Aug. 27, 1935. F. C. BIGGERT, JR 2,012,706

METHOD OF ROLLING METAL STRIP

Filed Jan. 20, 1934

Fig. 1.

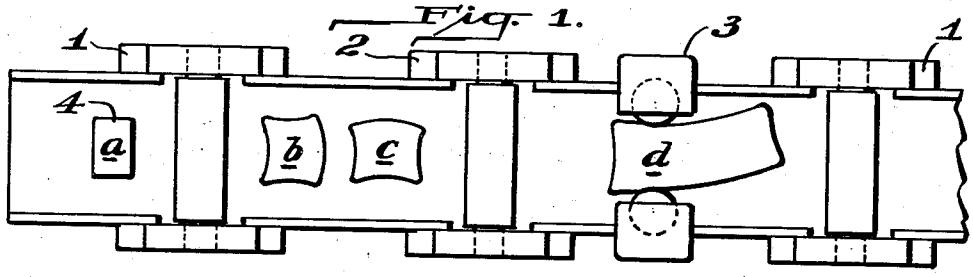


Fig. 2.

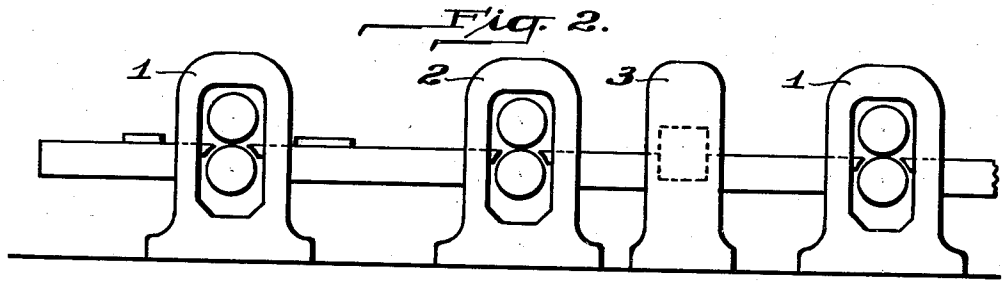


Fig. 3.

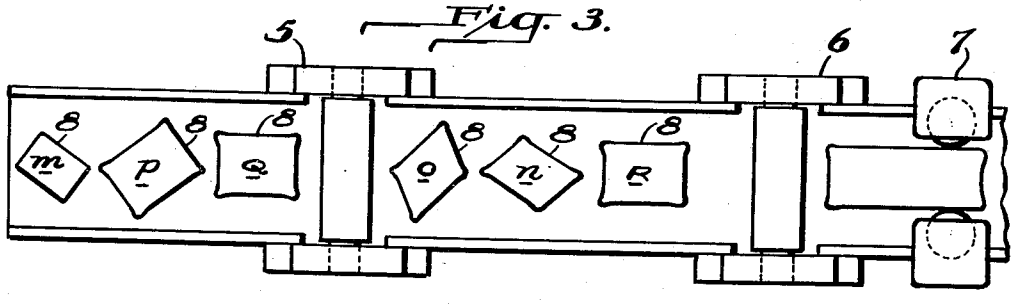


Fig. 4.

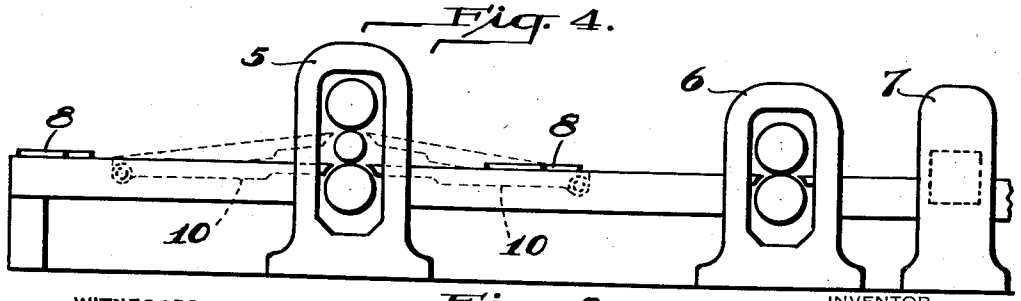
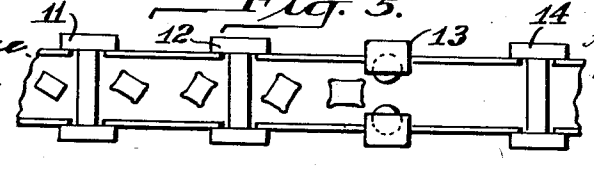


