W. A. DUNN.

ROLLER MILL.

APPLICATION FILED APR. 19, 1910.

1,002,907.

Patented Sept. 12, 1911.

4 SHEETS—SHEET 1.

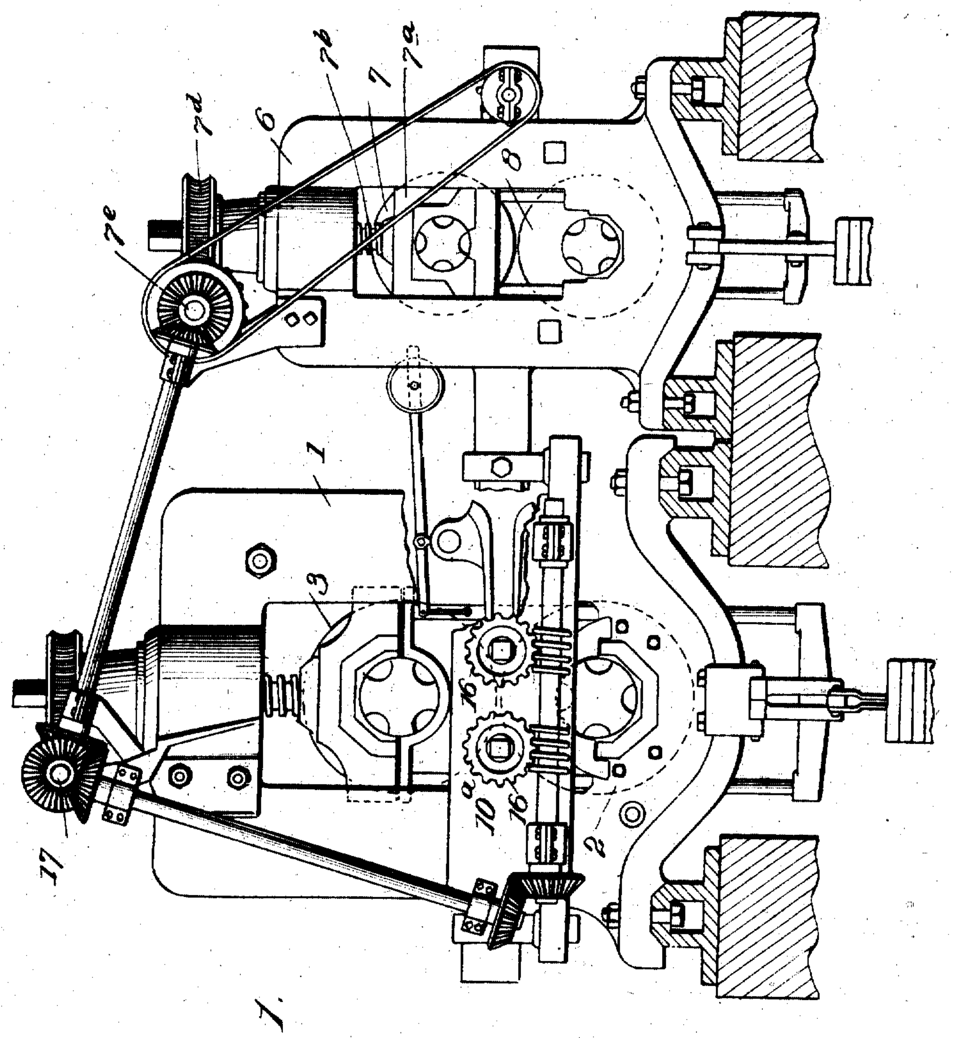

FIG. 1.

Witnesses

[illegible]

Louis Conner.

Inventor

W. A. Dunn

By [illegible]

