

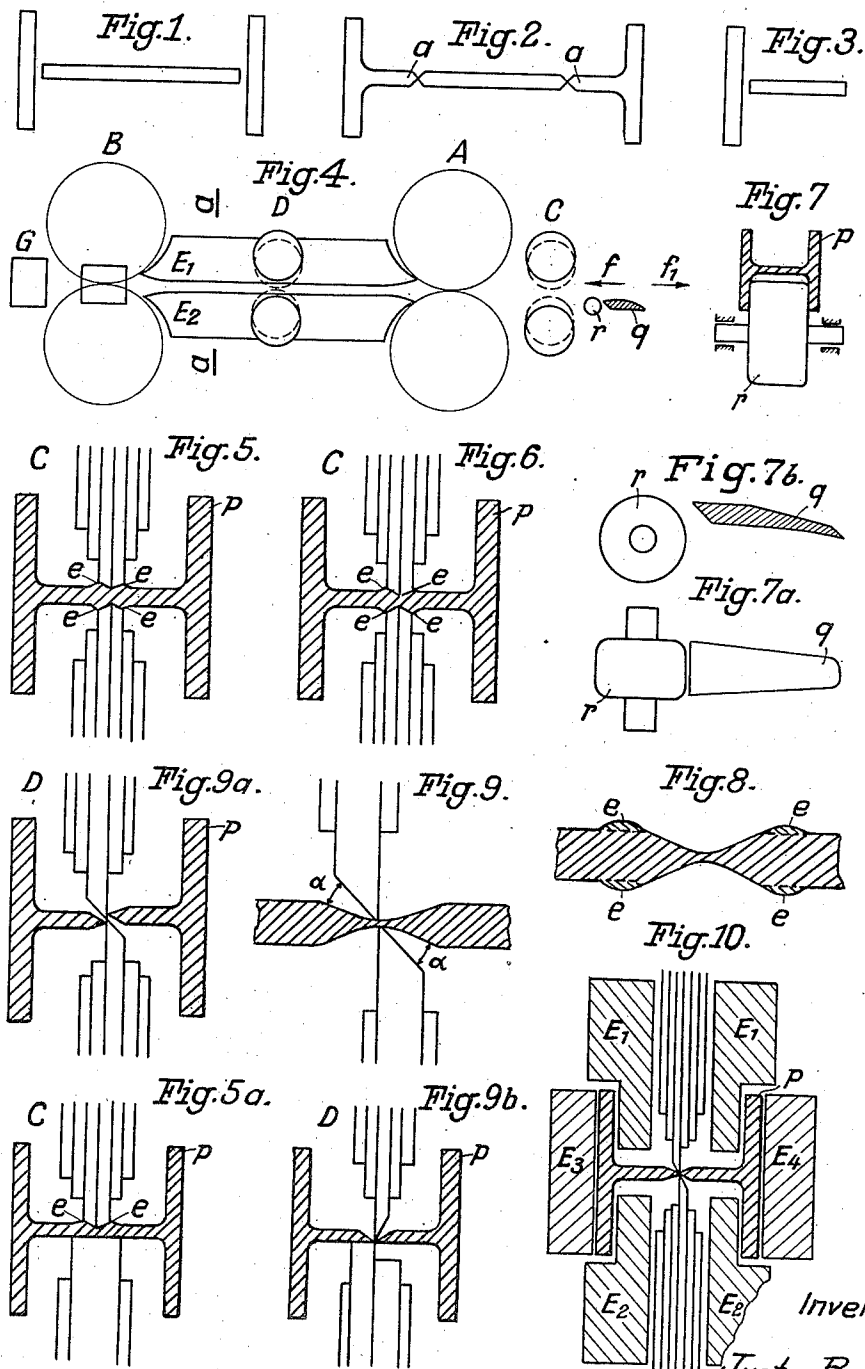
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METHOD OF PRODUCING IRON GIRDERS AND VERY LARGE T-SECTION IRON

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METHOD OF PRODUCING IRON GIRDERS
AND VERY LARGE T-SECTION IRON

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This invention relates to a method of producing iron girders and very large T-section iron.

