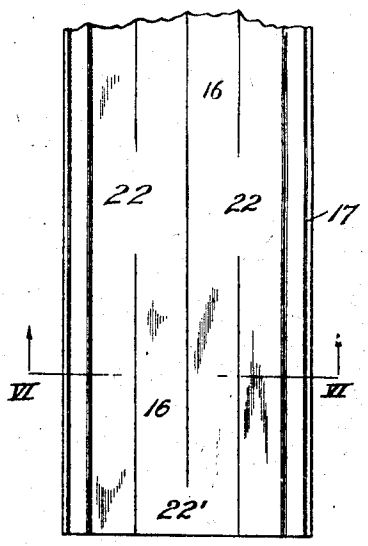


Fig. 5

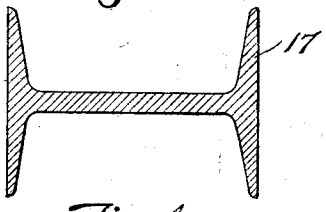


Fig. 4

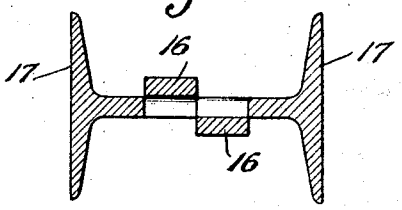


Fig. 6

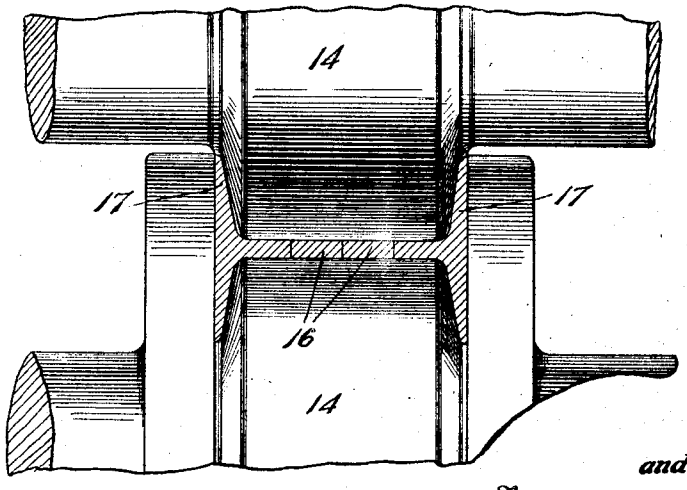


Fig. 7

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STEEL JOIST MANUFACTURE

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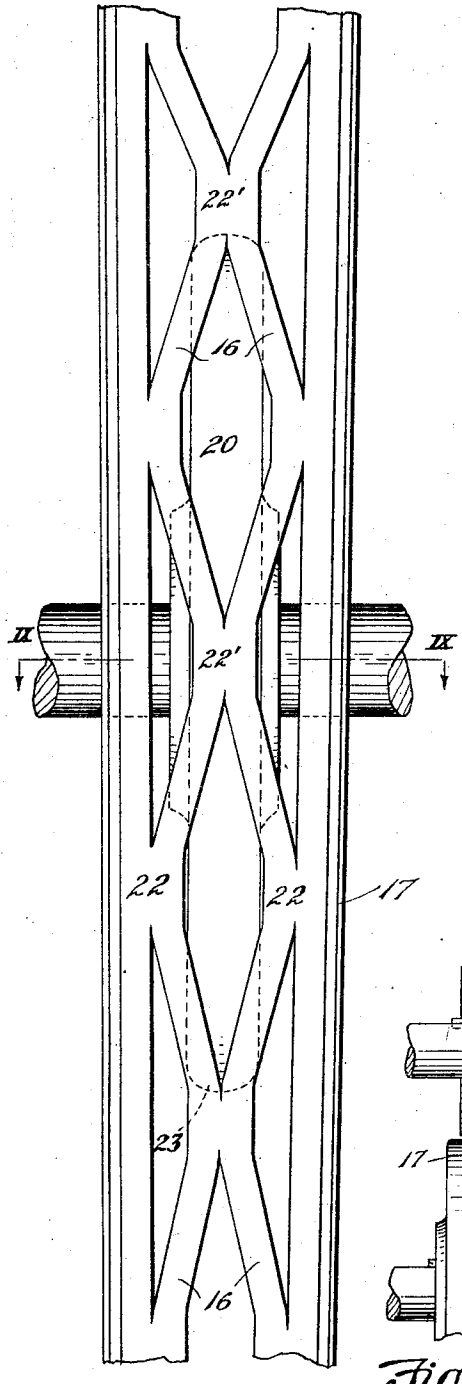