Fig. 5.



WITNESSES

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METHOD OF ROLLING METAL STRIP

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3 Claims. (Cl. 29—18)

This invention relates to the rolling of metal strip, and more particularly to the rolling of material of this character from slabs which have to be spread or widened in order to obtain the width of strip desired.

In practically all, if not all, rolling mills where particularly wide strip is rolled it is necessary to pass the slabs from which the strip is produced through spreading passes before the regular strip rolling operations are inaugurated. The reason for this is that they do not have any slab mills available which are capable of rolling slabs of sufficient width to produce the width of strip desired. To meet this situation it is the pravailing practice to pass the slabs as they are taken from the slab mills sidewise through what is termed a "broadside" pass to increase their width. After leaving this pass the slabs are rotated 90° and then entered into the first regular pass of the strip roll, which may be either a continuous or universal type of mill.

Frequently the spreading required is relatively large as compared to the original width of the slabs, and the regular shape of the slabs considerably deformed. This irregular deformation occurs mostly at the corners of the slabs where there is insufficient metal to prevent the edges flowing laterally. Such corner spreading also is usually different at the two ends of the slabs. In addition, the front end is usually convex in shape, while the tail end is concave when the slabs come out of the spreading pass. Because of this the problem of bringing the edges of the slabs back into line after they are spread, which is necessary in order to control the widths and uniformity of the strip, becomes very difficult and frequently impossible. Unless these edges are properly aligned the slabs become bent as they pass through the strip mill due to the unequal work which the edging rolls have to perform, and are most difficult to handle.

It is an object of this invention to overcome such difficulties in wide strip mills by diagonally spreading the slab in place of the usual broadside spreading, whereby the total deformation is greatly decreased.

By way of illustrating the invention and its improvement over the prior practice, reference may be had to the accompanying drawing, of which Fig. 1 is a plan view of a common form of strip mill showing different shapes which the slab takes as it is passed through such a mill; Fig. 2 a side elevational view of the mill shown in Fig. 1; Fig. 3 a view similar to Fig. 1 of a strip mill constructed in accordance with this invention and illustrating the different snapes which a slab takes when passed therethrough; Fig. 4 a view similar to Fig. 2 of the mill shown in Fig. 3; and Fig. 5 a plan view of a mill layout using a tandem arrangement of roll passes for practicing the invention.

Referring in detail to this drawing, the numeral 1 designates a roll stand forming what is shown as a broadside spreading pass, and the numerals 2 and 3 a series of reducing and edging roll stands respectively which, with the spreading rolls, comprise a continuous strip mill of the type commonly used in producing strip and sheet material. As illustrated at *a* in Fig. 1, in accordance with the present practice a slab 4, which is too narrow to produce the width of strip desired, is first passed sidewise one or more times through the spreading pass 1 to increase its width. During this operation, as shown in a somewhat exaggerated fashion at *b*, the corners of the slab are normally spread laterally more than the sides due to the unsupported condition of the metal at those points, and such deformations as a rule are more pronounced at the forward end than the rear end of the piece. Furthermore, the forward end usually becomes somewhat convex in shape, while the rear end becomes somewhat concave, and these conditions become more aggravated with increased spreading.

