

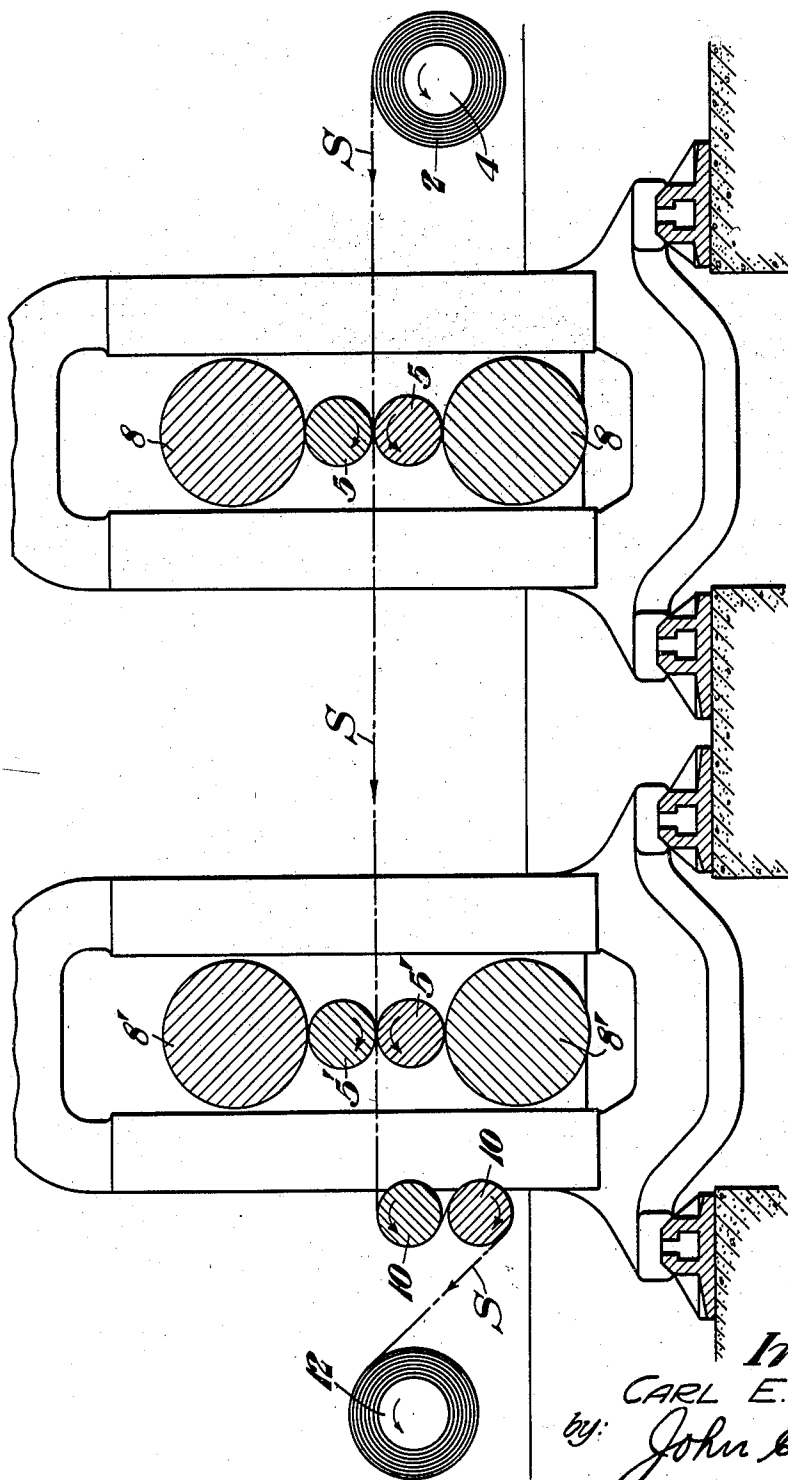
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METHOD OF TREATING ANNEALED STRIP STEEL

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METHOD OF TREATING ANNEALED STRIP
STEEL

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4 Claims. (Cl. 80-60)

This invention relates to the manufacture of low carbon strip steels wherein the same is annealed or otherwise softened in order that it be ductile and suitable for drawing, stamping or otherwise forming into various shapes. Such manufacture includes the step of cold rolling the strip after annealing, wherein the action of the cold rolling primarily provides a slight stiffening effect, and, secondly, provides a finished surface acceptable to the trade.

