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Senard

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[54] **METHOD FOR SMOOTHING ENDLESS STRIPS**

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[52] **U.S. Cl.** **72/164**

[51] **Int. Cl.**..... **B21d 1/02**

[58] **Field of Search**..... 72/160, 164, 214, 72/165

[56] **References Cited**

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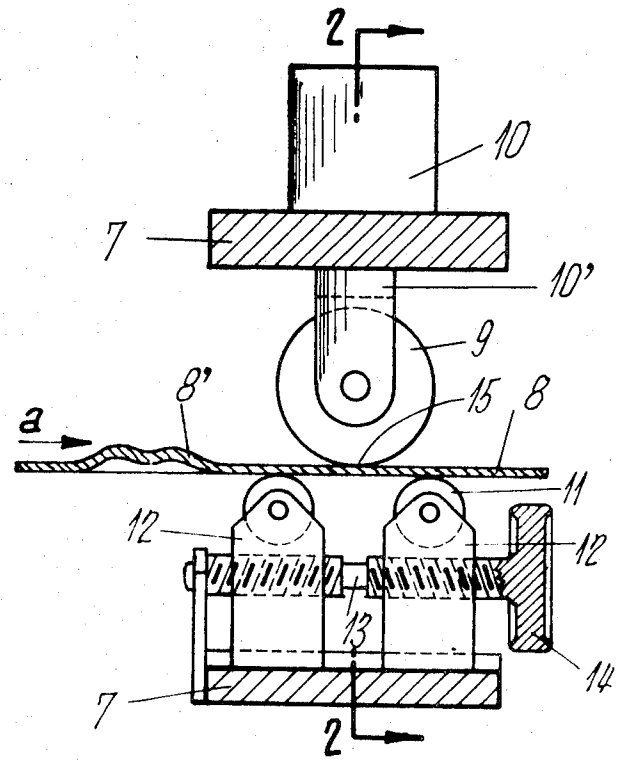
[57] **ABSTRACT**

Bumps are smoothed from endless steel strips such as saw blades, by feeding the strip past a smoothing roller of substantially less width than the width of the strip. The strip and the smoothing roller are progressively or stepwise laterally displaced relative to each other, so that a bump is smoothed stepwise. A sensing device moves the smoothing member into the plane of the strip substantially only when the bump is juxtaposed to the smoothing member. The smoothing member can be a thin roller backed on the opposite side of the strip by further rollers of which two can be disposed in the plane of the smoothing roller or four can be spaced in pairs on opposite sides of that plane. In either event, the backup rollers are fore and aft of the smoothing roller equal distances in the direction of movement of the strip, and are simultaneously adjustable toward and away from each other.

