Fig. 1. 
LAST PASS IN ROLLING BILLET.

Fig. 2. 
PASS NO. 1

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HOT STRIP ROLLING

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This invention relates to the rolling of metal, and is particularly concerned with the hot rolling of steel, one of the objects being to roll sections or shapes, particularly rectangular shapes, of greater width than thickness in such a manner that a greater portion of the surface of the metal is worked than was heretofore possible. A more specific object is to hot-roll steel strip in such a manner as to permit lateral spreading of the rolled corners. The term “strip” as here used is intended to cover products such as sheet bar, skelp, etc. Other objects may be inferred from the following disclosure.

As an example of the invention, a steel bloom is heated to a proper rolling temperature and worked into a square billet by any conventional method that will produce oppositely rolled corners. Ordinarily, this necessitates diagonal rolling, the oval square, diamond square and diamond methods being examples. Then, on the same heat, this billet is rolled on its opposite diagonal to flatten it into strip by spreading so that its previously rolled corners become the edges of this strip. To do this, the corners of the billet between its previously rolled corners are rolled in such a manner as to permit lateral spreading of its previously rolled corners.

The described procedure results in the entire surface of the strip being worked. It is to be understood that the volume of the metal is proportioned along with the various reductions to provide a strip of the width and thickness desired.

Referring to the accompanying drawings:

Figure 1 shows the last pass in the reduction of the bloom to the billet.

Figure 2 shows the pass beginning the reduction of this billet to the desired strip.

Figures 3 through 6 show the successive passes required to produce the strip.

Figure 1 represents the final pass used in reducing the bloom to the billet. The corners rolled onto the billet by this pass are numeraled 1, and the corners that cannot be so rolled are numeraled 2. This figure is included only to emphasize the fact that the rolling of the billet must be done in such a manner as to provide opposite rolled corners.

This billet is now entered on its opposite diagonal into pass #1 shown by Figure 2, the billet being here illustrated by the broken lines and the outline of the pass by the solid lines. It will be noted that the diagonal between the corners 1 is now horizontal, while that between the corners 2 is vertical. The pass itself is formed by rolls having grooves providing diagonal square or diamond surfaces which work a majority of the surface of the billet and flat surfaces that are oppositely spaced to provide recesses into which the previously rolled corners may spread. This first pass is open since edge control is not necessary at this time.

Pass #2 shown by Figure 3 differs somewhat in that it is a closed one to provide some edge control and its diagonal square or diamond is of reduced area. Otherwise, surfaces 3 and 4 are for the same purposes as the surfaces 3 and 4 in the case of the pass #1.

Pass #3 shown by Figure 4 is a closed flat pass which completely flattens the billet and provides for the edge control required to bring the strip to the proper width. This pass and passes #4 and #5 illustrated by Figures 5 and 6 may be considered as conventional flat passes, and in them the strip is further formed and finished.

The showing of the work by broken lines and the pass by solid lines, as explained in connection with pass #1, is maintained throughout these other figures. It is to be observed that the corners 1 of the billet eventually become the edges of the strip, the corners 2 disappearing at pass #3 to become the flattened section of the strip. The work does not require turning. In passes #1 and #2 the surfaces 3 and 4 provide thickened central sections of metal which eventually flows laterally and longitudinally into width and length, this eliminating the lateral stretching usually required to provide the strip with its proper width. The manner in which the width and thickness of the strip can be controlled or varied is obvious.

An important advantage connected with what has been disclosed consists in the fact that the edges of the strip are actually the corners 1 rolled into the billet by the last pass used in its formation and which is illustrated by Figure 1. It is obvious that these edges will be superior to those produced by the methods heretofore in vogue.

Another great advantage is that it is possible to construct passes #1 and #2 so that a great majority of the surface of the steel is worked while it is still in a plastic state. Although not previously mentioned, it is to be understood that in the interests of economy the rolling must be done on a single heat from the bloom through the billet and down to the final strip, and that due to rapid cooling the steel may not be in a plastic state after it reaches pass #4. For usual methods of rolling strip the work is kept 55
in a rectangular section at all times, and due to its relatively great thickness in the first two or three passes only a relatively small proportion of its surface is actually worked. By rolling the ingot on its diagonal in the manner described it is possible to use a pass like that shown by Figure 2 wherein diagonal square or diamond grooves of relatively great depth are provided to work a great majority of the metal's surface, the only portions unworked being those which spread into the recesses 4 and which have already been worked by the previous rolling of the square billet on its opposite diagonal. The same advantages are involved by pass #3, while pass #6 works the metal sufficiently thin to accomplish the same thing to a considerable extent.

The term "plastic state" as used above is not intended to mean that the steel is not sufficiently malleable to be rolled in passes #4, #5 and #6, but means that the steel falls to a temperature in or below its critical range about the time it reaches pass #4.

I claim:

1. A hot strip rolling method including producing a billet with rolled opposite corners and rolling down parts of said billet between said corners while permitting the latter to spread and become edges of the strip.

2. A hot strip rolling method including producing a rectangular billet by diagonal rolling and rolling said billet on its opposite diagonal to flatten it into strip and to spread its previously rolled corners so they become the edges of said strip.

3. A hot strip rolling method including producing a rectangular billet by diagonal rolling, rolling against a majority of the surface of said billet on its opposite diagonal while permitting its corners to spread laterally, flattening into strip by rolling on its same diagonal and forming said corners into the edges of said strip.

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