METHOD OF PRODUCING DUAL GAUGE STRIP

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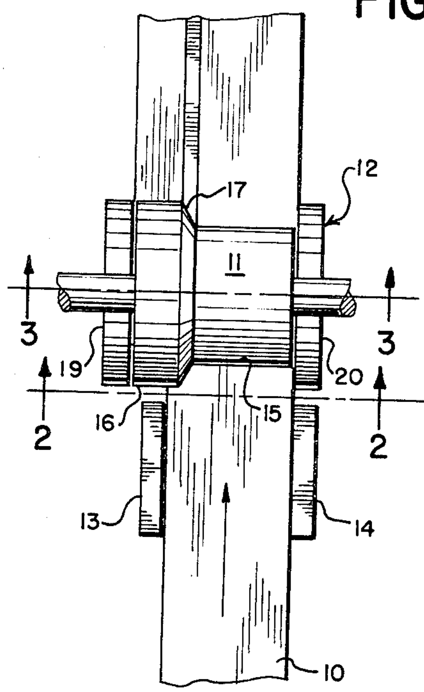

FIG. 1

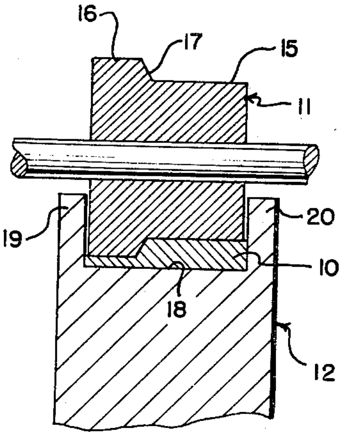

FIG. 3

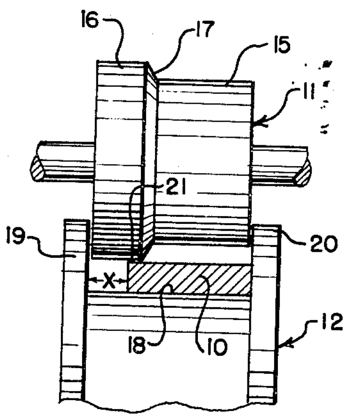

FIG. 2

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METHOD OF PRODUCING DUAL GAUGE STRIP
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ABSTRACT OF THE DISCLOSURE

A reduced gauge marginal edge portion is produced in a flat metal strip by restraining the metal strip against lateral displacement relative to a set of rolls and aligning the metal strip in relation to this set of rolls; one of the rolls has a stepped diameter and during rolling metal is displaced laterally beneath the enlarged diameter portion of the roll to produce a reduction in gauge along this marginal edge portion.

BACKGROUND OF THE INVENTION

This invention relates to a method of producing a reduced gauge marginal edge portion in a flat metal strip by a rolling operation.

In many applications, such as the production of copper strip for formation of electrical connectors, it is necessary to provide a dual gauge thickness in the metal strip. Heretofore when a dual gauge was required in a given application the method of producing the reduced gauge has been a milling operation. In the milling operation scrap is produced, but the major objection to a milling operation is the slow speed at which it is carried out. The milling speeds in these applications has usually ranged from only about 4 to 10 feet per minute. According to the invention a method is provided by which a dual gauge metal strip can be provided with a reduced gauge marginal edge portion by a rolling operation. This can be accomplished at speeds of up to 400 feet per minute.

SUMMARY OF THE INVENTION

The invention provides a method of producing a reduced gauge marginal edge portion in a flat metal strip by feeding flat metal strip longitudinally through the nip of a set of opposed rolls with one of the rolls having a stepped diameter, with its enlarged diameter portion located along one end thereof. During feeding of the flat metal strip through the nip of the rolls it is restrained against lateral displacement relative to the rolls and is aligned with its marginal edge to be reduced underlying a portion of the enlarged diameter portion of the roll but spaced from the adjacent side edge of the opening defined between the pinched rolls. The metal strip so aligned is then rolled by pinching the rolls under pressure against the moving strip to restrain the flow of metal laterally outward under the enlarged diameter portion of the roll with a substantially less reduction in the remainder of the metal strip to produce a strip having a marginal edge portion of reduced gauge thickness.

The method is particularly useful in conjunction with a set of rolls wherein one of the rolls has enlarged diameter collar portions and one side edge of metal strip is restrained against lateral displacement by aligning and holding it against one collar portion and the other edge is initially spaced from the other collar portion but flows laterally against this collar portion during rolling.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of apparatus for performing the method of the invention;

FIG. 2 is a section taken substantially along lines 2—2 of FIG. 1; and

FIG. 3 is a section taken substantially along lines 3—3 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIG. 1 a thin metal strip **10** is being fed in the direction of the arrow between a set of opposed top and bottom rolls **11** and **12** respectively. Positioned just before the set of rolls are a pair of spaced steel guides **13** and **14**. The elongated steel guides **13** and **14** are laterally spaced a distance slightly larger than the width of the metal strip **10** and are of sufficient length to restrain the metal strip **10** against lateral displacement and align the metal strip in relation to the nip of the rolls **11** and **12**.

