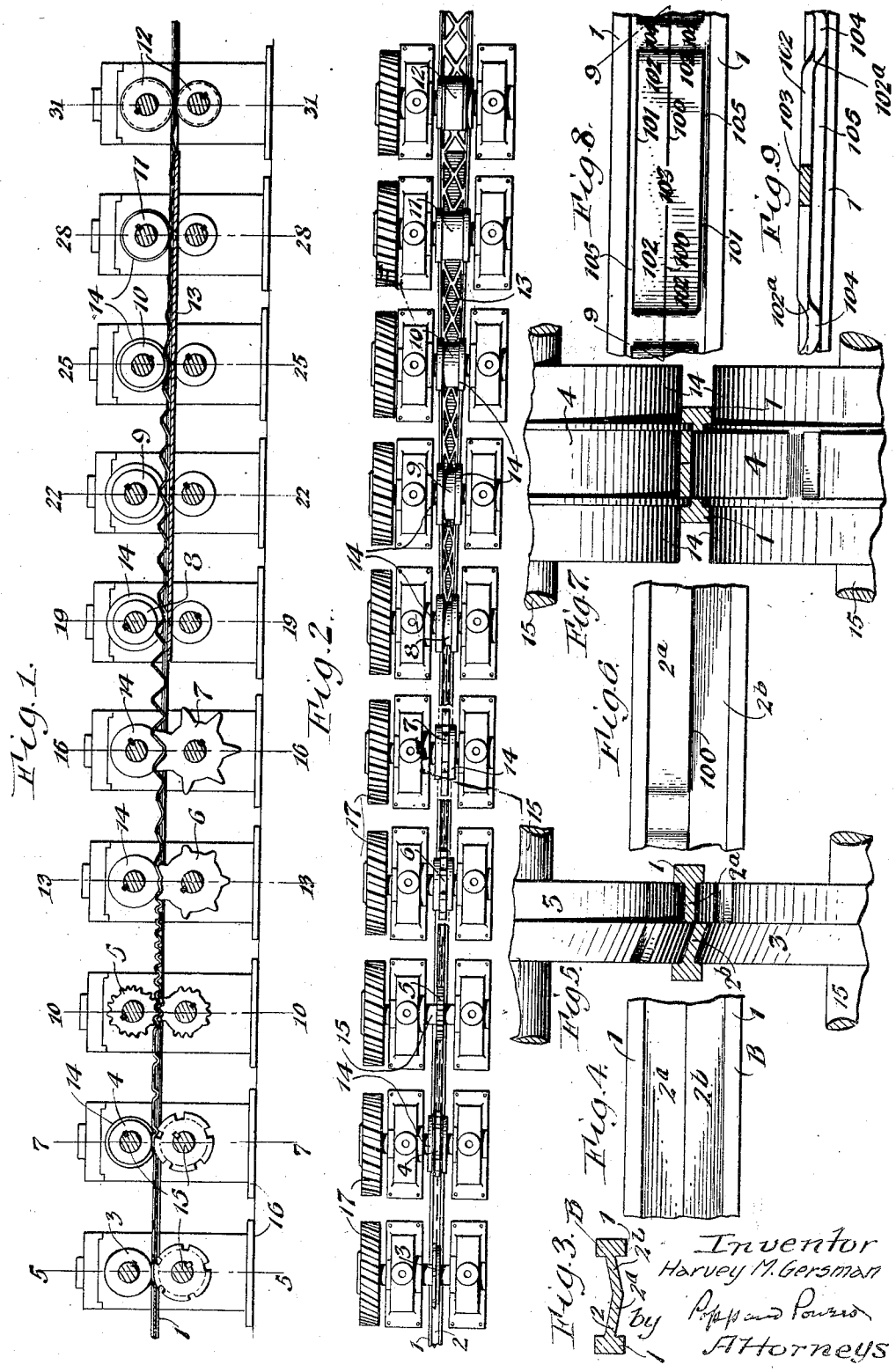
Oct. 13, 1931. H. M. GERSMAN 1,827,314

APPARATUS FOR THE MANUFACTURE OF EXPANDED STEEL LOAD BEARING MEMBERS

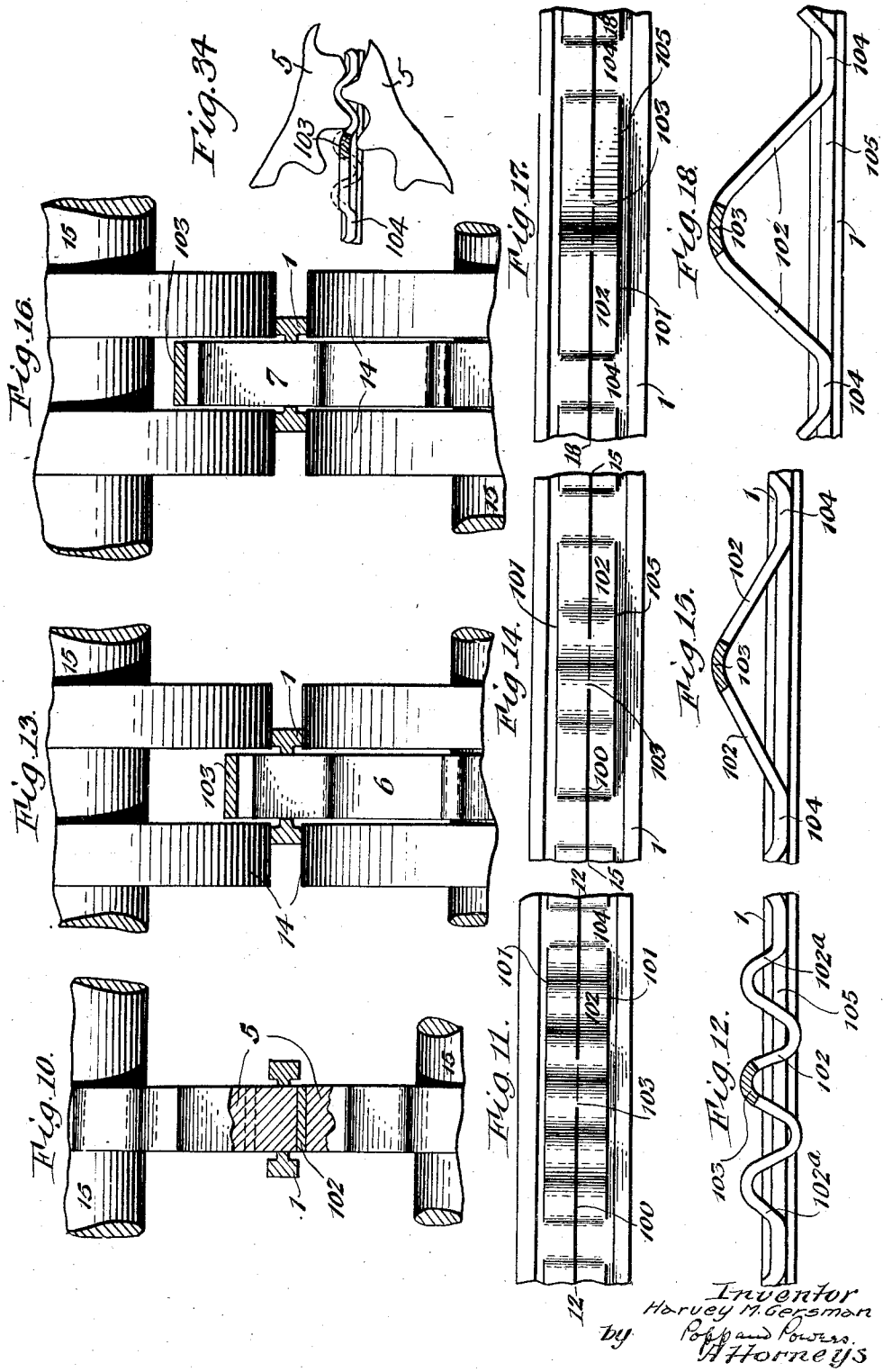
Filed Feb. 19, 1925 4 Sheets-Sheet 1



Oct. 13, 1931. H. M. GERSMAN 1,827,314