For the past fifty years attempts have been made by various big iron works in Europe and elsewhere to make available for constructional purposes iron girders of special cross-sectional design having a maximum attainable height of the web. The last improvement in this field was made by the Differdinger Iron Works, who for the past few decades have been rolling on the well known Grey girder mills girders, which possess a height at present limited to 1 metre and the flanged sides of which are parallel and sharp-edged, whereby any connections which require to be made are considerably facilitated.

For this purpose there have been employed trains of rolls based on the Grey system with reversible roll mechanisms on the lines of the four-roll universal train. The finishing rolls consist of two stands in which the girders are rolled in consecutive passes.

The development of girder constructions in the past few years, however, has necessitated the manufacture of girders having an extremely large cross-section and a considerably greater height of the web. Since rolling mills have not been able to produce the cross-sections in question the practice has been adopted of welding together three iron plates which in this way form the flanges and the web (Fig. 1).

The primary drawback in this method to which attention has repeatedly been drawn consists in the fact that the welding seams, taken with respect to the neutral axis, are located at the points where the connection of the web to the flanges calls for absolute reliability as regards the quality and even nature of the metal.

There will be recognised the advantage of rolling extremely high T-section iron in the manner which permits of production of the girders in accordance with Fig. 2, i. e., in such a fashion that the welding seams of a certain height of girder are approached more towards the neutral axis and accordingly into a more advantageous position. It is also important that the ends *a* of this T-section iron are furnished during the rolling with bevelled edges which accommodate the welding seams.

It is to be emphasised that these extremely large T-iron girders can be employed as primary elements in iron constructions, or also as upper or lower element in the case of compound girders, or the like. In practice constructors are at present making use of the welding art by welding to-

gether two large flat iron sections as in Fig. 3. This, however, is an expensive process.

Actually the rolling mills supply to constructors T-iron of smaller cross-section, which is employed in iron structures for auxiliary elements. This T-iron also possesses sloped sides to the flanges, which make the connection, the riveting together and finally the use unnecessarily difficult.

It is the object of the present invention to produce extremely large T-iron having parallel and sharp-edged flanges by the gradual rolling in and separation of Grey wide-flange girders at the points of constriction *a* (Fig. 2) during the hot rolling. This may take place in one or more passes without deforming the limbs of the T-iron, in such fashion that the web of the half-girder thus produced terminates in a simple or compound bevelled edge, i. e., in the form of a simple or double wedge.

Two of these T-iron members can then be combined by means of the bevelled edge on the web by welding to a wide flat section to form an extremely high girder as in Fig. 2, whereby the welding edges are disposed as near as possible to the neutral axis. They may also be employed as primary elements in heavy iron structures.

The drawing illustrates the invention and shows in Figs. 1-3, already referred to above, arrangements for producing compound girders or beams by welding together a plurality of elements. The girders of Figs. 1 and 2 being I-beams and the girders of Fig. 3 T-beams.

Figs. 4-10 illustrate the use of a train of rolls according to the Grey system, adapted to produce wide-flanged I-girders having parallel and sharp-edged flanges for the manufacture of T-beams by dividing the web of an I-beam.

Fig. 4 is a diagrammatic side view of a portion of a rolling mill for I-beams supplemented by web indenting, dividing and guiding means.

Figs. 5 and 6 show on a larger scale in cross-section the I-beam acted on by the indenting means.

Fig. 5a is a modification of Fig. 5.

Fig. 7 shows in cross-section the I-beam to be acted on guided by a roller.

Figs. 7a and 7b show in plan and side view respectively the guiding means for the I-beam.

Fig. 8 is a cross-section through a portion of the web of the I-beam after indenting.