Attorney

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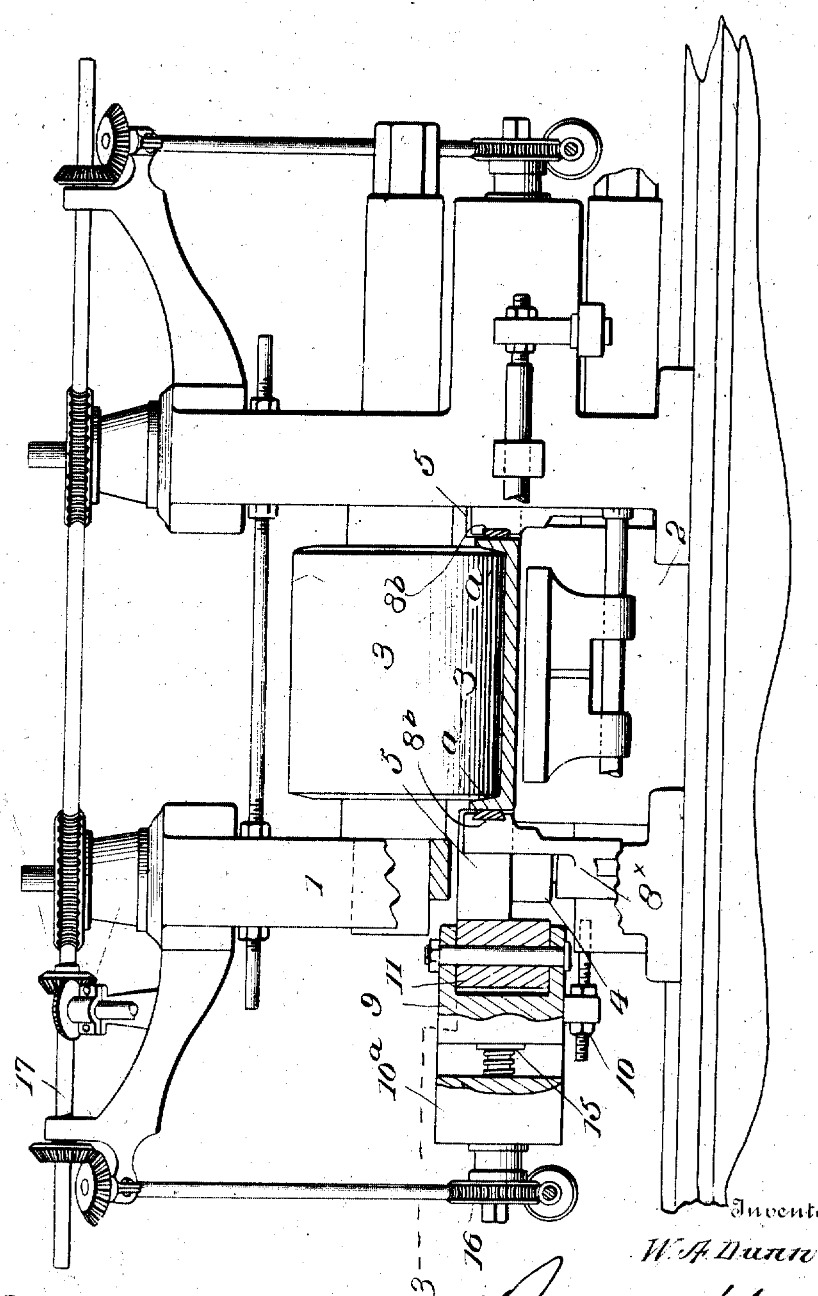
4 SHEETS—SHEET 2.

Fig. 2.



Witnesses

[illegible signature]

Louis Connor

Inventor

W. A. Dunn

By [illegible signature]

Attorneys

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4 SHEETS—SHEET 3.

Fig. 3.