APPARATUS FOR THE MANUFACTURE OF EXPANDED STEEL LOAD BEARING MEMBERS

Filed Feb. 19, 1925 4 Sheets-Sheet 2

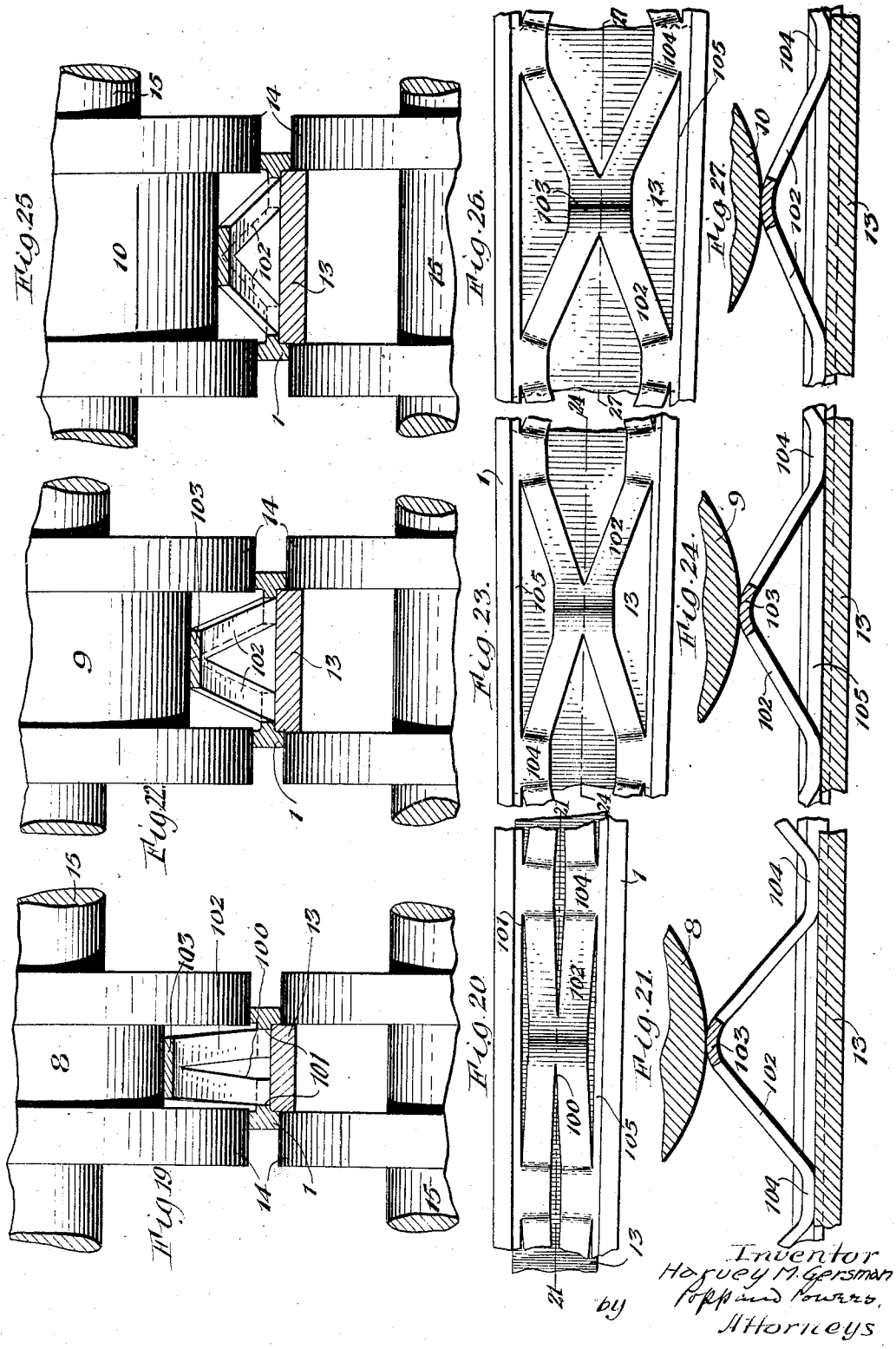


Inventor
Harvey M. Gersman
by Popp and Powers
Attorneys

Oct. 13, 1931. H. M. GERSMAN 1,827,314