Figs. 9 and 9a illustrate the lengthwise cutting of the web of the I-beam along the central indentation or groove.

Fig. 9b shows a modification of the cutting or shearing means.

Fig. 10 is a diagrammatic cross-section between two I-beam roll stands on the line $a-a$ of Fig. 4, showing the beams divided by shearing rolls or discs with its flanges guided by cooperating guiding elements.

In the drawing A and B (Fig. 4) are two stands of the finishing train, which roll the large wide-flanged girders in successive passes.

1. C represents a pair of rolls, which during the rolling of the girder in successive passes on the reversible train roll a gradually increasing groove or indentation into the web of the girder.

The driven rolls can be moved apart (as in full lines) or approached toward each other (as in broken lines) as desired by means of a setting and lifting mechanism. The grooving or indentation occurs during the odd series of passes (direction of the arrow f). The rollers are thereupon moved apart for the even series of passes (direction of the arrow f_1), but are again moved together for the gradual rolling in during the opposite and successive passes.

Figs. 5 and 6 show the positions of the rollers C and the rolling in upon two consecutive odd passes f . The rolling in is so regulated in the final pass that after the passage between the rollers C the half-girders are merely connected by a thin strip of metal.

2. It is to be emphasised that the gradual rolling in always occurs at exactly the same point in the following passes, i. e., in the axis of the bar, and the girder must accordingly always be accurately adjusted to the axis of the rolls. This is accomplished by the centering roll r (Fig. 4), which is adjustable horizontally and vertically, exactly corresponding to the inner form of the girder. In front of this roll there is provided a conical guide q for reliable and ready introduction of the girder between the rolls (Figs. 7, 7a and 7b).

3. After each rolling in by the rollers C the rolled in bar passes through the stand A (Fig. 4), which rolls the sectional form and also more particularly removes the deformations e produced during the rolling by the rolls C.

4. After emerging from the stand A the bar exhibits an accurately improved sectional form and is introduced between the two freely running shearing rolls D. These rolls are spaced apart during the consecutive passes, but are moved together for the final pass (in the direction of the arrow f) for the purpose of separating the two half-girders, which is accomplished by lightly shearing through the strip of metal holding the same together (Figs. 9 and 9a). This ready shearing operation takes place without the least deformation of the sectional form by the fact that the two half-girders are connected only by a very thin strip of metal and the cutting edges form a sufficiently large free angle α with the sectional form to be cut.

Fig. 10 shows a section $a-a$ (according to Fig. 4) through the guides E_1 and E_2 . p is the rolled girder, E_3 and E_4 are the lateral guides.

5. The two half-girders finally traverse the stand B (Fig. 4) and then the vertical hot straightening rolls G, which are adjustable horizontally and vertically to the direction of rolling.

The two T-iron members produced are accordingly held and guided at three points, viz., by the guide E, rolls B and adjustable straightening rolls G and are subjected to an actual hot

straightening process. Owing to the inner stresses of the girder the two half-girders exhibit the tendency to move apart and assume an arcuate form and by cold straightening of the extremely large cross-sectional form very considerable and dangerous stresses would be produced in the T-iron.

It is to be remarked that the rolling mill referred to in the above produces two extremely large T-iron members simultaneously, and in this way permits of high production with extreme economy.

In this way two T-iron members are obtained possessing the desired characteristics:

a. Extremely large T-iron members having parallel and sharp-edged flanges in similar fashion to the large Grey wide-flange girders, from which they are derived.

b. Sectional form without deformation, as after each rolling in between the rolls C the bar again traverses the stand A, and the cutting by the rolls D subsequently taking place is effected under desired conditions without deforming the sectional form.

c. Heat-straightened bar.

d. The extreme end of the sectional form of the cut web exhibits a compound or simple bevelled edge with desired slope governed by the form of the rolls C and the knife, and is adapted by reason of these edges to accommodate the welding seams in the welded iron construction.