Fig. 8

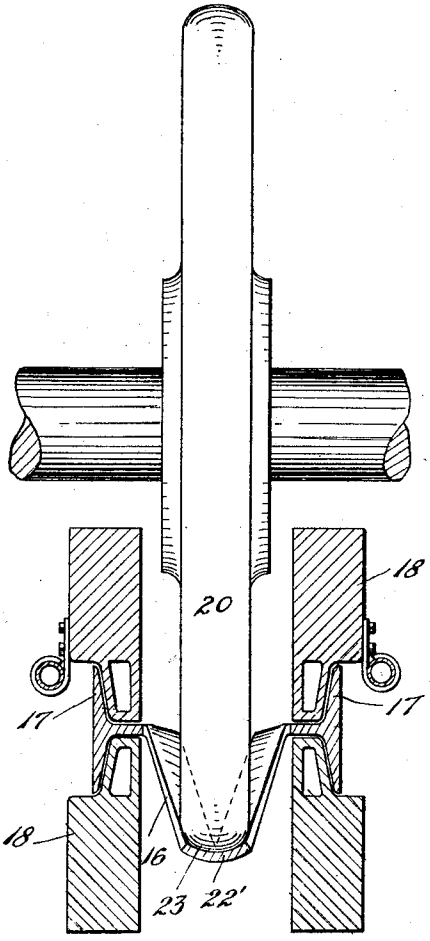


Fig. 9

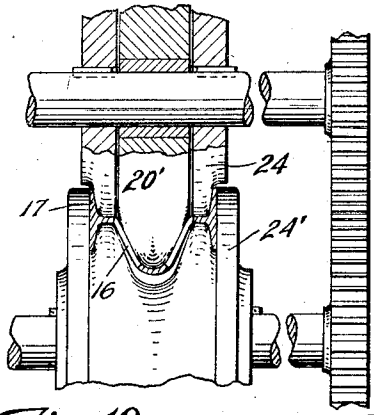


Fig. 10

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STEEL JOIST MANUFACTURE

Filed Dec. 27. 1921 6 Sheets-Sheet 5

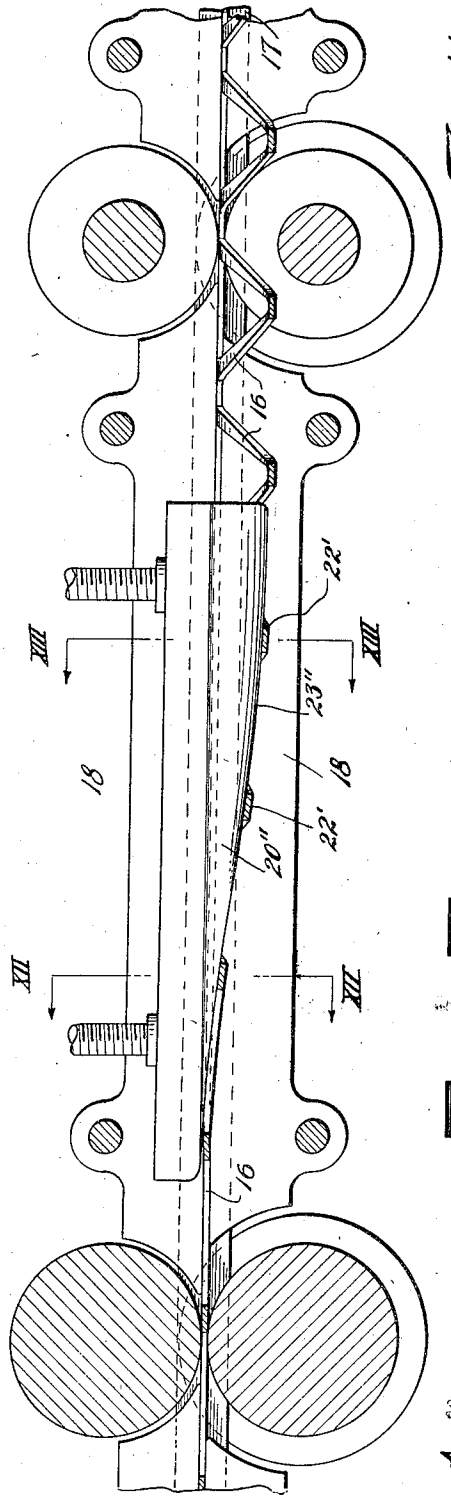


Fig. 11

Fig. 13

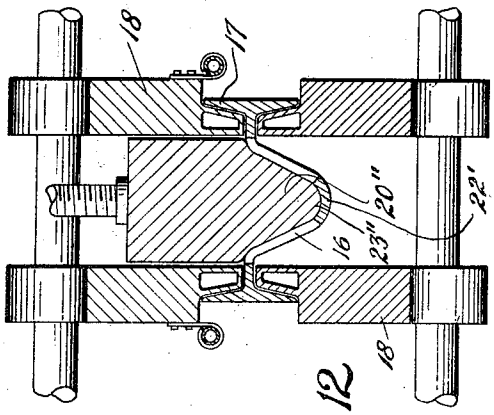