APPARATUS FOR THE MANUFACTURE OF EXPANDED STEEL LOAD BEARING MEMBERS

Filed Feb. 19, 1925 4 Sheets-Sheet 3

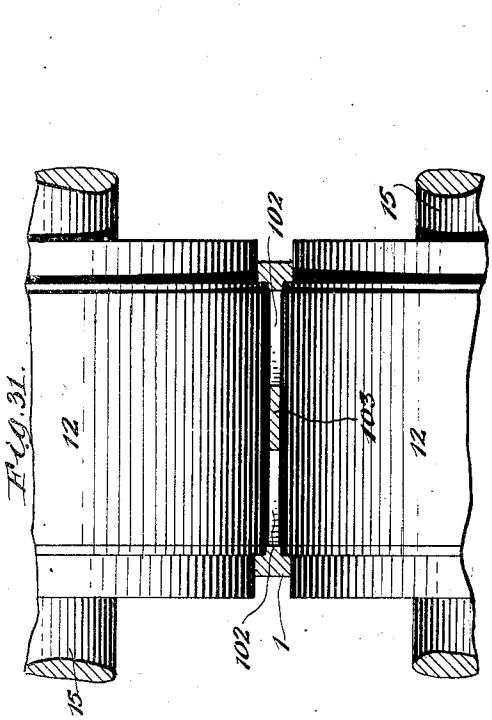


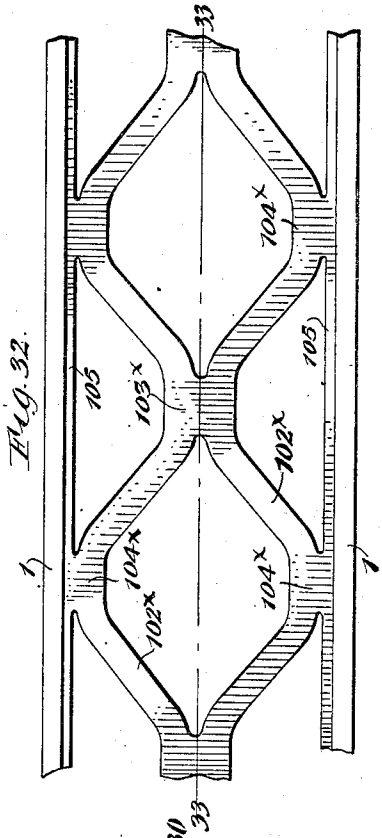
Inventor
Harvey M. Gersman
by Popp and Powers,
Attorneys

