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3,455,136

MEANS FOR SURFACE CONDITIONING METAL STRIP

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FIG. 1

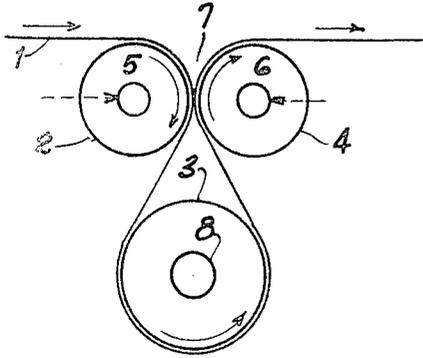


FIG. 2

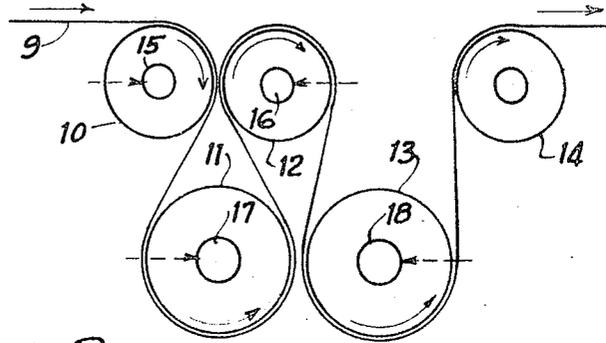


FIG. 3

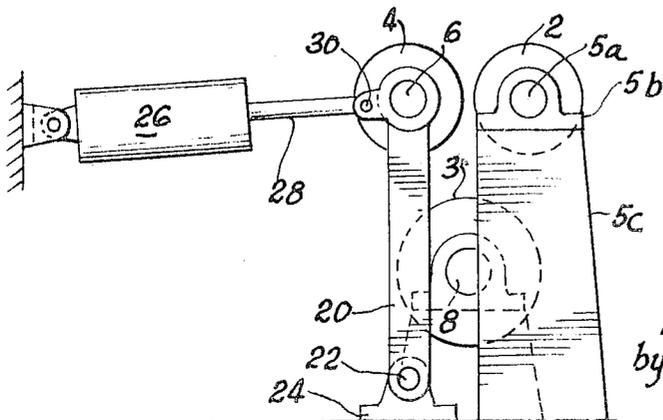
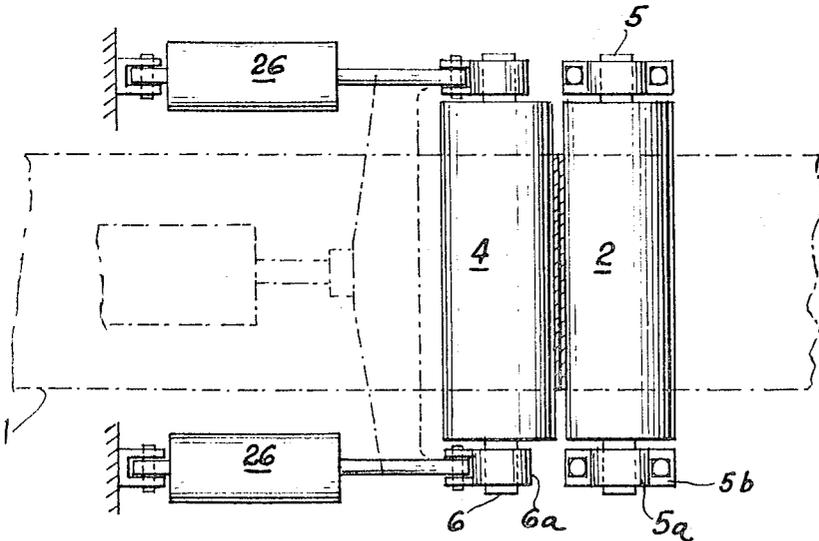


FIG. 4

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MEANS FOR SURFACE CONDITIONING METAL STRIP

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ABSTRACT OF THE DISCLOSURE

The method for surface treatment of metal strip comprising passing the strip under tension in one direction and turning the strip for passage under tension in the opposite direction while pressing the strip into surface contact during travel in opposite directions to cause rubbing between the surfaces of the strip.

This invention relates to the improvement in the surface finish of metal sheet or strip and it relates more particularly to a method and means for polishing the surfaces of metal sheet or strip.

It is an object of this invention to provide a method and means for producing a surface or surfaces having an improved finish or polish and it is a related object to produce apparatus of the type described which is simple in construction and easy in operation, which can be adapted for use as a continuous operation with metal strip or sheet forming or annealing or other metal treating equipment, which is constructed of relatively few simple parts and which makes use of a self-polishing action with very little, if any, wear on the equipment, and which is substantially independent of the character of or the wear on the work rolls.