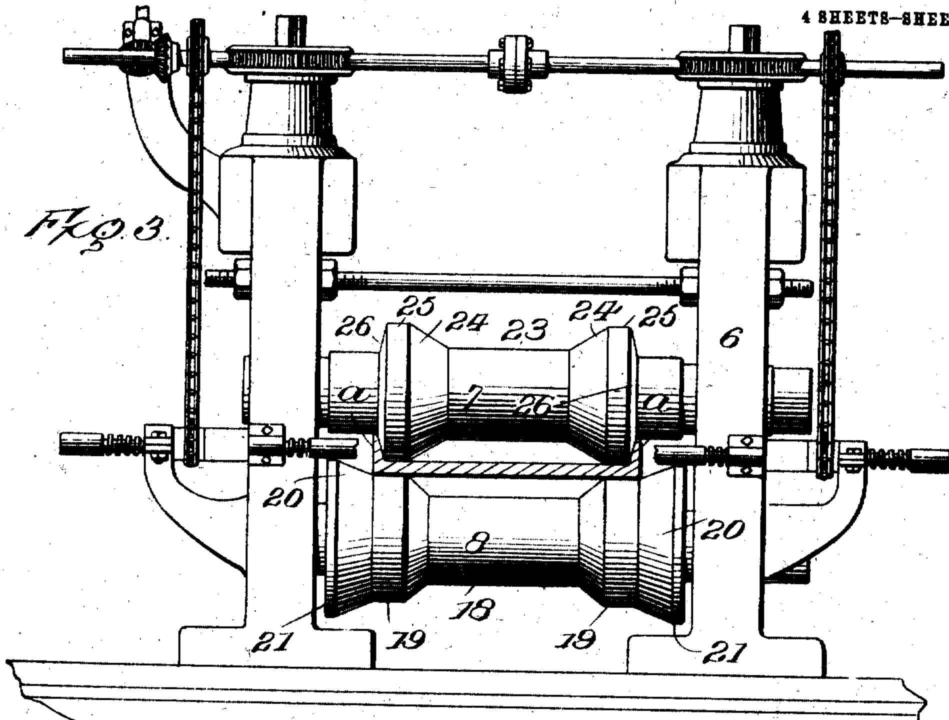
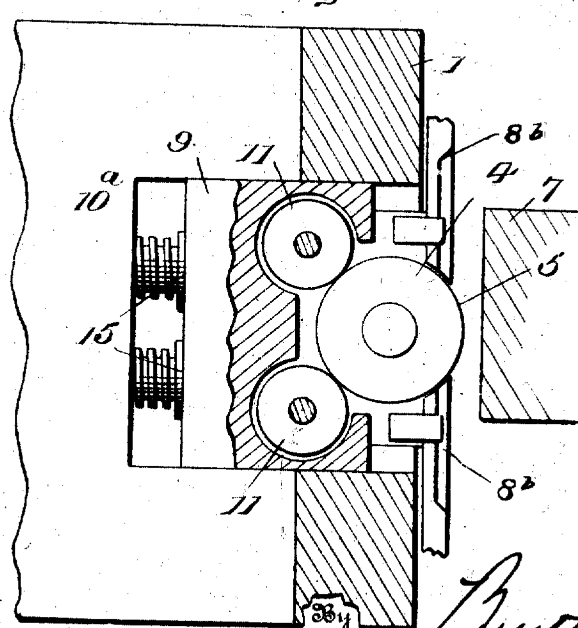


Fig. 4.



Inventor
W. A. Dunn

Witnesses
Helge A. H. Mu...
Louis Conner.

By
[signature]
Attorneys

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4 SHEETS—SHEET 4.

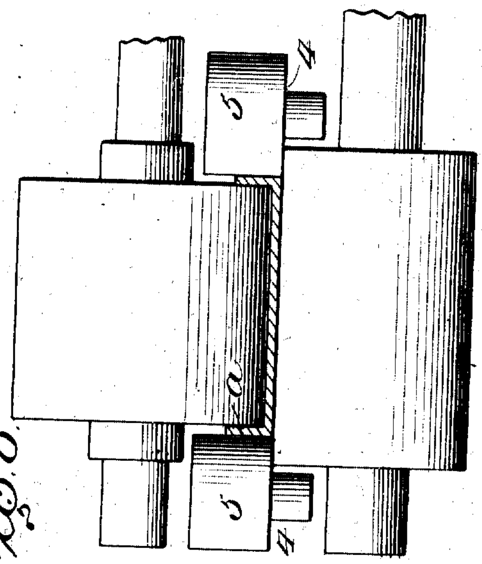

FIG. 6.

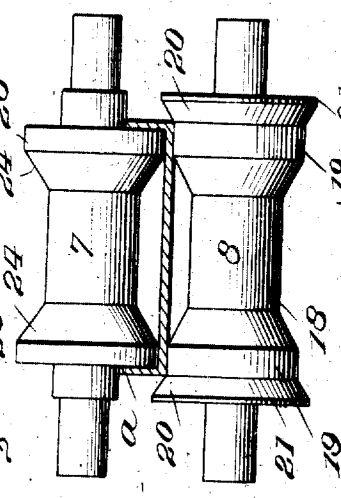

FIG. 8.