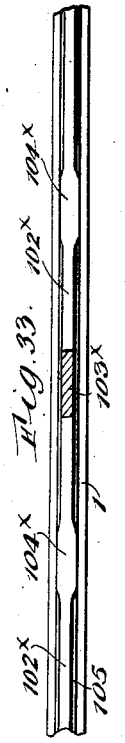
Oct. 13, 1931. H. M. GERSMAN 1,827,314

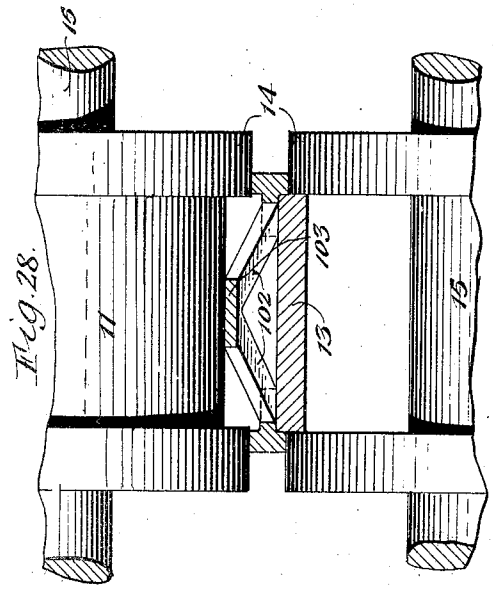
APPARATUS FOR THE MANUFACTURE OF EXPANDED STEEL LOAD BEARING MEMBERS

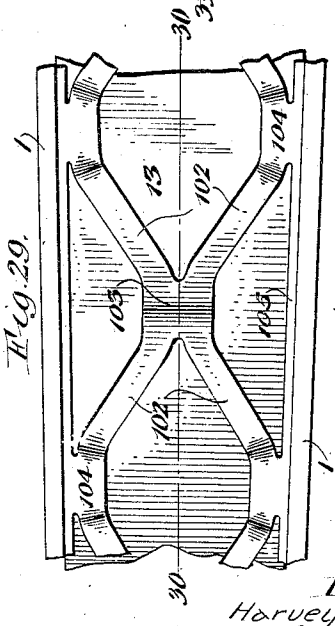
Filed Feb. 19, 1925 4 Sheets-Sheet 4

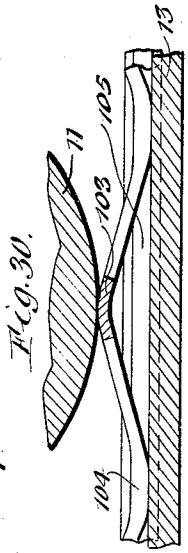












Inventor
Harvey M. Gersman
by Popp and Popp
Attorneys

Patented Oct. 13, 1931 1,827,314

UNITED STATES PATENT OFFICE

HARVEY M. GERSMAN, OF CHICAGO, ILLINOIS

APPARATUS FOR THE MANUFACTURE OF EXPANDED STEEL LOAD BEARING MEMBERS

Application filed February 19, 1925. Serial No. 10,349.

This invention relates to apparatus for the manufacture of expanded steel load bearing members and more particularly to apparatus for the production of such members in integral form from a rolled structural shape according to the process which forms the subject of my pending application, Serial No. 7,764.

The principal object of the invention is to provide an apparatus by which the strand portions of the blank can be completely stretched prior to the expansion of the blank and the expansion of the blank can be completely carried out without further stretching the strand portions.

The invention consists generally in an apparatus having novel features of structure and organization which are provided to carry out the operations above generally referred to and which will be set forth in detail as the description proceeds.

The accompanying drawings illustrate the apparatus diagrammatically but in sufficient detail to enable its principles of construction and operation to be readily understood. The drawings also illustrate the completed beam and the various stages of its manufacture, the beam forming the subject of my pending application, Serial No. 7,765.

In said drawings:

Figure 1 is a diagrammatic side elevation of the apparatus,

Figure 2 is a diagrammatic top plan view of the same.

Figure 3 is a cross section showing a preferred form of blank.

Figure 4 is a plan view of a portion of the blank.

Figure 5 is a cross section on the line 5—5 of Figure 1, more particularly showing a phase of the slitting operation.