It is to be remarked that

1. In order to obtain the simple bevelled edge the form of the rolls C and D is in accordance with Figs. 5a and 9b. This simple bevelled edge is also sometimes required by constructors for the welded iron construction.

2. The rolling in might also take place alone during the final pass of the bar. In this case there would be employed in place of one pair of rolls C a plurality of series disposed pairs, corresponding to the object and the thickness of the sectional form being rolled in. The gradual rolling in would then also be distributed over all pairs of rolls. The pair of rolling in rolls C might also be provided between the stands A and B. The stand B would accordingly then improve the sectional form, whilst the pair of shearing rolls D, without deforming the sectional form, would be situated behind the stand B.

What I claim as new and desire to secure by Letters Patent is:

1. In a method of producing wide-flange I-beams having a considerable height of the web, the steps which consist of shaping blocks of material in a hot rolling process into wide-flange I-beams, indenting the said web longitudinally during the rolling operation, passing the beam between shearing rolls to separate the beam longitudinally into half-beams having straight beveled edges to their webs, moving the said half-beams into contact by means of the said beveled edges with straight beveled edges of a flat iron section, and thereupon welding the beveled edges of the said webs to the beveled edges of the said flat iron section to produce an I-beam having a height which is greater than the combined heights of the webs of the said half-girders.

2. In a method of producing T-beams by longitudinally dividing wide-flanged I-beams the steps which consist of subjecting the web of an I-beam under hot rolling action to longitudinal pressure indentation, rolling the indented web in such a manner as to remove deformation resulting from the indenting thereof and passing the

web of the I-beam between shearing discs for the purpose of separation along the line of indentation.

3. In a method of producing T-beams by longitudinally dividing wide-flanged I-beams the steps which consist of subjecting the web of an I-beam under hot rolling action to longitudinal pressure indentation, rolling the indented web in such a manner as to remove deformation resulting from the indenting thereof and passing the web of the I-beam between shearing discs for the purpose of separation along the line of indentation, the outer cutting edges of the shearing discs leaving a substantial free angle with the adjacent surface of the bottom portion of the indentation rolled down to a thin metal strip.

4. In a method of producing T-beams by longitudinally dividing wide-flanged I-beams the steps which consist of subjecting the web of an I-beam under hot rolling action to longitudinal pressure indentation, rolling the indented web in such a manner as to remove deformation resulting from the indenting thereof and passing the web of the beam on the way from one roller stand for hot rolling the I-beam to another between shearing discs for the purpose of separation along the line of indentation.

5. In a method of producing T-beams by longitudinally dividing the web under hot rolling action the steps consisting of longitudinally indenting the web of the I-beam by means of one or more pairs of pressure rolls, so as to form a

groove, the bottom of which consists of a thin metal strip, subjecting the web deformed by indentation rolling to regularizing rolling action in such a manner as to remove deformation resulting from the indenting thereof, cutting through the thin metal strip by a pair of shearing discs arranged between I-beam flange guides, and subjecting the two halves of the I-beam web to hot straightening action by repeated rolling.

6. In a method of producing T-beams by longitudinally dividing wide-flanged I-beams the steps which consist of subjecting the web of an I-beam under hot rolling action to repeated longitudinal pressure indentation, rolling the web after each indenting operation in such a manner as to remove deformation resulting from the indenting thereof, and passing the web between shearing disks for the purpose of separation along the line of indentation.

7. In a method of producing T-beams by longitudinally dividing wide-flanged I-beams the steps which consist of subjecting the web of an I-beam under hot rolling action to repeated longitudinal pressure indentation, rolling the web after each indenting operation in such a manner as to remove deformation resulting from the indenting thereof, and passing the web between shearing disks for the purpose of separation along the line of indentation, rolling the separated sections of the I-beam and subjecting the separated sections to hot straightening action.

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