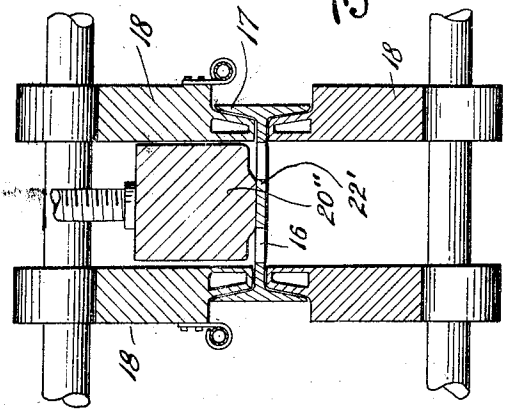


Fig. 12



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1,510,696

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STEEL JOIST MANUFACTURE

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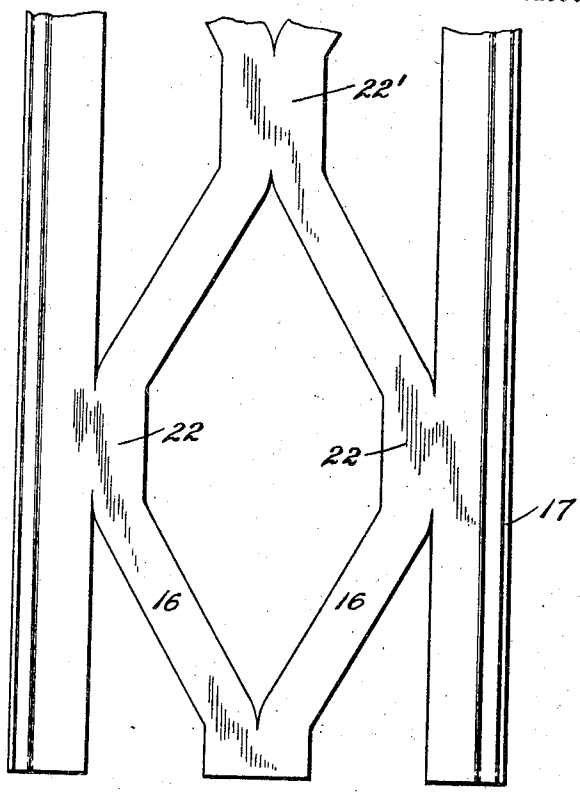


