Nov. 11, 1924.

1,515,075

P. A. SCHULZ

METHOD OF ROLLING SHAPES

Filed Dec. 20, 1920

3 Sheets-Sheet 1

FIG. 1.

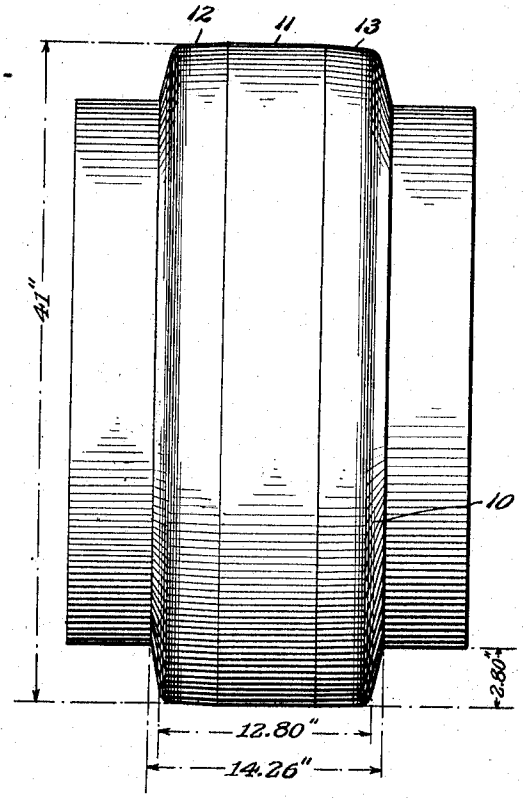

FIG. 2.

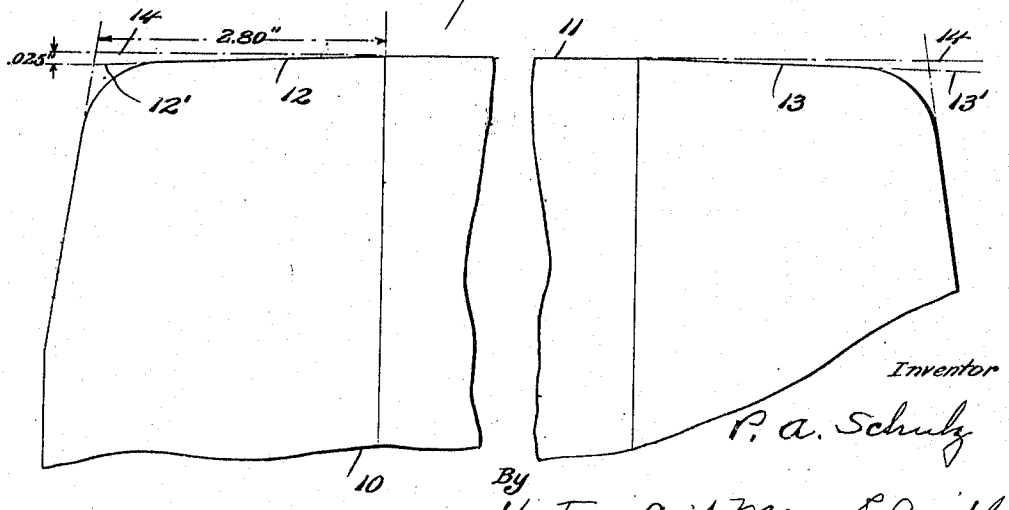

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FIG. 3.

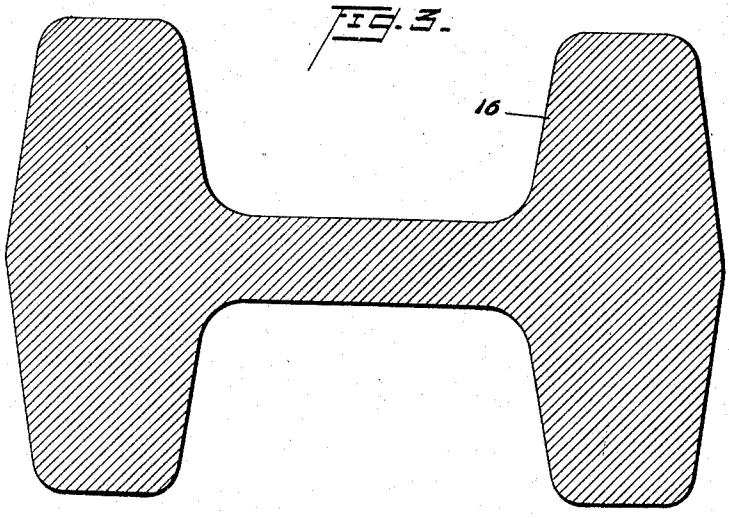

FIG. 4.