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawings in which—

FIG. 1 is a schematic elevational view of the roll arrangement employed in the practice of this invention for the treatment of one side of a metal strip;

FIG. 2 is a schematic elevational view of the roll arrangement for the treatment of both sides of a metal strip;

FIG. 3 is a top plan view, partially in section, of the means for support and adjustment of the rolls; and

FIG. 4 is an elevational view of the roll assembly shown in FIG. 3.

A satisfactory and constant surface texture or finish is of major concern in the cold rolling of metal sheet or strip. At the present time, the prerequisite surface characteristics are sought to be secured by conditioning the strip before cold rolling, as by grinding and/or by polishing the surface of the work rolls and by the use of a suitable lubricant. In practice, it has been found that the work rolls wear such that their surface finish deteriorates during use, with corresponding adverse effect on the strip surface. For reasons which are not well understood, deterioration and wear of the roll surface is selective in that greater wear and deterioration often occurs in one area by comparison with others with the result that slight level differences and even abrupt steps are found in the surfaces of the work rolls. These are imprinted into the strip and such imprints remain visible even after coating, as in bright finished strip such as tinned steel strip.

These discrete defects in the metal strip can be removed, in whole or in part, by temper rolling. This is a costly procedure from the standpoint of capital invest-

ment and the additional time, labor and energy required.

Another area where surface finish finds importance is in the field of double rolled foil in which one side is formed with a bright finish and the other side with a matte finish.

A further area where surface finish is important is in annealed and tension leveled low carbon steel where a very large number of minute micro Lüders' lines form across the width of the strip. While these are generally not objectionable, they do reduce the reflectivity of the surface and a means or method for wiping out such lines would be desirable, provided that the means or method was capable of operation at low cost and at high speeds for use in coordination with the rolling or flattening, or annealing process.

These and other objects of this invention are capable of being achieved inexpensively and at high speed with continuous coils by a self polishing operation by causing one portion of the strip surface to rub against another portion of the surface under controlled pressure. The equipment required to perform this operation can be aligned for use in combination with a rolling mill, a continuous strip annealing mill, and the like sheet processing or coating equipment.

With reference now to the drawings, illustration is made in FIG. 1 wherein the metal strip 1 is subjected to a one side rubbing action in accordance with the practice of this invention. The strip 1 is advanced under tension successively about rolls 2, 3 and 4. Each of the rolls 2, 3 and 4 are mounted at their ends in suitable journals 5, 6 and 8 which are respectively supported in conventional bearings fixed to the side frame members of the machine or otherwise supported on pedestals.

In the modification shown in FIG. 1, the metal roll 3 is a turnabout roll and the rolls 2 and 4 are arranged to form a nip 7 therebetween with one or both of the rolls being mounted for movement in the direction towards and away from the other for variation in the spaced relationship between the peripheral surfaces of the rolls and for the allocation of contact pressure between the surfaces of the strip passing in opposite directions through the nip to cause the desired rubbing action between the surfaces on one side of the strip.

Since the two rolls 2 and 4 are separated at their nip 7 by two thicknesses of strip 1, the surfaces are caused to rub one on the other as the strip is propelled in the direction of the solid arrows by the tension applied to the leading end of the strip, as by the takeup reel (not shown) which conventionally forms a part of strip processing equipment. Owing to the pressure at the line of contact across the strip, the strip is subjected to a self rubbing or self polishing action responsive to the slippage between the contacting portions moving in opposite directions.

Tension from the takeup roll of the machine can be used alone for advancing the strip about the rolls. In addition one or all of the rolls can be driven rolls by the use of conventional gears interconnecting the rolls with a driving motor for the combination of power driven rolls and tension for processing the strip through the roll system.

In the modification illustrated in FIG. 1, only one side of the strip is subjected to the described rubbing action or self-polishing. In the modification illustrated in FIG. 2, both sides of the strip 9 can be rubbed merely by the addition of a single roll.

In the modification shown in FIG. 2, one side of the strip 9 is rubbed as it passes between rolls 10 and 12 which correspond to rolls 2 and 4 of FIG. 1, using roll 11 as the turnabout roll. The other side of the strip 9 is rubbed as it continues onward to pass between rolls 11

and 13 arranged in the manner described with reference to rolls 2 and 4 of FIG. 1, using the roll 12 as the turn-about roll.

Rolls 10 and 12 have their journal shafts 15 and 16 mounted in suitable bearings with means for movement of at least one of the rolls in the direction toward and away from the other roll, as indicated by the broken arrows, to vary the nip between the rolls to accommodate different gauges of strip and to apply rubbing pressure between the surfaces of the strip passing therebetween. Similarly, rolls 11 and 13 have journals 17 and 18 at their ends for rotatable support in suitable bearings, as previously described.