9 Claims, 6 Drawing Figures



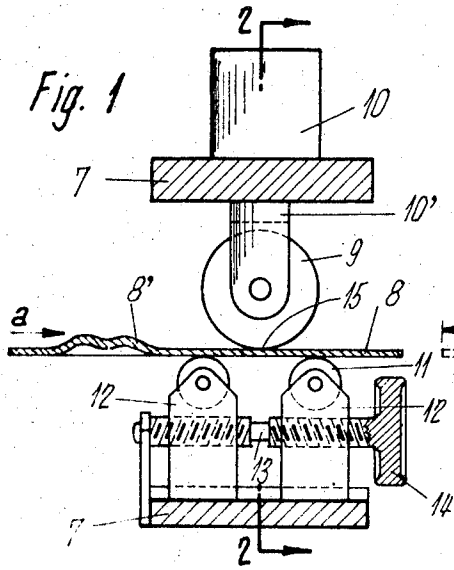


Fig. 1

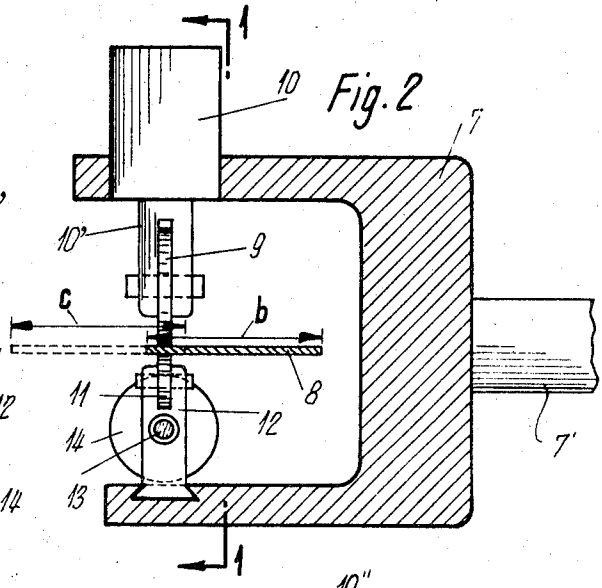


Fig. 2

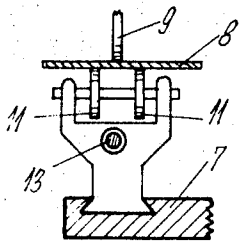


Fig. 3

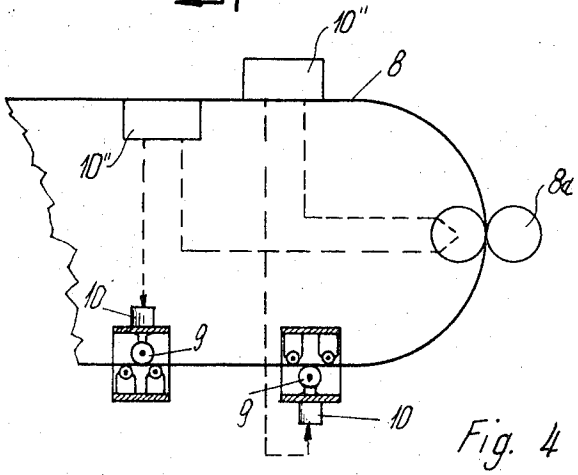


Fig. 4

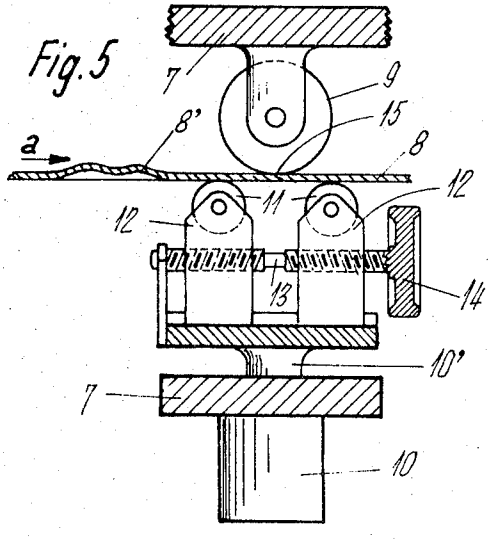
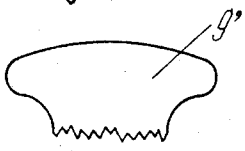


Fig. 5

Fig. 6



METHOD FOR SMOOTHING ENDLESS STRIPS

The present invention relates to apparatus and methods for smoothing strip material, such as the steel blades of endless band saws.

It is known to provide apparatus for smoothing strip material in which large rollers bend the material alternately on opposite faces, each passage of the rollers deforming the strip past its elastic limit. As a result, the desirable properties of the strip may be lost which were carefully imparted to the strip prior to this treatment, and this without necessarily achieving the desired flatness.

Accordingly, it is an object of the present invention to provide apparatus and methods for imparting a desirable flatness to strip material.