When this spreading operation is completed the slab is turned around 90°, as shown at *c*, and passed into the first stand 2 of reducing rolls. But in order to produce a uniformly shaped strip its side edges, which were irregularly distorted in the spreading pass 1, have to be brought back into line. This is accomplished by the edging rolls in the edging stands 3. However, where the sides are too greatly distorted this problem becomes too difficult to cope with and the slab is wasted, and even at its best, due to the fact that the edging rolls on the side of the mill through which the convex edges of the slab pass have to do more work than those on the other side, the strip is bent as shown at *d* as it emerges from the edging rolls. This bending, as will be readily appreciated, makes for great difficulty in passing the strip through the succeeding roll stands, in that it complicates and slows up the rolling operation and militates against the production of a strip having straight, smooth edges, which is desired.

In accordance with this invention to overcome these difficulties, as illustrated in Figs. 3 and 4, a multiple pass spreading roll stand 5 is arranged in front of the regular reducing passes of the mill

which may consist of a series of horizontal and vertical roll stands 6 and 7, or a universal mill. This multiple pass spreading roll stand is made somewhat wider than the customary broadside spreading roll stand, and the slab 8, as shown at *m* in Fig. 3, is first entered in the lower pass of such roll stand along one of its diagonals. When rolled in this fashion it spreads the slab into a somewhat diamond shape, as shown at *n*, and the corners, while distorted somewhat, are deformed considerably less than they are in a broadside mill.

After being rolled in this manner the slab is turned 90°, as shown at *o*, and passed back through the upper rolls of the spreading stand. On emerging from this pass the slab, as shown at *p*, is expanded along its opposite diagonal and has a shape substantially the same as when it was first entered in the spreading rolls except that it is larger and its corners slightly deformed. While not shown in detail, any suitable form of manipulating apparatus 10 may be used for handling the slab and passing it back and forth through this mill until it is spread sufficiently, which may require one or more passes in each direction.

When these spreading operations are completed the slab is rotated 45°, as shown at *q*, and then again passed through the lower rolls of the spreading stand to take out any roughness in it. It will be understood of course that instead of the slab being rotated as stated to make the entries required with the least amount of turning they may be rotated in the opposite direction, all of which is contemplated by the appended claims. On leaving this latter pass the slab is passed directly as indicated at *r* into the strip mill proper through which it then moves with accurate uniformity as its edges, while deformed slightly at the corners, are symmetrical with respect to the center line of the edging rolls so that relatively little difficulty is encountered in correcting the deformation. It will be appreciated that the last-mentioned spreading pass operation may be dispensed with, as such is employed merely to smooth out the stock in preparation for its entries in the mill.

As illustrated in Fig. 5 the invention may also be practiced by using a series of roll stands consisting of spreading stands 11 and 12, and an edging stand 13, which are arranged in front of the first mill stand 14, the slab being rotated as indicated before it is entered in each of these stands.

Among the advantages of the invention, as will be apparent to those skilled in the art, it permits the use of spreading operations to a greater extent than is permissible in the customarily used broadside spreading pass as it greatly reduces the irregular deformation at the corners of the slab, and as such deformation as may occur is symmetrical and therefore more easily corrected. As a result strips having accurately straight edges may be rolled wtih a minimum of difficulty and wasted material.

According to the provisions of the patent statutes, I have explained the principle and mode of operation of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. The method of rolling metal strip from a slab having an insufficient width to produce the width of strips desired comprising alternately spreading the slabs uniformly along its two diagonals until the proper width is obtained, straightening its lateral edges by passing it through an edge working device and then reducing and elongating the slab in a continuous mill until the desired thinness is obtained.

2. The method of rolling metal strip from a slab having an insufficient width to produce the width of strip desired comprising passing such slab diagonally through a spreading pass, turning it 90° and passing it through said spreading pass again along its opposite diagonal, then turning it 45° and passing it through a series of edging and reducing roll passes.

3. The method of rolling metal strip from a slab having an insufficient width to produce the width of strip desired, comprising passing the slab one or more times through a spreading pass along one of its diagonals, rotating it 90° after each such pass and passing it an equal number of times back through said spreading pass along its opposite diagonal, and then passing it in succession through a series of edging and reducing passes to straighten its edges and reduce its thickness.

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