Figure 6 is a plan view of a portion of the blank conforming to the operation shown in Figure 5.

Figure 7 is a cross section on the line 7—7 of Figure 1, more particularly showing a further phase of the slitting operation.

Figure 8 is a plan view of a portion of the blank conforming to the operation shown in Figure 7.

Figure 9 is a sectional view of the blank on the line 9—9 of Figure 8.

Figure 10 is a cross section on the line 10—10 of Figure 1, more particularly showing the operation of the compensating rolls by which the bar or strand portions produced by the slitting of the blank are caused to be of uniform thickness throughout their extent.

Figure 11 is a plan view of a portion of the blank conforming to the operation shown in Figure 10.

Figure 12 is a sectional view of the blank on the line 12—12 of Figure 11. The deformation of the strand portions is shown in this figure on a somewhat exaggerated scale in order to promote clearness of illustration.

Figure 13 is a cross section on the line 13—13 of Figure 1, more particularly showing the operation of the first expansion roll.

Figure 14 is a plan view of a portion of the blank conforming to the operation of Figure 13.

Figure 15 is a sectional view of the blank on the line 15—15 of Figure 14.

Figure 16 is a cross section on the line 16—16 of Figure 1, more particularly showing the operation of the second expansion roll.

Figure 17 is a plan view of a portion of the blank conforming to the operation of Figure 16.

Figure 18 is a sectional view of the blank on the line 18—18 of Figure 17.

Figure 19 is a cross sectional view on the line 19—19 of Figure 1, more particularly showing the operation of the first flattening roll.

Figure 20 is a plan view of a portion of the blank and an adjacent portion of the spreader conforming to the operation of Figure 19.

Figure 21 is a sectional view on the line 21—21 of Figure 20, this view also showing the lower portion of the first flattening roll.

Figure 22 is a cross sectional view on the line 22—22 of Figure 1, more particularly showing the operation of the second flattening roll.

Figure 23 is a plan view of a portion of the blank and an adjacent portion of the spreader conforming to the operation of Figure 22.

Figure 24 is a sectional view on the line 24—24 of Figure 23, this view also showing the lower portion of the second flattening roll.

Figure 25 is a cross section on the line 25—25 of Figure 1, more particularly showing the operation of the third flattening roll.

Figure 26 is a plan view of a portion of the blank and an adjacent portion of the spreader conforming to the operation of Figure 25.

Figure 27 is a sectional view on the line 27—27 of Figure 26, this view also showing the lower portion of the third flattening roll.

Figure 28 is a cross section on the line 28—28 of Figure 1, more particularly showing the operation of the fourth flattening roll.

Figure 29 is a plan view of a portion of the blank and an adjacent portion of the spreader conforming to the operation of Figure 28.

Figure 30 is a sectional view on the line 30—30 of Figure 29, this view also showing the lower portion of the fourth flattening roll.

Figure 31 is a cross section on the line 31—31 of Figure 1, more particularly showing the final flattening and delivery rolls.

Figure 32 is a plan view of a portion of the completed beam.

Figure 33 is a sectional view on the line 33—33 of Figure 32.

Figure 34 is a detail view showing the formation and function of the rolls 5.

The drawings illustrate in detail the production of a lattice truss and for most, if not all, practical purposes it will be sufficient if the struts of the completed beam have a single line of intermediate bonds representing points of intersection, the remaining bonds being the connections between the struts and the chords. The blank for such a beam will have three longitudinal rows of slits arranged in the manner and relation of the slits provided in the blanks from which diamond mesh lath, so called, is produced, that is to say with the slits of each row in symmetrically staggered or break-joint relation to the slits of the adjacent row or rows. While the blank for such a beam may, as stated, be of regular I cross section it is preferably of a modified original cross section which promotes the facility of the slitting operation, such a blank, as B, being shown in Figures 3 and 4 and being provided with parallel flanges 1 and a connecting web 2 which has a wide-angled V cross section that provides angularly related longitudinal web portions 2*a* and 2*b*.

The operations in the order of their performance are slitting the blank, unifying the thickness of the bar or strand portions and the intermediate bonds, stretching the bar or strand portions, and separating the flanges and pressing the stretched bar or strand portions and the intermediate bonds back into a single common plane. The several elements of the apparatus by which these operations are carried out may, of course, be structurally varied. As diagrammatically shown, the apparatus includes slitting rolls 3 and 4, strand unifying or compensating rolls 5, strand stretching rolls 6 and 7, strand flattening rolls 8, 9, 10, 11 and 12, the rolls 12 also serving as delivery rolls, a spreader 13 which is co-operative with the rolls 8, 9, 10 and 11, and feed rolls 14 which act on the flanges 1 and may be arranged as required or desirable, in some instances being mounted on the shafts of certain of the other rolls and in some instances being mounted on shafts specially provided therefor. The several shafts which carry the rolls above enumerated are indicated at 15 and are mounted in bearings for which housings 16 are provided, the shafts being positively driven from a line shaft (not shown) or otherwise suitably by gearing which is sufficiently indicated by the showing of a gear element 17 for each shaft.