Fig. 15

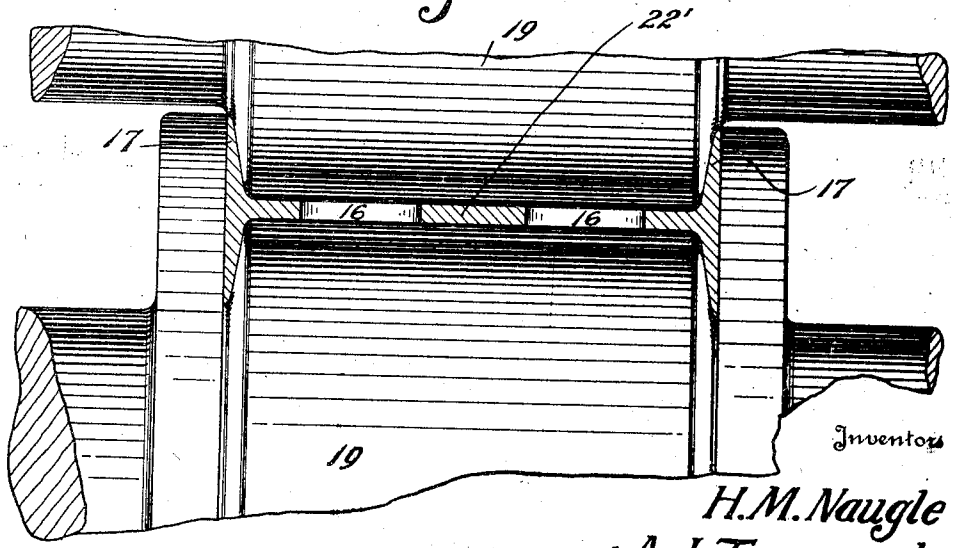


Fig. 14

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Patented Oct. 7, 1924. 1,510,696

UNITED STATES PATENT OFFICE.

HARRY M. NAUGLE AND ARTHUR J. TOWNSEND, OF CANTON, OHIO, ASSIGNORS, BY MESNE ASSIGNMENTS, TO JONES & LAUGHLIN STEEL CORPORATION, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

STEEL-JOIST MANUFACTURE.

Application filed December 27, 1921. Serial No. 524,996.

To all whom it may concern:

Be it known that we, HARRY M. NAUGLE and ARTHUR J. TOWNSEND, citizens of the United States, residing at Canton, in the county of Stark and State of Ohio, have invented a new and useful Improvement in Steel-Joist Manufacture, of which the following is a specification.

The invention relates to methods and apparatus for making steel joists and the like, for use in building construction in places where standard rolled structural shapes may not be used because of the excessive weight or improper distribution of the metal therein.

A standard rolled beam cannot be economically used as a floor joist or like member in building construction, because the limitations of rolling methods prevent the web portion being reduced to a thickness which would correspond in strength and rigidity to the resistance of the flange portions, so that there is an unnecessary weight of metal in the web.

Likewise, in the ordinary forms of steel joists, made of pressed channels with their webs abutted and secured together, the double thickness of the web portions gives an unnecessary weight of metal therein, as compared with the strength of the flange portion.

The present invention involves the expansion of the web portion of a rolled I-beam or other structural shape into an integral lattice portion; in such a manner that the strength of the lattice will be co-ordinated with that of the flanges without any excess metal being present in any portion of the beam. Referrence is made to our Patent No. 1,472,770, dated October 30, 1923, for improvements in steel joist manufacture, for further illustration of the principles and aims of the invention.

The expansion of the web of a flanged beam, which has been slitted to form bars and bonds, necessarily requires a stretching or elongation of the bars because the length of the flanges cannot be contracted. A stretching of bars effected solely by a lateral separation of flanges, can only be accomplished to a limited extent even though the same be done at a working heat. When more than a single row of bars is involved, difficulty is experienced in uniformly stretching the same and in preventing a rupture of the bars at the angle of their connection with the bonds.

The objects of the present improvement, as distinguished from that described in our Patent No. 1,472,770, are to expand the slit web of a beam partially by a separation of the flanges and a stretching of the bars at a working heat; also to stretch the partly deployed bars further by bodily deflecting intermediate portions from the plane of the web; and to expand the web fully by a further separation of the flanges of the beam. The expanding operations may be followed by a flattening of the expanded web to set the bars and bonds into a common plane.