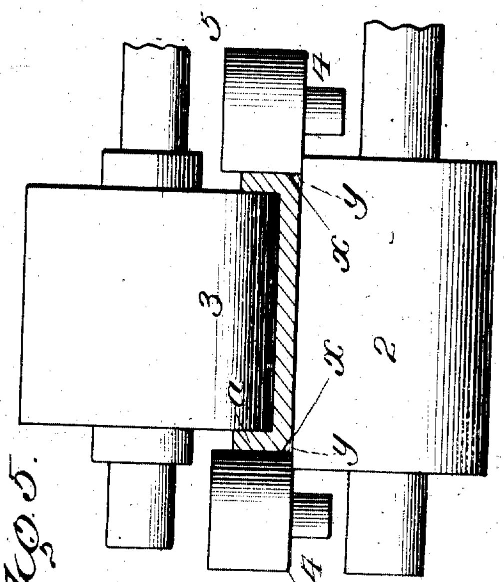

FIG. 5.

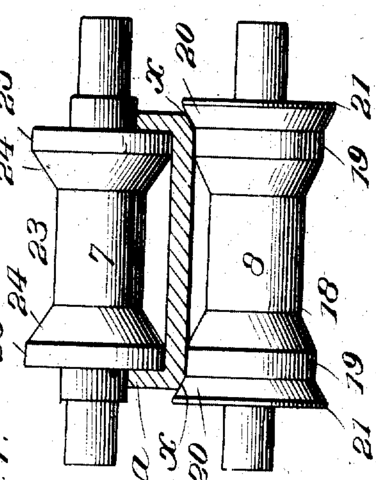

FIG. 7.

Witnesses
Helga A. Murray
Louis Conner.

Inventor
W. A. Dunn

By Beaton Young
Attorneys

UNITED STATES PATENT OFFICE.

WILLIAM A. DUNN, OF SMITHVILLE, MINNESOTA, ASSIGNOR OF ONE-HALF TO ATHOL MORTON MILLER, OF DULUTH, MINNESOTA.

ROLLER-MILL.

1,002,907. Specification of Letters Patent. Patented Sept. 12, 1911.

Application filed April 19, 1910. Serial No. 556,380.

To all whom it may concern:

Be it known that I, William A. Dunn, a citizen of the United States, residing at Smithville, in the county of St. Louis and State of Minnesota, have invented certain new and useful Improvements in Roller-Mills, of which the following is a specification.

This invention relates to improvements in rolling mills for the manufacturing of steel beams of various shapes.

The present invention relates to improvements on the construction disclosed in my Patent No. 709,083, in that I provide a novel structure for relieving the friction on the vertical rolls; and I overlap the vertical rolls over the periphery of the lower web reducing roll, which coöperates with the former, to prevent the formation of "fins" on the beams.

The invention also comprehends improvements in the specific construction and arrangement of the rolls, whereby I am enabled to greatly facilitate the production of beams of various shapes.

In the drawings: Figure 1 is a side elevation of a rolling mill constructed in accordance with my invention. Fig. 2 is an elevation of the vertical rolls and their mountings, part being in section. Fig. 3 is an elevation of the flange controlling rolls, and their mountings. Fig. 4 is a detail, horizontal, section on the line 3—3 of Fig. 2. Fig. 5 is a diagrammatic view of the vertical and the web reducing rolls, illustrating an ingot in one of its early passes through the mill. Fig. 6 is a similar view, the ingot having been shaped into a beam blank. Fig. 7 is a sectional view of the flange controlling rolls, showing the shape of the ingot in one of the early passes through the mill, or as illustrated in Fig. 5. Fig. 8 is a similar view, but showing the ingot shaped into a beam blank by the said web controlling rolls, or as illustrated in Fig. 6.

The same numerals refer to like parts in all the figures.

In order to give a comprehensive understanding of the invention it is necessary to illustrate, and describe somewhat in a general way, the structure disclosed in my patent heretofore referred to.

Referring to Fig. 1, 1 indicates side frames in which are mounted lower and upper web reducing rolls 2 and 3, and vertical rolls 4—4, to coöperate with said rolls 2 and 3. Spaced from the frames 1, is a second set of frames 6, affording mountings for an upper horizontal flange controlling roll 7, and a lower flange controlling roll 8. The flange controlling roll 7 is mounted in bearings 7^a provided with adjusting screws 7^b on the ends of which are worm gears 7^d meshing with a worm on a shaft 7^e. The shaft 7^e is geared to receive power from the shaft 17 so as to adjust the bearings of said flange controlling roll simultaneously with the web reducing roll 3.