The slitting rolls may be of any well known type. While the slitting may be performed in a single stage it is preferably performed in two successive stages, the first stage by the rolls 3 and the second stage by the rolls 4. In the first stage (Figures 5 and 6) the blank is formed with the central row of slits 100 and in the second stage (Figures 7, 8 and 9) with the outer row of slits 101, these being located close to the web. The modified cross section of the blank is of advantage as will appear from Figures 5 and 7 in that the angle of the portions which are displaced during the slitting to the shearing edges is at no point greater than a right angle and this characteristic provides for greater facility in the slitting operation than is possible where, as in a blank of regular I form, certain portions of the web which would be displaced during the slitting operation would lie at an obtuse angle to the shearing edge. In the first stage of the slitting as effected by the rolls 3 the portion 2*b* is moved into a plane normal to and located centrally of the flanges 1 and parts of the portion 2*a* (being those parts which provide the intermediate bonds) are similarly displaced while the remaining parts of the portion 2*a* are held in their original plane and are thus severed from the adjacent parts of the portion 2*b*. In the second stage of the slitting as effected by the rollers 4 the parts of the portions 2*a* which during the first stage were held in their original plane are moved into the same plane as the portion 2*b*, that is to say a plane normal to and located centrally of the flanges 1, and from this common plane adjacent parts of both of the portions 2*a* and 2*b* are displaced into a common plane parallel to the plane from which the displacement started, the portions so displaced being thus severed from

the web along lines parallel and adjacent to the flanges and leaving in the plane from which the displacement started those portions which provide the bonds between the struts and the chords, i. e., the outer lines of bonds, and if, as preferred, the outer lines of slits be slightly distant from the flanges also leaving chord portions of the web. In Figures 8 and 9 the strand portions are indicated at 102, the portions which provide the intermediate bonds at 103, the portions which provide the bonds of the outer lines at 104 and the chord portions at 105.

The strand portions 102 and the intermediate bond providing portions 103 are, as above explained, displaced incident to the slitting operation in planes parallel to the planes of the outer bond providing portions 104 and the chord portions 105. In consequence of this displacement the length of the parts between successive portions 104, these parts being two strand portions 102 and an intermediate bond providing portion 103 located between them, is greater than the length which these parts had prior to their displacement, that is to say prior to the cutting of the outer slits 101. It follows that as an incident of the slitting operation there is some stretching of the metal of the displaced portions. This stretching occurs in the parts by which the displaced portions are connected to the outer bond providing portions 104, these parts being shown in Figure 9 at 102*a* and being terminal parts of the strand portions 102 which extend diagonally from the straight parts of such strand portions to the portions 104. Thus the parts 102*a* due to their stretching are of somewhat less thickness than the parts 104 and the straight parts of the strand portions 102. It is desirable, however, that the displaced parts be of equal thickness throughout their extent since, otherwise, the resultant strands would not only be of unequal thickness at different points but the parts stretched during the slitting operation would be further attenuated during the ordered stretching operation, offering as they do less resistance to the stretching forces than the remaining parts, and would therefore be a source of weakness in the finished beam. I therefore provide for compensating the stretch of the parts 102*a* by making all parts of the bond providing portions 103 and the strand portions 102 of equal thickness, this end being best served by attenuating the intermediate bond providing portions 103 and the flat parts of the strand portions 102 prior to the ordered stretching operation whereby said flat parts and their connecting portions 103 are increased in over-all length and are reduced to the same thickness as the connecting parts 102*a*. This operation is accomplished by a pair of unifying or compensating rolls 5, one acting on the blank from above and the other from below. The rolls 5 are formed with cooperating transverse corrugations which are shaped and arranged to deform the displaced portions of the blank into sinuous outline as shown in Figures 11 and 12, the parts 102*a* being included in the sinuous curve at any point of which the metal is of the same thickness as at any other point. The general form and arrangement of the rolls 5 is illustrated diagrammatically in Figure 1 and in greater detail in Figure 34. The transverse corrugations above mentioned are provided in cooperating series on the two rolls, the corrugations of each series being designed and arranged to produce the preliminary strand formation shown in Figure 12, and to avoid any stretching of the panel point providing portions of the blank. It follows that between the adjacent series of corrugations of each roll there will be breaks which constitute inactive areas, and it is obvious that in producing the preliminary strand formation shown in Figure 12, a series of corrugations on one roll will intermatch with and cooperate with a corresponding series of corrugations on the other roll, and that the break of one roll will register peripherally with the break of the other roll during the period when a panel point providing portion passes between the rolls. The result of the operation of the rolls formed and arranged in the manner described is the formation shown in Figure 12, wherein those strand providing portions which are connected by an intermediate bond providing portion are, together with such bond providing portion, uniformly preliminarily stretched. It is to be noted that the deformation of the strand portions is shown in Figures 11 and 12 on a somewhat exaggerated scale in order to promote clearness of illustration.

