June 7, 1932.

V. E. EDWARDS

1,861,525

ART OF ROLLING METAL

Filed July 22, 1929

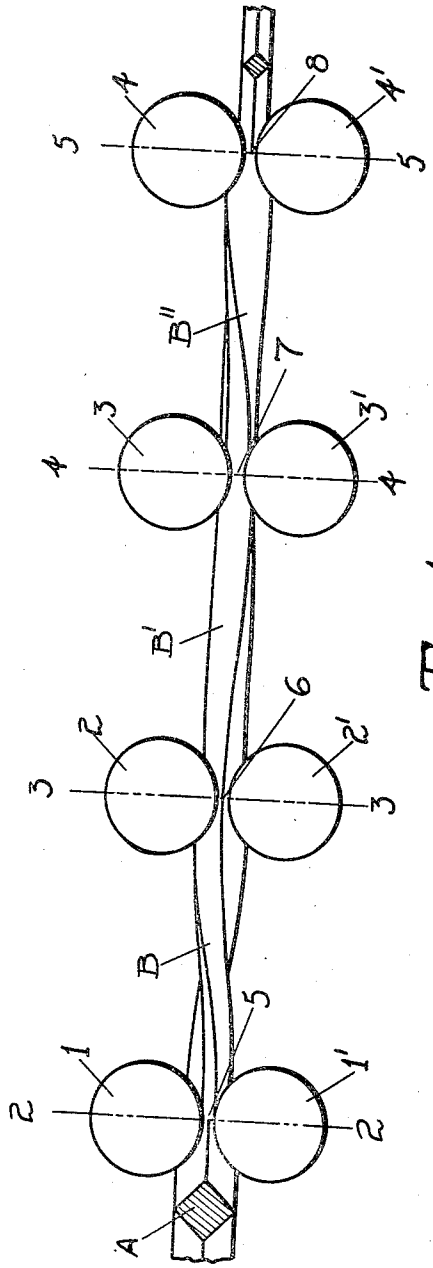



Fig. 1.

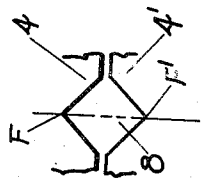



Fig. 5.

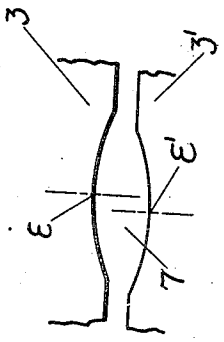



Fig. 4.

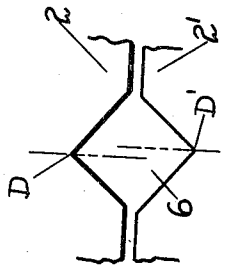



Fig. 3.

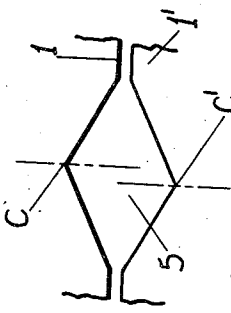



Fig. 2.

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# UNITED STATES PATENT OFFICE

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## ART OF ROLLING METAL

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The present invention relates to a metal rolling method and apparatus, wherein provision is made for axially twisting or turning the stock, on its delivery from each reducing pass, so as to enter the next reducing pass in a different angular position.

In continuous rolling, especially, this twisting or turning of the stock, between successive reducing passes, is availed of, to promote the removal of scale, and to subject different surfaces of the stock to direct rolling pressures. Heretofore, such twisting usually has been accomplished by a tube or guide, with interior surfaces conforming substantially to the stock section, but so deflected, longitudinally, as to gradually twist or turn the section through forty-five degrees or ninety degrees, or any angle desired, before it reaches the next pass.

The use of such twist guides, however, is attended with certain disadvantages. The scale which tends to collect in said guides is a source of constant trouble, since it not only impedes the passage of the stock through the guide, with a consequent increase in the power required for the rolling operation, but it produces scratching and roughness on the surface of the stock which can never be entirely removed, no matter how many subsequent finishing passes are employed. Moreover, such twist guides, because of the severe punishment imposed on them by the forcible contact of the rapidly moving hot stock, have only a brief life; under ordinary conditions, there is frequent necessity for their replacement.

Another expedient for the production of twist is the formation of the pass-forming grooves in reducing rolls of tapering or conical form, as shown by Reese, No. 275,856, April 17, 1883; because of such taper, the passes present sides of unequal height, whereby, in consequence of the unequal draft thus produced on the sides of the metal undergoing reduction, the latter has a tendency to twist. The use, however, of tapering reducing rolls is attended with many disadvantages, such as the greater initial cost of said rolls and the difficulty of correctly resurfacing the same when undue wear has developed.