FIG. 2 shows the top and bottom rolls **11** and **12** in their respective positions before the roll pinch, and in this embodiment the top roll has the stepped diameter construction in which the major width of the roll defines a smaller diameter portion **15** and one enlarged side portion **16** separated by a beveled shoulder **17**. The bottom roll has a uniform diameter roll surface **18** and has annular radially extending side collar portions **19** and **20**. The collar portions **19** and **20** are laterally spaced to allow the top roll **11** to fit therebetween during the rolling operation and thus the top and bottom rolls provide a confined space through which the metal strip **10** is passed.

It is to be noted that the metal strip **10** is aligned by the steel guides **13** and **14** so that one edge portion substantially abuts collar portion **20** and is effectively locked against collar portion **20** so that no lateral displacement of the metal can take place along that side edge of the metal strip. This side edge of the strip which is locked against collar **20** is also the portion of the metal strip which underlies the smaller diameter portion **15** of the top roll **11**. A marginal side edge portion **21** of the opposite free side edge of the metal strip, as shown in FIG. 2, is partially positioned beneath the enlarged diameter portion **16** of the top roll **11** and a space X is provided between the free side edge of the metal strip and the collar **19**.

The rolls **11** and **12** as shown in FIG. 3 are then pinched together while the metal strip **10** is being advanced therethrough at speeds of up to 400 feet per minute and the metal of the marginal side edge portion **21** of the strip **10** is spread or flows laterally under the pressure of the enlarged diameter portion **16** of the top roll **11** and is substantially reduced in gauge thickness and increased in its width (as shown in FIG. 1 in dotted lines and in FIG. 3) with the free side edge of the metal strip flowing the distance X and abutting the collar portion **19**.

In one example a copper alloy having a starting size of 0.725 inch by 0.050 inch was impedance rolled to 0.807 inch by 0.035 inch/0.017 inch gauge. This dual gauge strip was then annealed and drawn to a finished size of 0.794 inch wide by 0.031 inch/0.013 inch gauge.

In a second example a copper alloy (Alloy No. 110) having a starting size of 1.330 inch wide by .1100 inch gauge thickness was rolled by the method of the invention to a size of 1.400 inch wide by .090 inch/.066 inch gauge thickness.

In a third example a Phosphor-bronze alloy (Alloy No. 5182) was rolled from the same starting stock size as Example No. 2 to the same finished dual gauge size given in Example No. 2. It was found that the alloy did not produce any difference in flow of metal and it is theorized that only an increase in roll pressure would be required to compensate for the differences in alloys.

While the alloy selected, except for roll pressure, does not appear to offer any limitations on the method of the invention, it does appear that the diameter of the rolls will influence the amount of spreading realized. In one example using a 7 inch diameter roll the starting metal strip was 0.618 inch wide by 0.110 inch gauge thickness; a marginal edge portion of 0.198 inch was positioned beneath the enlarged diameter portion of the top roll. After rolling the strip had spread 0.060 inch to a strip width of 0.678 inch and the marginal edge portion had been reduced 61% from 0.110 inch to 0.043 inch while the remainder of the strip was reduced from 0.110 inch to .077 inch a reduction of about 30%.

We claim:

1. A method of producing a reduced gauge marginal edge portion in a flat metal strip comprising

(a) feeding flat metal strip longitudinally through the nip of a set of opposed rolls, one of said rolls having a stepped diameter with its enlarged diameter portion along one end thereof,

(b) restraining the metal strip against lateral displacement relative to said rolls while feeding the strip therethrough and aligning the strip with its edge to be reduced underlying a portion of the enlarged diameter portion of the roll but spaced from the side edge adjacent said enlarged diameter portion, and

(c) rolling the metal strip so aligned by pinching the rolls under pressure against the moving strip so restrained to flow metal laterally outward under the enlarged diameter portion of the roll to produce a substantially smaller reduction of the remainder of the metal strip thereby producing a strip having a marginal edge portion of reduced gauge thickness.

2. A method according to claim **1** comprising restraining one side edge of the metal strip against lateral displacement and allowing the opposite marginal edge to be reduced.

3. A method according to claim **1** wherein one of said rolls has enlarged diameter collar portions against which the side edges of the metal strip abut during the rolling operation.

4. A method according to claim **3** wherein one side edge of the metal strip is restrained against lateral displacement by aligning it against one collar portion and the other edge is initially spaced from the other collar portion but flows laterally against this collar portion during rolling.

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