The web reducing roll 2 is of greater length than the web reducing roll 3, but both said rolls are cylindrical throughout their entire length, for the purpose of fitting snugly a channel beam blank. The vertical rolls 4, are each of stepped formation, the enlarged flanged portions 5 overlying the periphery of the horizontal web reducing roll 2, and the peripheries of the enlarged flanged portions 5 are designed to coöperate with the outer ends of the web reducing roll 3, to confine the outer flange *a*, of the channel beam to make the width of the latter uniform, throughout. By stepping the vertical rolls, I am enabled to use the web reducing roll 2 to hold the channel beam, and at the same time prevent the spreading of the metal at the ends of the ingot. The reduced portions of the rolls 4 will readily permit of the flanges 5 to overlie the periphery of the roll 2, as shown in Figs. 2 and 6.

The vertical rolls 4 are mounted in yokes 8^x operating in guides in the frame 1, and connected to sliding blocks 9 by connections 10. The blocks 9 operate in guides formed in extensions 10^a on the frames 1. The blocks 9 are each grooved on their inner ends to receive two antifriction rollers 11, of substantially the diameter of the rolls 4, and located equal distance from a medial line drawn through the center of the said rolls 4. By so arranging the antifriction rollers it will be observed that a seat is formed for each vertical roll 4, and the pressure exerted on said latter rolls by the ingot passing through the mill is more evenly distributed. By the employment of the large rolls liability of crushing or destroying them is absolutely prevented, owing to the fact that they may be made of such size as will effectually resist the pressure of the metal when passing through the mill.

The sliding blocks 9, are operated by screws, swiveled to the blocks at 15, and have at their outer ends worm gears 16, connected through a train of gears with a line shaft 17.

The flange controlling rolls, when it is desired to produce channel beams, are of special construction, to coöperate with the specially formed web reducing rolls 2 and 3 and the stepped vertical rolls 4. The lower flange controlling roll 8 has a reduced central portion 18, with a cylindrical enlargement 19, at each end, and from the outer ends of these enlargements the roll flares to provide annular inclined surfaces 20, terminating in cylindrical end portions 21. The upper flange controlling roll 7 is reduced at the center, at 23, and inclined from the ends of said reduced portion, are surfaces 24, terminating in cylindrical portions 25, which are slightly beveled on their outer edges at 26. The ingot in passing between the flange controlling rolls 7 and 8 is compressed transversely as well as vertically. The surfaces 26 and 19 tend to shape the depth of the flange, while the beveled surfaces 20 tend to crowd the molecules of metal inwardly toward the center of the body of the ingot. The beveled surfaces 20 form inclined surfaces *x* under the blank which are important when stepped vertical rolls are employed. The outer end surfaces of the upper roll 7 are located just inside the plane of the juncture lines, formed between the cylindrical portions 19, and the beveled surfaces 20, of the lower roll 8, the difference being about equal to the thickness of the flanges of the finished channel beam blank, as shown in Fig. 8.

8^b indicates side guide bars for the metal similar to those described in the patent before mentioned.

As stated, when the ingot passes between the flange controlling rolls 7 and 8, the surfaces 20, form inclined surfaces *x* on the bottom so that when the outer edges of the ingot come within the plane of action of the peripheries of the flanges of the vertical rolls 4, and the latter compress the metal inwardly, the metal will be compressed or crowded down to the periphery of the web reducing roll 2, as indicated in dotted lines at *y*—*y* in Fig. 5. Were it not for these bevel surfaces, the metal in being compressed by the vertical rolls, would have a tendency to be forced between the enlarged flange portions 5, and the periphery of the roll 2. After the ingot has passed through the mill a number of times, so as to reduce it to substantially the width and thickness required to shape it into a beam, the side pressure exerted by the vertical rolls is not as great as during the previous passes, hence, after the flanges are completely formed, and the bevel surfaces *x* on the bottom side of the ingot have been removed, due to the compression of the metal beyond the beveled surfaces 20 in the previous passes, the liability of the formation of "fins" is so remote as to remove the question from consideration.

Assuming now that the ingot is passing through the mill, referring particularly to Figs. 5 to 8, in the first pass, shown in Fig. 7, the upper flange controlling roll 7, holds the metal down on the lower flange controlling roll 8, while the inclined or beveled flanges 20 crowd the metal in to form the lateral flanges. The collars on the upper roll 7 and the flanged end of roll 8, engage the edges of the flanges and thereby determine their height. Then as the ingot is passed between the web reducing rolls 2 and 3, the upper web reducing roll fits snugly within the recess or depression formed in the blank between its end flanges thereof, so that the pressure exerted by the vertical rolls, compresses the molecules of metal against the ends of the said lower web reducing roll 2, in proportion or thereabout to that of the pressure exerted by the horizontal web controlling rolls in the preliminary shaping of the blank. And as before stated, this inward pressure, exerted on the blank crowds the metal in such way as to take up the space formed by the beveled surfaces on the underside of the blank, and thereby prevents the formation of fins, and therefore, leaves the edges perfectly sharp or square. In other words, the rolls 4, in acting on the sides of the metal crowd the molecules thereof down on the periphery of the supporting roll.