Still another expedient for the production of twist is the proposal to provide a substantially symmetrical pass in canted relation to the axes of the reducing rolls, as shown in the Miller Patent No. 1,749,671, March 4, 1930; this, however, requires a very complicated and expensive construction of the reducing rolls in the vicinity of their meeting surfaces adjacent the pass.

My invention contemplates the production of the desired twist in the stock undergoing reduction, in the absence of all the disadvantages attendant upon the use of twist guides or of the two expedients above referred to. According to my invention, ordinary cylindrical reducing rolls are employed, but the pass-forming grooves thereof have their centers of pressure slightly offset, so that the stock emerges with a non-symmetrical section. This serves to impart the desired twisting tendencies to the stock, so that, even though the usual twist guides be used, in a supplementary manner, their work is diminished to such an extent that wear becomes a negligible factor, in consequence of which the usual life of such a guide is many times multiplied. Other and further objects and advantages of the invention will be apparent from the following detailed description thereof, taken in connection with the accompanying drawing, in which—

Fig. 1 is a diagrammatic view in side elevation, partly in section, illustrating successive stands of reducing rolls arranged to twist the stock in accordance with my invention.

Figs. 2, 3, 4 and 5 are fragmentary schematic sectional views, on the lines 2—2, 3—3, 4—4 and 5—5, respectively, of Fig. 1, and illustrating on a larger scale the reducing passes of the roll stands of Fig. 1.

Like reference characters refer to like parts in the different figures.

To illustrate my invention, I have shown the stock in process of reduction, for example, in the successive stands of reducing rolls 1, 1′, 2, 2′, 3, 3′ and 4, 4′. Let it be assumed that the stock, upon presentation to the pass 5 of rolls 1, 1′, is of substantially square cross section, as shown at *a* in Fig. 1; said pass 5, here shown by way of example

merely, as a "diamond" form of pass, is so arranged, according to my invention, that the stock before entering the next pass 6, provided by the rolls 2, 2', will have been twisted or turned axially through a predetermined angle, for example ninety degrees,—such that the major axis of the "diamond" section will be substantially vertical, as it goes into pass 6;—the latter, for example, being shown as a substantially square or Gothic form of pass. Heretofore, this twisting or turning of the stock, as indicated at B, Fig. 1, has ordinarily been performed through the agency of a twist guide, disposed between the rolls 1, 1' and 2, 2'.

By my invention, this twisting can be obtained in the reducing pass itself. As shown, the pass 5, instead of being a truly symmetrical "diamond" pass, has its centers of pressures $c$ and $c'$ in the upper and lower rolls 1 and 1' respectively, offset substantially one from the other. This offsetting of the centers of pressure produces a twisting moment on the stock emerging from the pass 5, which, in the example here assumed, tends to throw the major axis of the section toward a vertical position. The effect of such twisting moment is cumulative; that is to say, any section of the stock acquires more and more twist, as its distance from the pass increases. Therefore, the amount by which the centers of pressure $c$ and $c'$ are offset is so adjusted, according to my invention, as to produce in the distance between passes 5 and 6 a twist of the desired amplitude (in this case ninety degrees) by the time the stock reaches the pass 6.

In this pass 6, the centers of pressure $d$ and $d'$ are similarly offset, whereby to produce the necessary twist B', prior to the passage of the stock into the next pass 7. Preferably, however, this twist is in the opposite direction from the twist imparted in the preceding pass 5, a result obtained by offsetting the pressure centers $d$ and $d'$ in a relation opposite to that of the pressure centers $c$ and $c'$. In the pass 7, here shown for example, as a substantially oval pass, a similar offset of the pressure centers $e$ and $e'$ is availed of, to produce the necessary twist B'', prior to the passage of the stock into the next pass 8. From the latter, if it be the size and section desired to be rolled, the stock emerges without twist, because the centers of pressure $f$ and $f'$, instead of being offset, are, as shown, in exact vertical alinement.

I claim,

1. A pair of cylindrical reducing rolls presenting cooperating pass-forming grooves which have their centers of pressure offset, and which meet on opposite sides at the tangent plane of the rolls' cylindrical surfaces.

2. A pair of cylindrical reducing rolls presenting cooperating angular pass-forming grooves, the respective sides of which meet each other at the tangent plane of the rolls' cylindrical surfaces, the bottoms of said grooves being laterally offset from each other.

3. In the twisting of rolled material in the process of reducing the same by successive passes through cylindrical rolls, the improvement which consists in offsetting the centers of pressure of the cooperating pass-grooves of said rolls while maintaining the terminal edges of said grooves at the tangent plane of the rolls' cylindrical surfaces.

4. The improvement in rolling which consists in subjection of the stock to successive reducing passes which twist said stock first in one direction and then in the other direction.

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