The stretching operation follows the operation of the compensating rolls and is preferably performed in more than one stage, two stages being provided for in the apparatus disclosed. The stretching operation is so performed that the intermediate bond providing portions 103 are offset in paths at right angles to the mean longitudinal plane of the web with the result that the adjacent strand portions at opposite sides of the several slits 100 while remaining in parallel relation are stretched proportionately to the increase in the distance between their ends as measured by their points of connection with the respective bond providing portions 103 and 104. By proceeding in this manner the bending of the strands where they join the bond providing portions is along transverse lines and the stretching forces are applied at right angles to these transverse bending lines with the result that there is no possibility of tearing. Various mechanical agencies may be employed for offsetting the bond providing portions 103 in order to stretch the strand

portions 102. As shown in the drawings the means for this purpose consists of the rolls 6 and 7 which are provided with suitable teeth as shown. These rolls are arranged whereby their teeth enter the angle of the convolution of which the portion 103 provides the apex. As shown in Figure 12 this angle faces downward and the rolls 6 and 7 are accordingly arranged to engage the blank from below. The teeth of the roll 6 act in the first stage of the stretching operation and are therefore of less depth than the teeth of the roll 7 by which the stretching operation is completed. At the completion of the first stage of the stretching operation, as shown in Figure 15, the strand portions 102 have been straightened from the sinuous form which they had when the operation started and have been stretched to a partial extent. At the completion of the second stage of the stretching operation, as shown in Figure 18, the strand portions have been stretched to the degree which may have been determined upon and each stretched part which includes an intermediate bond providing portion and the strand portions thereby connected is displaced into substantial V-form.

The next step is the expansion of the blank into the completed structural section. This involves operations merely for the production of open work and does not involve any sensible stretching of any of the parts. In the expansion of the blank the strand portions are subjected to a two-fold displacement operation, that is to say, they are bent outward relatively to one another so as to extend divergingly from the common bond and they are also pushed back into the central longitudinal plane of the web, in short, flattened. These operations are accomplished by moving the flanges of the blank relatively outward and at the same time applying pressure to the offset bond providing portions to move them and the strands back into the central longitudinal plane of the web. By pressing the offset bond providing portions back toward the central longitudinal plane of the web while the flanges are being spread, the rate at which the bond providing portions are pressed back being proportional to the rate at which the flanges are spread or slightly greater, further stretching of the strands is avoided and at the same time all liability of tearing the strands in the directions of the slits is avoided. The flattening of the displaced parts may be effected by various means, the drawings illustrating for this purpose a series of rolls 8, 9, 10, 11 and 12 by which the operation is completed in successive stages. The relative outward movement of the flanges may be effected by various means but is preferably effected by the spreader plate 13 which is employed in cooperation with the rolls 8, 9, 10 and 11, the web passing over the plate 13 which is thus used as a support and the flattening rolls engaging the displaced parts of the web from above. The plate 13 has a close fit between the flanges 1 of the blank and its sides are regularly divergent whereby said plate regularly increases from a width corresponding to that of the web at the end of the strand stretching operation to the width which it is intended that the web shall have in the finished beam, the diverging sides of the plate 13 acting on the flanges 1 during the travel of the blank to cause an increase in the mutual spacing of said flanges corresponding to the regular increase in the width of the spreader. The operation of the first of the flattening rolls is illustrated in Figures 19, 20 and 21 from which it will be observed that the roll 8 has applied pressure to the adjacent portion 103 and forced the same to a lower plane, the flanges 1 have moved relatively outward to a slight degree by the spreader 13 and the strand portions 102 have adjusted or accommodated themselves to the altered positions of the portion 103 and the flanges 1, the laterally adjacent strand portions now extending from the portion 103 at a slight angle to one another and the longitudinally opposite strand portions now extending from the portion 103 at an increased angle to one another. The operation of the second flattening roll 9 is similarly illustrated in Figures 22, 23 and 24 from which it will be observed that the portion 103 has been forced to a position somewhat below that of Figure 21, the mutual spacing of the flanges 1 has been further increased and that the strand portions have again and in like manner adjusted or accommodated themselves to the further altered positions of the portion 103 and the flanges 1. The operation of the third flattening roll 10 is illustrated in Figures 25, 26 and 27 and that of the fourth flattening roll 11 in Figures 28, 29 and 30. These operations are similar to those of the rolls 8 and 9 and involve further increase in the spacing of the flanges 1 and further flattening of the stretched displaced portions.