The accompanying drawings, forming part hereof by way of explanation, illustrate the method and show apparatus for expanding a rolled I-beam by slitting two rows of bars and forming a middle row of diamond openings between side rows of triangular openings, but the invention is not restricted to this method and apparatus, nor to the product described, these being merely illustrative examples.

Referring to the drawings:

Figure 1 is a general plan view, in two parts, of the apparatus;

Fig. 2, a longitudinal vertical mid-section, in two parts, of the apparatus;

Fig. 3, a fragmentary side view of an I-beam;

Fig. 4, a cross section of the same;

Fig. 5, a view similar to Fig. 3, showing the web slitted to form bars;

Fig. 6, a cross section of the same, on line VI—VI, Fig. 5;

Fig. 7, a fragmentary elevation of the nip of bar flattening rolls, showing an I-beam in section with a slitted web flattened between the rolls;

Fig. 8, an under plan view of an I-beam in process of treatment with its web initially expanded, showing the operation of the bar stretching roll thereon, the flange guides being omitted for clarity;

Fig. 9, a cross section of a beam, on line IX—IX, Fig. 8, showing the bar stretch-

ing roll in elevation and including the flange guides in section;

Fig. 10, a fragmentary view similar to Fig. 9 of a modified form of bar stretching means, showing cooperating guide rolls;

Fig. 11, a fragmentary view similar to Fig. 2 of another form of bar stretching means, showing a deflecting guide;

Fig. 12, a cross section of same on line XII—XII, Fig. 11;

Fig. 13, a cross section of same, on line XIII—XIII, Fig. 11;

Fig. 14, a fragmentary elevation of the nip of web flattening rolls, showing a fully expanded beam in section with its expanded web flattened between the rolls; and

Fig. 15, a fragmentary side view of a fully expanded and flattened lattice web.

Similar numerals refer to similar parts throughout the drawings.

The apparatus may include slitting rolls, shown by broken lines in Figs. 1 and 2, and preferably includes one or more sets of bar flattening rolls 14, preceded by flange guides 15 and 15′ and serving to flatten the bars 16 of the previously slit web of an I-beam, into the original plane of the web, as shown in Fig. 8. Diverging guides 18 for engaging the flanges 17, extend from the delivery side of the bar flattening rolls 14, to the receiving side of web flattening rolls 19.

For the purpose of the present invention the I-beams should be received at a working heat of about 1500° F. which may be received directly from the finishing rolls of a shape rolling mill, or may be obtained from a reheating furnace. The initial portion of the expansion requires but a little elongation of the bars, and the same is accomplished by the separation of the flanges of the beam by the diverging guides 18, which operation serves to directly diverge and elongate the bars in the plane of the web.

At a suitable distance in rear of the bar flattening rolls is located bar stretching means, which may be in the form of a roll 20 mounted in suitable housings 21. This roll may or may not be power driven, and is preferably made of such a width as will pass freely between the bonds 22 which connect the bars 16 with the flanges 17 of the beam, as the same are initiallly separated by the divergence of the flange guides, as shown in Figs. 8 and 9.

The peripheral face 23 of the bar stretching roll is preferably slightly convexed so as to bear bodily upon the intermediate bonds 22′ which connect adjacent bars together, without corrugating the same to any considerable extent; and the diameter of the roll is such that its periphery travels a substantial distance below the plane of the web of the bar, so as to bodily deflect the intermediate bonds 22′ downward from the median plane, thereby longitudinally stretching and elongating the bars, as well shown in Figs. 2 and 9.

When using such a bar stretching roll the flange guides extend continuously on each side of the roll, so as to guide and sustain the flanges during the bar stretching operation, as shown in Fig. 9; and the broad face of the roll bearing bodily upon the intermediate bonds prevents a rupture of the metal at the departure of the bars therefrom.

A modified arrangement for a bar stretching roll is shown in Fig. 10, wherein the stationary flange guides are omitted alongside the roll, and in place thereof a set of driving rolls 24 and 24′ are provided to operate upon the flanges and adjacent portions of the web, to positively sustain the same during the bar stretching operation. The upper drive rolls 24 may be integral with the stretching roll 20′, or as shown, may be made separate therefrom so that the stretching roll will run idly between them.