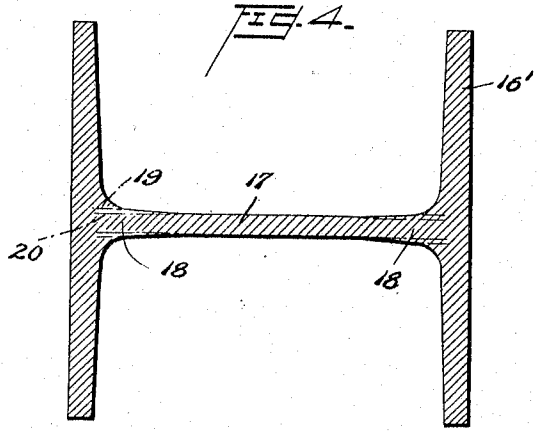

FIG. 5.

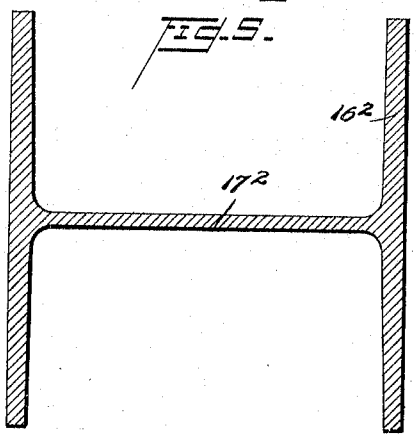

FIG. 6.

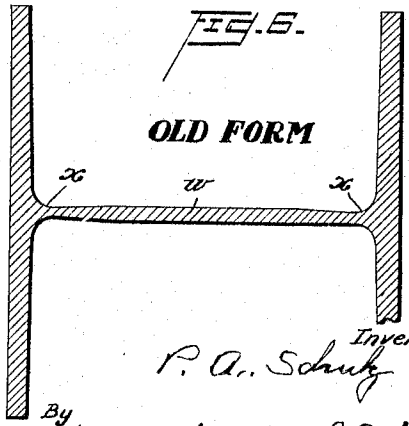

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Fig. 7.

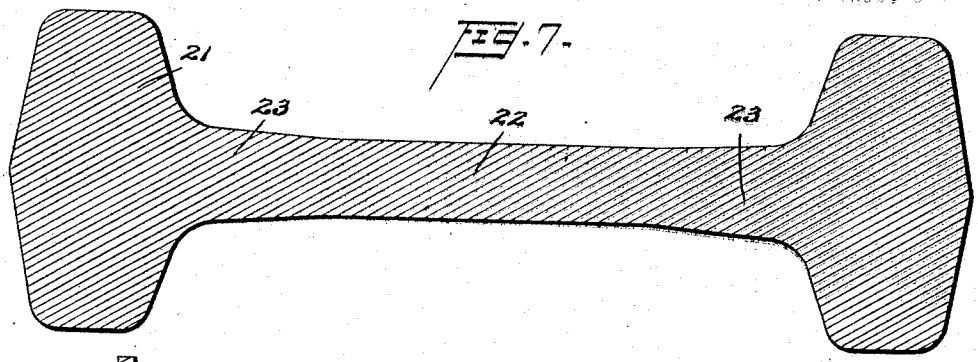


Fig. 8.

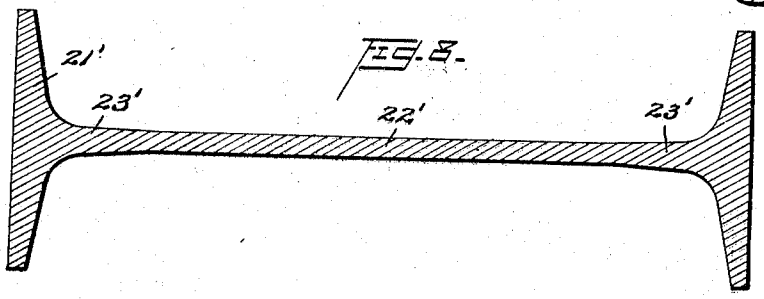


Fig. 9.