This cold rolling effect is the result of working the steel in minute degree, thus providing a superficial area of work and, therefore, is not to be confused with that type of cold rolling wherein the strip steel is given extreme reductions which may range from between 15 to 90 per cent in its thickness or gage.

The class of cold working of annealed strip steels wherein only superficial hardening and good surface is obtained is commonly carried out on so-called "temper" pass mills. So far as I am aware, this temper pass mill was difficult to handle in that the heat generated (even though the reduction in gage was practically negligible) produced a tendency of the rolls to heat and the contour thereof to become distorted.

This distortion of roll contour is not permissible in cold rolling annealed strip steel, as the material at this point must be tempered and left in an almost perfectly flat condition for subsequent coiling and further processing. So far as I am aware, it has not been heretofore possible to temper roll annealed low carbon strip steels in wide widths and gages, and obtain the degree of temper desired, together with flatness and surface finish, without causing the rolls of the temper mill to become distorted, thereby limiting the degree of temper to that which would be obtained with 5 per cent reduction in strip thickness.

This condition was accepted for a number of years because the trade did not demand extremely flat materials or temper mill finishes on annealed strip which could not be attained by temper rolling with a resultant reduction in thickness not in excess of 5 per cent. However, the trade has recently been demanding annealed strip steels of very thin thickness and wide widths, together with improved surface finishes and greater temper, which has necessitated greater reduction in thickness. This involves two (2) or more separate passes through the mill, which is not only slow and costly but also entails considerable storage or floor space, additional handling costs and decreased production.

It is among the objects of the present invention to temper pass low carbon annealed strip steel in such manner as to obtain improved surface and additional stiffness. According to the teachings of the present invention, there is provided a pair of cold rolling mills arranged in tandem and in such manner as to stretch the annealed strip material between said pair of mills.

The annealed strip steel is unwound under tension, given a light tempering pass between the work rolls of the first stand, which rolling is of such magnitude that the work rolls do not overheat and thereby become distorted, and is then caused to be stretched between the first and second stands in order to provide the desired degree of stretcher leveling or flattening. Finally, the strip steel is allowed to pass between the work rolls of the second stand, wherein the flatness is not only maintained but, if desired, additional flatness may be obtained.

The foregoing and other objects will be apparent after referring to the drawing, in which:

The single figure is a diagrammatic elevation of two four-high cold working rolling mills arranged in tandem with pay-off and take-up reels, together with a tensioning device disposed between the take-up reel and the second of the four-high cold working rolling mills.

Referring more particularly to the drawing, the numeral 2 designates a coil of annealed low carbon strip steel. Within the concept of the present invention, this strip may be, for example, .010 inch thick, 32.75 inches wide and of any suitable length. The carbon content should be less than 1.10 per cent.

The coil 2 is carried on a suitable reel 4, the axis of which is parallel to the work rolls 5 of an adjacent cold rolling mill, generally indicated at 6. In accordance with well known practice, the work rolls 5 are held against deflection by backing-up rolls 8. The work rolls 5 are driven in a suitable manner (not shown) but the backing-up rolls 8 are idle.

As shown in the drawing, a second cold rolling mill is disposed adjacent the one described immediately hereinbefore and in alignment with the outlet end thereof. This second cold rolling mill is identical in construction with the one earlier described and its component parts are designated by the same reference characters together with the exponent prime (').

Immediately adjacent and in alignment with the second cold rolling mill (referred to herein-after as the No. 2 stand) there is disposed a pair

of tension rolls 10 which are driven in a suitable manner (not shown).