One means for support and adjustment of a roll pair, such as rolls 2 and 4, is illustrated in FIGS. 3 and 4 in which roll 2 is a stationarily supported roll in which the journals 5 are rotatably mounted in bearings 5^a in pillow blocks 5^b supported on the pedestals 5^c. Roll 4 is mounted for movement in the direction toward and away from roll 2. For this purpose, roll 4 is rotatably supported at its ends in bearings 6^a provided on the upper end of a pair of supporting rocker arms 20 pivotally mounted at their lower ends on a pin 22 to a fixed bracket 24. The arms 20 are rocked for movement of the roll 4 in the direction toward and away from the roll 2 by a piston and cylinder arrangement 26 in which the cylinder is pivotally mounted at its outer end on a fixed frame while the piston rod or arm 28 is pivotally secured to ears 30 extending outwardly from the bearing housing 6^a or from the arm 20. Thus the roll 4 is continuously urged in the direction towards roll 2 by a predetermined level of hydraulic pressure. In the modification shown in FIG. 3, separate piston and cylinder arrangements are employed for engagement of the bearing supports at the opposite ends of the roll. It will be understood that the bearing supports may be interconnected by a cross frame member for actuation by a single fluid operated piston and cylinder arrangement. It will be also understood that the resilient pressure which is desired continuously to urge the one roll in the direction towards the other may be supplied by coil spring members and that such resilient pressure applicator means may be employed with both rolls of the pair as well as with one.

The means described will provide continuous pressure onto the roll and correspondingly onto the strip passing between the rolls. Adjustment of one or both the rolls of a roll pair to a fixed position for variation of the nip between the rolls can be effected by substitution of a screw jack means for the ram rod 28 with the outer end fixed to the machine frame.

Instead of generating pressure by the use of force applied to the roll supports, the desired pressure can be generated or the desired adjustments can be effected by mounting the rolls on shafts having an eccentric at their end supports for displacement of the one roll in the direction toward and away from the other roll in the pair.

In FIG. 2, roll 14 is shown as an idler roll but it can be paired with roll 12 to add another rubbing station. It will be apparent that the number of rubbing pairs can be increased merely by the addition of rolls to form rubbing pairs in the manner described either with rolls in other pairs or with independent and separate pairs.

The rubbing action of the surfaces of the strip one upon the other, under pressure, while traveling in opposite directions, provides a separate polishing action that appears to erase imperfections, imprints, Lüders' lines and the like surface deformities substantially independently of

the characteristics of the underlying surface of the supporting rolls. Thus roll surface characteristics are retained over long periods of use, even with hard strip, especially in the absence of direct slippage between the strip and the peripheral supporting surface of the rolls. Thus the rolls enjoy an extremely long, useful life thereby to increase the utility and the efficiency of the machine. Since the rolls merely have a supporting function in the polishing or rubbing action, the apparatus can be operated at variable speeds, including extremely high speeds, for use with other strip processing equipment such as a cold roll mill, a continuous annealing line and the like.

It will be understood that changes may be made in the details of construction, arrangement and operation without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. A continuous roll mill for processing metal strip comprising a pair of rolls mounted for rotational movement and forming a nip therebetween corresponding to twice the thickness of the strip, means for advancing the strip continuously through the nip between the roll pair in one direction and back through the nip between the same roll pair in the opposite direction whereby the adjacent surfaces of the metal strip rub one upon the other during passage in opposite directions through the nip.

2. A roll mill as claimed in claim 1 which includes a turnabout roll about which the strip passes between passages through the nip whereby the rubbing surfaces are on the same side of the strip.

3. A roll mill as claimed in claim 1 in which the rolls of the pair are driven rolls.

4. A roll mill as claimed in claim 1 which includes tension means for pulling the strip for passage between the rolls.

5. A roll mill as claimed in claim 1 which includes means for adjustment of at least one of the rolls in the roll pair in the direction towards the other for varying the nip between the rolls.

6. A roll mill as claimed in claim 1 which includes means constantly urging at least one of the rolls of the roll pair in the direction towards the other for the continuous application of pressure onto the strip passing through the nip between the rolls.

7. The method of surface treatment of metal strip comprising passing the strip under tension in one direction, turning the strip for passage under tension in the opposite direction, and pressing the strips into surface contact during a portion of their travel in opposite directions to cause a rubbing action between the adjacent surfaces of the strip.

References Cited

UNITED STATES PATENTS

752,975	2/1904	Hood.	
3,230,867	1/1966	Nelson	100—162 X
3,326,025	6/1967	Nishioka	72—199 X
2,635,509	4/1953	Cowie et al.	29—90.1 X

FOREIGN PATENTS

237,428 12/1964 Austria.

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U.S. Cl. X.R.

29—90; 72—246, 366