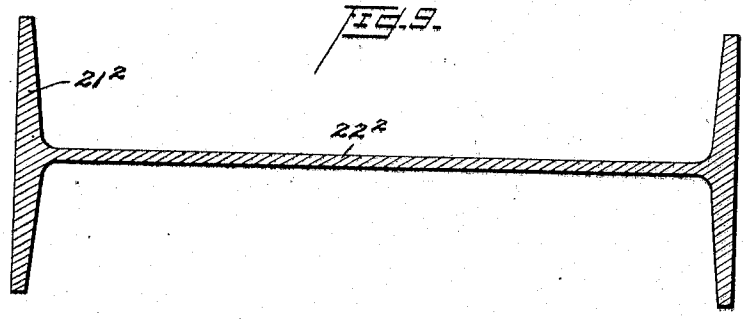
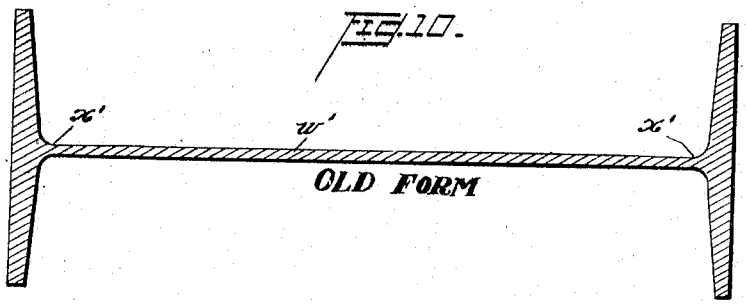


Fig. 10.



OLD FORM

Inventor

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By

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Patented Nov. 11, 1924. 1,515,075

UNITED STATES PATENT OFFICE.

PAUL AUGUST SCHULZ, OF BETHLEHEM, PENNSYLVANIA, ASSIGNOR TO BETHLEHEM STEEL COMPANY, OF BETHLEHEM, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

METHOD OF ROLLING SHAPES.

Application filed December 20, 1920. Serial No. 431,943.

To all whom it may concern:

Be it known that I, PAUL AUGUST SCHULZ, a citizen of the United States, and residing at Bethlehem, Northampton County, State of Pennsylvania, have invented certain new and useful Improvements in Methods of Rolling Shapes, of which the following is a specification.

Structural shapes, especially H, I, and channel beams as heretofore rolled by universal mills have been more or less defective, in that the webs of the beams were not of uniform thickness throughout. For some reason, the webs adjacent or at the junctures with the flanges were of slightly less thickness than the remainder of the web; and this defect occurred although the rolls had cylindrical peripheral surfaces. In other words, the webs of the finished beams did not have the same thickness throughout as the distance between the adjacent peripheral surfaces of the horizontal rolls of the mill.

It is the principal object of the present invention to remedy this defect, that is to say, to produce structural shapes in which the webs are of uniform thickness throughout. To this end I have discovered that the defect may be remedied by forming the bloom or blank with a web having greater thickness adjacent the junctures with the flanges as compared with the rest of the web and thereafter reducing the web to a uniform thickness throughout. The features of novelty will be apparent from the description taken in connection with the drawings in which:

Figure 1 is an elevation of a roll constructed in accordance with the present invention;

Figure 2 is an elevation of part of a roll to a larger scale to illustrate more clearly the tapered portions of the periphery thereof;

Figure 3 is a cross section of a bloom or blank as it leaves the blooming mill showing a shape adapted to be finally rolled into an H beam;

Figure 4 is a cross section of the foregoing bloom or blank showing the relative size and shape of the blank after it leaves the first stand;

Figure 5 is a similar view showing the finished beam produced from the previous blank in the second or finishing stand of the plant;

Figure 6 is a view corresponding to Figure 5 illustrating a beam of the same size made by the present mills;

Figure 7 is a cross section of a bloom as it is discharged from the blooming mill adapted to be rolled into an I beam;

Figure 8 is a corresponding section showing the same blank after it is discharged from the first stand;

Figure 9 is a cross section showing the finished I beam produced by the present process; and

Figure 10 is a view similar to Figure 9 showing I beams as they are manufactured on the mills heretofore employed.