Only one stretching roll of each kind is illustrated and described, but it is obvious that a plurality of such rolls may be arranged in tandem, so as to gradually deflect the intermediate bonds and stretch and elongate the bars to the desired extent; or a suitable stationary stretching guide 20″ may be employed and the same may take the form shown in Figs. 11, 12 and 13, so that its inclined face 23″ will bodily impinge the intermediate bonds 22′ and deflect them downward between the side bonds 22 in substantially the same manner as the operation is performed by a stretching roll, or a series of the same.

As the beam is conveyed rearward beyond the bar stretching means, the continued divergence of the flange guides further separates the flanges and gradually separates the side bonds 22 to fully expand the web, which operation gradually returns the intermediate deflected bonds 22′ to or toward the original plane of the web, as well shown in the lower section of Fig. 2.

The fully expanded web of the beam is then acted upon by the web flattening rolls 19, of which a plurality of sets may be employed, which not only act as driving rolls to move the beam rearward through the machine, but serve to flatten and set the bars and bonds into the original plane of the web, so that the beam emerges from the flattening rolls as a finished product, with its web fully expanded into an integral flat lattice, located in the original plane of the web, as shown in Figs. 14 and 15.

We claim:

1. The method of expanding the web of a structural shape or the like slit to form bars and bonds, which includes elongating the bars by bodily deflecting intermediate

bonds from the plane of the web, and then expanding the web by laterally separating the adjacent bonds.

2. The method of expanding the web of a structural shape or the like to form bars and bonds, which includes initially expanding the web by laterally separating the bonds, elongating the bars by bodily deflecting intermediate bonds from the plane of the web, and finally expanding the web by further separating the adjacent bonds.

3. The method of expanding the web of a structural shape or the like slit to form bars and bonds, which includes initially expanding the web by laterally separating the bonds at a working heat, elongating the bars by bodily deflecting intermediate bonds from the plane of the web, and finally expanding the web by further separating the adjacent bonds.

4. The method of expanding the web of a structural shape or the like slit to form bars and bonds, which includes flattening the bars into the plane of the web, initially expanding the web by laterally separating the bonds, elongating the bars by bodily deflecting intermediate bonds from the plane of the web and finally expanding the web by further separating the adjacent bonds.

5. The method of expanding the web of a structural shape or the like slit to form bars and bonds, which includes flattening the bars into the plane of the web, initially expanding the web by laterally separating the bonds, elongating the bars by bodily deflecting intermediate bonds from the plane of the web, finally expanding the web by further separating the adjacent bonds, and then flattening the bonds and bars into the horizontal plane of the web.

6. The method of expanding the web of a structural shape or the like having side flanges, which includes slitting the web to form bars and bonds, initially expanding the web by laterally separating the flanges, elongating the bars by bodily deflecting intermediate bonds from the plane of the web, and finally expanding the web by further separating the flanges.

7. The method of expanding the web of a structural shape or the like having side flanges which includes slitting the web to form bars and bonds, elongating the bars by bodily deflecting intermediate bonds from the plane of the web, and expanding the web by laterally separating the flanges.

8. The method of expanding the web of a structural shape or the like having side flanges which includes slitting the web to form bars and bonds, elongating the bars by gripping the flanges between rolls while engaging an intermediate portion of the web to deflect it from the median plane, and expanding the web by laterally separating the flanges.

9. The method of expanding the web of a structural shape or the like having side flanges which includes slitting the web to form bars and bonds, elongating the bars by gripping the flanges between rolls while engaging an intermediate portion of the web to deflect it from the median plane, and expanding and flattening the web by laterally separating the flanges, said operations being performed at a working heat.

10. The method of expanding the web of a structural shape or the like having side flanges which includes fabricating the web to form bars and bonds connecting the flanges, elongating the bars by engaging an intermediate portion of the web to deflect it from the median plane while gripping the flanges between rolls, and separating the flanges and flattening the expanded web.

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