At each subsequent pass of the ingot through the mill, all the various rolls are simultaneously adjusted by the train of gearing described in the previous patent, heretofore mentioned.

What I claim is:—

1. In a mill of the character described, the combination of a lower web reducing roll, an upper web reducing roll associated with and of less width than the lower web reducing roll, a vertically mounted roll adjacent the ends of the upper and lower web reducing rolls, and overlapping the periphery of the lower web reducing roll, means for adjusting the vertical rolls, and two horizontal flange controlling rolls, the lower flange controlling roll having outwardly beveled ends to force the ends of the beam inwardly to form flanges, and the upper flange controlling roll having hubs located above and in the plane of the outwardly beveled ends of the lower roll and adapted to bear on the upper edges of the flanges of a beam, the distance between the periphery of the lower web reducing roll and the shaft of the upper web reducing roll being greater than the distance between the lower flange

controlling roll and the hubs of the upper flange controlling roll, whereby the edges of the flanges of a beam passing through the mill will not contact with the shaft of the upper web reducing roll.

2. In a mill of the character described, the combination of a pair of horizontal flange controlling rolls, the upper one of which is formed with hubs, and the lower one of which is formed with outwardly inclined annular surfaces which form bevel surfaces on the bottom corners of an ingot, the distance between the periphery of the lower flange controlling roll and the hubs on the upper flange controlling roll being equal to the depth of the flanges on a beam, whereby said flanges will be gaged, a lower web reducing roll, an upper web reducing roll above the lower web reducing roll of less width than the lower web reducing roll, the distance between the periphery of the lower web reducing roll and the shaft of the upper web reducing roll being greater than the distance between the periphery of the lower flange reducing roll and the hubs of the upper flange controlling roll, a roll each side of and overlapping the periphery of the lower web reducing roll, means for adjusting the vertical rolls toward and from each other the peripheries of the vertical rolls being spaced from the ends of the upper web reducing rolls to form guides for the end flanges formed on the metal passing through the mill, whereby the vertical rolls will compress the metal forming the flanges of the beam and fill out the beveled edges formed by the inclined annular surfaces on the flange controlling roll and thereby prevent the formation of fins.

3. In a mill of the class described, the combination of a lower flange controlling roll provided with outwardly beveled annular ends extending from the cylindrical portion of said roll, an upper flange controlling roll having hubs against which the flanges of a beam bear to control the height of said flanges, the outwardly beveled annular ends of the first mentioned flange controlling roll being wholly beyond the plane of the inner ends of the hubs of the upper flange controlling roll, a lower cylindrical web reducing roll in alinement with and substantially equal to the full length of the lower flange controlling roll, an upper cylindrical web reducing roll of less width than the lower cylindrical web reducing roll, the distance between the hubs of the upper flange controlling roll and the periphery of the lower flange controlling roll being less than the distance between the shaft of the upper web reducing roll and the periphery of the lower web reducing roll, two vertical side rolls adjacent the ends of the web reducing rolls, and overlapping and fitting close to the periphery of the lower web reducing roll, whereby to compress the end flanges on a beam and to force the metal thereof downwardly on the periphery of the lower cylindrical web reducing roll to destroy the inclined surfaces on the edge of a beam formed by the annular inclined ends of the lower flange controlling roll.

4. In a mill of the class described, the combination of flange controlling rolls for forming side flanges on beams, of a pair of web reducing rolls the lower one of which is of greater length than the upper one, vertically disposed rolls adjacent the web reducing rolls, and overlapping the periphery of the lower web reducing roll, the distance between the periphery of the lower web reducing roll and the shaft of the upper web reducing roll being greater than the depth of the flanges of a beam formed by the flange controlling rolls, whereby when the vertically disposed rolls compress the metal of the flanges the said metal will have sufficient space to be vertically expanded.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM A. DUNN.

Witnesses:

F. L. Browne,

A. L. Weaver.