The universal mill plant in manufacturing structural shapes usually includes a blooming mill in which the ingot is formed into a bloom or blank, a finishing mill or stand from which the finished shape is discharged and one or more intermediate mills or stands through which the bloom passes after it leaves the blooming mill and before it is acted on by the finished mill or stand.

The H beams and I beams heretofore produced in such mills are illustrated in Figures 6 and 10 of the drawings. It will be noted that the H beam shown in Figure 6 has a web w, the thickness of which is reduced at the junctures with the flanges of the beam. Of course this reduction has been somewhat exaggerated in the drawing in order to emphasize the same. Similarly the I beam shown in Figure 10 has a web w' with reduced portions at the junctures with the flanges. These reduced portions have also been somewhat exaggerated in order to make them apparent. As previously stated, these reduced zones occur although the surfaces of the rolls are cylindrical. It is the aim of the present invention to remedy this defect and produce shapes with webs of uniform thickness throughout, such as shown in Figures 5 and 9 of the drawings. To this end the bloom in one or more of the stands before the finishing stand is formed with a web the thickness of which at the portions adjacent the flanges is greater than the remaining portions. In the stands subsequent to the stand in which the thickkened portions are first formed, the said portions are reduced and in the finishing or a previous stand are reduced to the same thickness as the other portions of the web. The product is

a shape having a web of uniform thickness throughout.

As a specific example, a plant may be considered consisting of a blooming mill, a first stand and a second or finishing stand. To practice the invention with such a plant, in some instances the bloom leaving the blooming mill is formed with a web having thickened juncture portions and the cross sectional area of the bloom is reduced in the first stand, the bloom as it leaves said stand having a web with thickened juncture portions. In the second or finishing stand the web is further reduced and at the same time said portions are reduced to the same thickness as the remainder of the web, so that the shape leaving the second stand has a web of substantially uniform thickness throughout. In other instances, the bloom which leaves the blooming mill may have a substantially uniformly thick web; but leaves the second stand with the juncture portions thicker than the remainder of the web, the finishing stand acting as described above.

In a plant consisting of a blooming mill, a finishing stand and two or more stands intermediate the blooming mill and finishing stand, the bloom is formed with the thickened portions aforesaid in one of the stands previous to the finishing stand and is delivered to the finishing stand with such thickened portions, where such portions are reduced and the shape discharged therefrom with a uniformly thick web. If the reduction in the thickness of the web is very slight in the finishing mill, the thickened portions might be reduced in the stand next preceding the finishing stand.

According to the present invention the thickened junctures are obtained by forming the horizontal rolls of the mill or stand of the proper shape. Thus the cylindrical peripheral surface of the horizontal rolls is changed by slightly tapering the portions adjacent the ends thereof. A roll for producing the thickened portions in **H** and **I** beams therefore, has its peripheral surface divided into three zones or portions, that is to say, the central cylindrical zone and the end zones slightly tapered from the central zones to the ends of the rolls. Such a roll is indicated at 10 in Figure 1 and to a larger scale in Figure 2. As shown, the roll has a peripheral surface consisting of the central cylindrical zone or portion 11 and tapered zones or portions 12 and 13. Referring to Figure 2, the dotted lines 14 indicate continuations of the cylindrical surface 11 and dotted lines 12′ and 13′ indicate continuations of the surfaces 12 and 13 respectively. The very slight degree of taper required, is clearly shown by the small angles between lines 14 and 12′, and 14 and 13′. In order to give a definite illustration of the taper, the dimensions of a roll have been applied to the drawings, the particular rolls shown being used in making 15 inch **I** beam. It will be noted that the taper of the end portions is only .025 inches in 2.80 inches. It is to be distinctly understood however, that the invention is not limited to the dimensions given as they will vary with the different sizes and shapes and the kind of steel employed. No definite rule can be given to determine the extra thickness at the junctures for all the various sizes of shapes, or to determine the taper on the rolls required to produce these thickened portions. A very slight taper will give the desired result, and as far as I have been able to ascertain the desirable results of the present invention will be obtained even if the thickened portions are greater than the minimum which might be employed.