The present invention makes it possible to flatten strip material by acting solely on the deformed portions of the strip material, without losing the desirable properties of the undeformed portions of the strip. To this end, the flattening member acts on only a small part of the strip at the same time that the strip is displaced laterally and relative to the flattening member. This lateral displacement can be progresssive or stepwise and each increment of lateral displacement will be less than the width of the strip.

The flattening member comprises a roller or presser applied to each deformation, while the strip is supported on its opposite face by backup means in the form of rollers or reaction plates disposed a precisely predetermined distance before and after the point of action of the roller or flattening presser for the deformation in question, either in the plane of action of the roller or presser, or else in two planes parallel and symmetric with respect to the plane of action of the presser.

The line of action of the roller or presser relative to the backup members is preferably in a direction substantially perpendicular to a face of the strip to be smoothed.

It will be evident that the distance between the points of action of the smoother and the backup members is variable according to the nature of the material of the strip, its hardness, its mechanical resistance, its modulus of elasticity, and other factors which can influence the joint action of the smoother and the backup members.

A conventional detector is provided, which is spaced ahead of the smoothing member and which detects each bump and imparts to the smoothing member after a suitable time delay a displacement somewhat greater than the height of the bump to be smoothed, so that the smoothing member will impart to the material to be smoothed a displacement greater than the height of the bump, with the result that the material will return to a truly smooth condition. In other words, the smoothing member should overcompensate in order to achieve its purpose.

Other objects, features and advantages of the present invention will become apparent from a consideration of the following description, taken in connection with the accompanying drawing, in which:

FIG. 1 is a side cross-sectional view of one embodiment of the invention, taken on the line 1—1 of FIG. 2;

FIG. 2 is a view at 90° to FIG. 1, taken on the line 2—2 of FIG. 1;

FIG. 3 is a view similar to FIG. 2, on a reduced scale, of a modified form of the invention;

FIG. 4 is a schematic view showing apparatus according to the present invention in its position of use;

FIG. 5 is a view similar to FIG. 1 but showing the displacement control applied to the backup members while the smoothing member is fixed; and

FIG. 6 is a fragmentary view of an alternative form of smoothing member or backup member that does not revolve.

Referring now to the drawing in greater detail, and first to the embodiment shown in FIGS. 1 and 2, there is shown apparatus according to the present invention, comprising a support 7 for a smoothing member, which is displaceable transversely with respect to the strip 8 to be fed by power-driven rollers 8*a* lengthwise in the direction of the arrow *a*. A hydraulic jack, whose piston rod is shown at 7'may be provided to move support 7 progressively or stepwise relative to strip 8. The smoothing member may also be laterally fixed and the strip itself moved laterally, from the position *b* to the position *c* indicated in FIG. 2.

In FIGS. 1 and 2, the smoothing member 9 is actuated by a hydraulic jack 10 whose piston rod 10' carries the smoothing member. Jack 10 is fixed to support 7 and is actuated by a conventional detector 10'' that detects the bump 8' in advance of the smoothing member and, after a time delay corresponding to the distance between detector 10'' and member 9, and the speed of strip 8, moves the smoothing member into and somewhat across the plane of the strip 8 at an appropriate time so as to contact and smooth out the bump 8'. Detector 10'' is actuated only so long as the bump is in juxtaposition with it, and so the member 9 will be advanced only for that period of time and will then retract, and may for example be constituted and operate as in U.S. Pat. Nos. 2,020,877, 2,601,154, 2,770,975 or 3,212,354.

A pair of reaction rollers 11 is disposed in the same plane as the roller 9 (see FIG. 2) but on the opposite side of strip 8. These reaction or backup rollers 11 are equally spaced on opposite sides of the contact point 15 of the roller 9 with the strip 8 in the direction of strip movement (FIG. 1). To this end, the rollers 11 are mounted on members 12, the members 12 being oppositely screw-threaded to receive oppositely screw-threaded portions of a screw 13 actuated by rotation of a handwheel 14 to move the rollers 11 toward and away from each other. The lower ends of members 12, opposite the rollers 11, are slidably received in a recess in a lower support 7.