The fifth and final stage of the expanding operation is performed by a pair of co-operating rolls 12. The spreader 13 projects for some distance in advance of the fourth flattening roll 11 and as the blank is fed forward from this roll a further increase in the spacing of the flanges 1 is effected by the spreader. The rolls 12 act on the blank as it passes beyond the spreader. At this time the flanges 1 have been spaced to the extent determined upon and the flattening of the stretched displaced portions has been nearly completed. The office of the rolls 12 is, therefore, to perform the final step of bringing the displaced portions uniformly into the central longitudinal plane of the web and to give a desirable finish to the completed beam. These rolls are therefore shaped and proportioned

to act on all parts of the web and are operative to deliver the completed structural member which is shown in Figures 32 and 33.

The machine described produces a beam expanded from a rolled structural shape in which all of the parts displaced by the expansion lie in the central longitudinal plane of the beam, the structure being integral throughout. In the completed product the strands 102x are of equal thickness throughout their extent, the intermediate bonds 103x are of equal thickness with the strands and the outer bonds 104x are of somewhat greater thickness than the strands since they are not subject to any stretching and therefore give a greater factor of safety to the structural member.

Having fully described my invention, I claim:

1. In apparatus for the manufacture of an expanded steel load bearing member from a rolled shape slitted to provide strand portions, opposed cooperating rolls having circumferentially spaced ribs engageable with parts of said strand portions to displace said parts in a direction at a right angle to the original central longitudinal plane of the slitted portion of the shape and by such displacement to stretch the strand portions said displaced parts being sinuous in outline, means for increasing the width of the shape after the strand portions have been stretched, and means operating during the operation of the last mentioned means for pressing the strand portions back into the plane from which they were displaced by the stretching operation.

2. In apparatus for the manufacture of an expanded steel load bearing member from a rolled shape slitted to provide strand portions, opposed cooperating rolls having circumferentially spaced ribs engageable with parts of said strand portions progressively to displace said parts in a direction at a right angle to the original central longitudinal plane of the slitted portion of the shape and by such displacement progressively to stretch the strand portions said displaced parts being sinuous in outline, means for increasing the width of the shape after the strand portions have been stretched, and means operating during the operation of the last mentioned means for pressing the strand portions back into the plane from which they were displaced by the stretching operation.

3. In apparatus for the manufacture of an expanded steel load bearing member from a rolled shape slitted to provide strand portions, in combination, opposed cooperating rolls having circumferentially spaced ribs for displacing parts of the strand portions in a longitudinal plane wholly at right angles to the original central longitudinal plane of the slitted portion of the shape and by such displacement stretching the strand portions in sinuous outline to the full extent of their length in the expanded member, means for producing a continuous feeding movement of the shape means for increasing the width of the shape after the strand portions have been stretched and means operating during the operation of the last mentioned means for pressing the strand portions back into the plane from which they were displaced by the stretching operation.

4. In apparatus for the manufacture of an expanded steel load bearing member from a rolled shape slitted to provide strand portions, in combination, means for deforming the unweakened strand portions in sinuous outline to provide strands of uniform thickness, means subsequently acting on the strand portions to stretch them means for increasing the width of the shape after the strand portions have been stretched, and means operating during the operation of the last named means for pressing the strand portions back into the plane from which they were displaced by the stretching operation.

5. In apparatus for the manufacture of an expanded steel load bearing member from a rolled shape slitted to provide strand portions, in combination, means for stretching in sinuous outline in the direction of their leng h the strand portions, means for increasing the width of the shape after the strand portions have been stretched, and means operating during the opera ion of the last named means for pressing the strand portions back into the plane from which they were displaced by the stretching operation.

6. In apparatus for the manufacture of an expanded steel load bearing member from a rolled shape slitted to provide strand portions, in combination, means for stretching in sinuous outline in the direction of their length the strand portions, means for increasing the width of the shape after the strand portions have been stretched, and means operating during the operation of the last named means and at a rate proportionate to the stretching of the shape for pressing the strand portions back into the plane from which they were displaced by the stretching operation.

7. In apparatus for the manufacture of an expanded steel load bearing member from a rolled shape slitted to provide strand portions, means for stretching in sinuous outline in the direction of the length the strand portions, means for progressively increasing the width of the shape after the strand portions have been stretched, and means operating during the operation of the last named means for progressively pressing the strand portions back into the plane from which they were displaced by the stretching operation.

8. In apparatus for the manufacture of an expanded steel load bearing member from a rolled shape slitted to provide strand portions, means for stretching in sinuous outline

in the direction of their length the strand portion, means for progressively increasing the width of the shape after the strand portions have been stretched, means operating during the operation of the last named means for progressively pressing the strand portions back into the plane from which they were displaced by the stretching operation, and means for continuously feeding the shape in relation to the several means above set forth.

In testimony whereof I affix my signature.

HARVEY M. GERSMAN.