Referring now to Figures 3 to 5 inclusive of the drawings, the numeral 16 indicates a bloom or blank as it leaves the blooming mill, the section being of proper shape to be used in the production of an **H** beam. It will be noted that the web of this bloom is of substantially uniform thickness, although this is not necessary, as said web where it joins the flanges might be somewhat thicker. In Figure 4 the same blank indicated by the numeral 16′ is shown after it leaves the first stand. It will be observed that the web 17 has the thickened portions 18 adjacent the fillets joining the web and the flanges. The increase in thickness is only very slight, an idea of the same being given by the distance between the lines 19 and 20, this distance being somewhat exaggerated as it is not possible to draw fine enough lines to indicate the same to scale. These increased portions of the web are produced by the rolls previously described. It is to be understood that the bloom 16 is passed back and forth through the first stand several times and is reduced in cross sectional area from the section shown in Figure 3 to that shown in Figure 4, the shape also being changed as indicated, these figures and Figure 5 being to scale. In Figure 5 the numeral 16^2 indicates the finished **H** beam produced from the bloom of Figure 3. It will be noted that the increased thickness of the portions 18 of Figure 4 have been eliminated and that the web 17^2 of Figure 5 is of substantially uniform thickness.

Figures 7 to 9 inclusive show a blank or bloom in the different stages of its manufacture into an **I** beam. Figure 7 shows a bloom 21 as it leaves the blooming mill. In this case the web 22 has the thickened portions 23 adjacent the fillets joining the web and the flanges. These thickened portions are not absolutely necessary in the bloom, but in the manufacture of **I** beams best results are obtained if this feature is used. After leaving the blooming mill the bloom

21 is passed back and forth several times through the first stand and a cross section of the blank discharged from said first stand, is indicated at 21^4 in Figure 8. It will be noted that the web 22′ has the thickened portions 23′ adjacent the fillets joining the web and the flanges, the same being produced with rolls as previously described. After leaving the first stand the blank 21′ passes to the finishing mill and the finished beam 21^2 obtained from the finishing mill, is illustrated in Figure 9. It will be noted that the thickened portions 23′ have been eliminated and the web 22^2 is of substantially uniform thickness throughout. The sectional views of Figures 7, 8 and 9 are to the same scale and indicate the relative sizes and shapes of the blank as it is discharged from the blooming mill, the first stand and the finishing stand.

The term "structural shapes" in the claims is intended to include H, I, and channel beams and any other shapes which may be rolled in a universal mill and to which the invention is applicable.

Although a specific embodiment of the invention has been described in detail, it is to be understood that the invention is not thus limited but includes modifications and changes which come within the scope of the appended claims.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

1. The process of forming structural shapes of the flange and web type in a universal mill consisting in rolling a blank to provide a web having a central zone of substantially uniform thickness and lateral zones which increase in thickness from the central zone to the fillets joining the webs and the flanges and thereafter in reducing the web between the fillets to a substantially uniform thickness throughout.

2. The process of rolling structural shapes of the flange and web type in a universal mill consisting in rolling the web with thicker lateral zones than the central zone thereof, the lateral zones being joined by fillets to the flanges, and thereafter in reducing the lateral zones to the same thickness as the central zone.

3. The process of rolling structural shapes of the flange and web type in a universal mill consisting in first forming the web of a beam with central and lateral zones, the lateral zones being of greater thickness than the central zone and being joined by fillets to the flanges, and thereafter in rolling the beam to reduce the thickness of the lateral zones.

4. The process of rolling structural shapes of the flange and web type in a universal mill consisting in forming the web of a beam in one stand with a central zone of uniform thickness and with lateral zones of increasing thickness toward the fillets which join the web and flanges and in reducing the web to a uniform thickness in a later stand.

5. The process of rolling structural shapes of the flange and web type in a universal mill consisting in first forming the web of a beam with a central zone of uniform thickness and with lateral zones which increase in thickness from the central zone to the fillets joining the web to the flanges and thereafter in rolling out said lateral zones of a web to substantially the same thickness as the central zone.

6. The process of rolling structural shapes having at least two parts disposed at an angle to each other consisting in rolling the blank to provide one part having a zone of uniform thickness joined by a zone which increases in thickness from the first zone to the fillets joining said part with the other part and thereafter in rolling the blank to reduce said zone of increasing thickness to one of substantially uniform thickness.

In testimony whereof I affix my signature.

PAUL AUGUST SCHULZ.