FIG. 3 shows that the rollers 11 may be disposed symmetrically on opposite sides of the plane of roller 9, there being in this case four rollers 11 movable toward and away from each other in pairs only one of which pairs is shown in FIG. 3.

FIG. 4 shows the positioning of two devices according to the present invention, so as to act on bumps on opposite sides of the strip 8; and to this end, the devices are reversed relative to each other. The motors 10 may be actuated by a common source of hydraulic pressure (not shown). FIG. 4 indicates schematically the two detectors 10'', one for each side of strip 8, the connection of the detectors 10'' with the drive rollers 8*a* whereby the speed of the strip is coordinated with the delay between the detection of a bump and the actuation of the smoothing member to correct the bump, and the con-

nection of the detectors 10'' to the smoothing members for effecting that delayed correction of the bump.

FIG. 5 shows that the jack 10 may be applied instead to the backup means, while FIG. 6 shows that the smoothing member may be in the form of a stationary presser 9'.

From a consideration of the foregoing disclosure, therefore, it will be apparent that the object of the invention has been achieved.

Although the present invention has been described and illustrated in connection with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit of the invention, as those skilled in this art will readily understand. Such modifications and variations are considered to be within the purview and scope of the present invention as defined by the appended claims.

Having described my invention, I claim:

1. In apparatus for smoothing endless strip material, comprising means to move the strip material in its own plane, means bearing against the strip material to smooth out bumps in the strip material, and backup means acting on the side opposite the side of the strip opposite the side contacted by said smoothing means and in the vicinity of said smoothing means; the improvement in which said smoothing means bears against said strip across a width less than the width of the strip, and means moving the strip and said smoothing means relative to each other laterally in the direction of the width of the strip thereby progressively to smooth out bumps in the strip upon subsequent passes of the bumps past said smoothing means.

2. Apparatus as claimed in claim 1, and detector means spaced from said smoothing means to detect the presence of a bump upon the strip and operable in timed relation to said moving means to advance said smoothing means toward and past the plane of the strip when said bump reaches said smoothing means.

3. Apparatus as claimed in claim 1, said smoothing means comprising a member disposed in a plane parallel to the length of the strip and perpendicular to the strip, said backup means being disposed in said plane and comprising at least a pair of members spaced apart equal distances on opposite sides of the point of application of said smoothing means to said strip.

4. Apparatus as claimed in claim 1, said smoothing means being disposed in a plane perpendicular to the strip and parallel to the length of the strip, said backup means comprising at least a pair of members spaced equal distances on opposite sides of said plane.

5. Apparatus as claimed in claim 1, said smoothing means comprising a roller disposed on one side of the strip, said backup means comprising at least a pair of rollers spaced equal distances lengthwise of the strip on opposite sides of the point of application of said smoothing means to said strip, and means for moving said backup rollers simultaneously in opposite directions lengthwise of said strip.

6. A method of smoothing bumps from an endless strip, comprising moving a said endless strip in a closed path with the material of the strip moving lengthwise of itself, applying to the strip at least in the vicinity of a bump a force in a direction to smooth out the bump but over less than all the width of the strip, and moving the strip past the point of application of said force to the strip a plurality of times while applying said force at different lateral locations progressively across the width of the strip.

7. A method as claimed in claim 6, and applying said force to less than half the width of the strip at each pass of the strip past said point of application.

8. A method as claimed in claim 6, and sensing the location of a said bump at a point remote from the point of application of smoothing force, and applying said smoothing force substantially only to said bump.

9. A method as claimed in claim 6, in which said smoothing force is applied by a solid member that contacts the strip across only a minor portion of the width of the strip, and moving said smoothing member and strip laterally relative to each other parallel to the plane of the strip to effect the progression of the smoothing member across the width of the strip.

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