A tension reel 12 is disposed adjacent and in axial parallelism with the tension rolls 10.

In operation, the annealed strip S is unwound from its coil 2 on the reel 4 and is passed between the driven work rolls 5 of the No. 1 stand, where it is given its primary cold rolling or tempering pass.

According to the teachings of the invention, the strip at this point is elongated not less than .40 per cent nor more than 2.0 per cent. It is in this No. 1 stand that the major tempering or superficial hardening of the annealed strip is attained and, therefore, it is desirable that the average elongation approximate the maximum (2.0 per cent).

The strip S is then passed between the work rolls 5' of the No. 2 stand. These rolls 5' are so driven as to produce in that portion of the strip passing therebetween a linear speed which is always in excess of the linear speed of travel of that portion of the strip, which is passing between the work rolls 5 of the No. 1 stand. This causes that portion of the strip which is between the work rolls 5 of the No. 1 stand and the work rolls 5' of the No. 2 stand to acquire a continuous stretching or elongation. This elongation by stretching between stands must be within very definite limits for the particular class of material; and I have found that the average elongation between such stands should be around 0.60 per cent when related to its length. I have further found that the continuous elongation between stands should never be less than 0.10 per cent or more than 6.0 per cent.

In the No. 2 stand, the degree of cold rolling or tempering of the annealed strip S is considerably less than in the No. 1 stand; and I have found that its average elongation between the work rolls 5' should be approximately .40 per cent.

I have further found that correctly tempered strip steels of the variety described hereinbefore do not permit of elongation in the No. 2 stand of more than 1.70 per cent, or less than .40 per cent.

By the foregoing arrangement of tandem mills, the total elongation of the annealed strip in the two stands in tandem plus the continuous stretching action between stands should never exceed 10 per cent per unit length of material.

The foregoing arrangement produces not only "dead flatness" but also a surface which is greatly desired by the trade.

While I have shown and described one specific embodiment of my invention it is to be under-

stood that I do not wish to be limited thereto, since various modifications may be made without departing from the scope of my invention, as defined in the appended claims.

I claim:

1. The method of treating annealed strip steel which includes cold rolling the same in a pair of tandem mills, the first of said mills being operated to effect an elongation by rolling of between .40 per cent and 2.0 per cent, the second of said pair of tandem mills being operated to effect an elongation by rolling of between .40 per cent and 1.70 per cent, the effective speeds of said pair of tandem mills being such as to elongate the strip by stretching between stands from between .01 per cent and 6.0 per cent.

2. The method of treating annealed strip steel which includes cold rolling the same in a pair of tandem mills, the first of said mills being operated to effect an elongation by rolling of between .40 per cent and 2.0 per cent, the second of said tandem mills being operated to effect an elongation by rolling of between .40 per cent and 1.70 per cent, the effective speeds of said tandem mills being such as to elongate the strip by stretching between stands from between .01 per cent and 6.0 per cent; and then pulling the strip from the delivery end of the second tandem mill under tension, the tension being such as to elongate the strip by stretching from between .010 per cent and 0.30 per cent.

3. The method of treating annealed strip steel which includes cold rolling the same in a pair of tandem mills, the first of said mills being operated to effect an elongation by rolling of approximately 2.0 per cent, the second of said pair of tandem mills being operated to effect an elongation by rolling of approximately .40 per cent, the effective speeds of said pair of tandem mills being such as to elongate the strip approximately .60 per cent by stretching between stands.

4. The method of treating annealed strip steel which includes cold rolling the same in a pair of tandem mills; the first of said mills being operated to effect an elongation by rolling of approximately 2.0 per cent, the second of said pair of tandem mills being operated to effect an elongation by rolling of approximately .40 per cent, the effective speeds of said pair of tandem mills being such as to elongate the strip approximately .60 per cent by stretching between stands; and then pulling the strip from the delivery end of the second tandem mill under tension, the tension being such as to elongate the strip approximately .10 per cent.

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