United States Patent

[11] 3,587,275

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[21] Appl. No. **754,231**
[22] Filed **Aug. 21, 1968**
[45] Patented **June 28, 1971**

[54] **EDGE ROLLING MECHANISM**
9 Claims, 7 Drawing Figs.

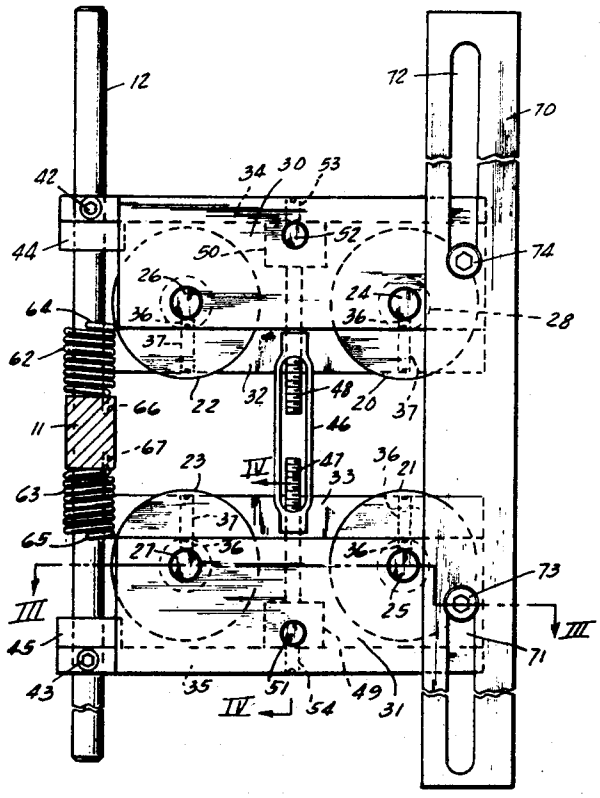
[52] **U.S. Cl.** **72/199**
[51] **Int. Cl.** **B21b 31/00,**
B21b 39/00
[50] **Field of Search** 72/40, 160, 162, 164, 183, 199, 206, 211, 235, 237, 246

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ABSTRACT: A two-stage strip material edge rolling apparatus comprises two pairs of grooved rollers mounted on upper and lower frame members that are pivotally connected to a rigid frame system of side frame members, spacer means and a mounting rod. A spring biased mounting means allows the apparatus to be counterbalanced in "free-floating" position to accept changes in the angle of feed of material. A wide range of material widths may be accepted by the flexible width adjustments and lateral curvatures or deviations of the material are readily accommodated by the pivotally mounted rollers. Groove configuration on the first pair of rollers is V-shaped while the last pair of rollers has a U-shaped configuration so the final material edge is smoothed.

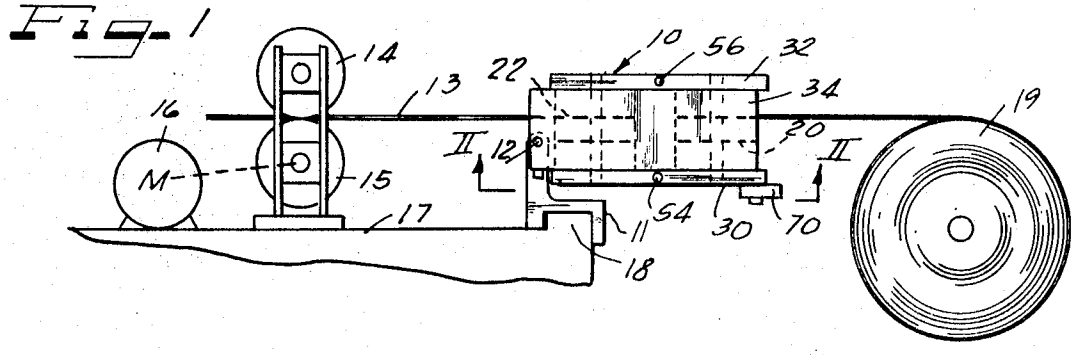


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Fig. 1



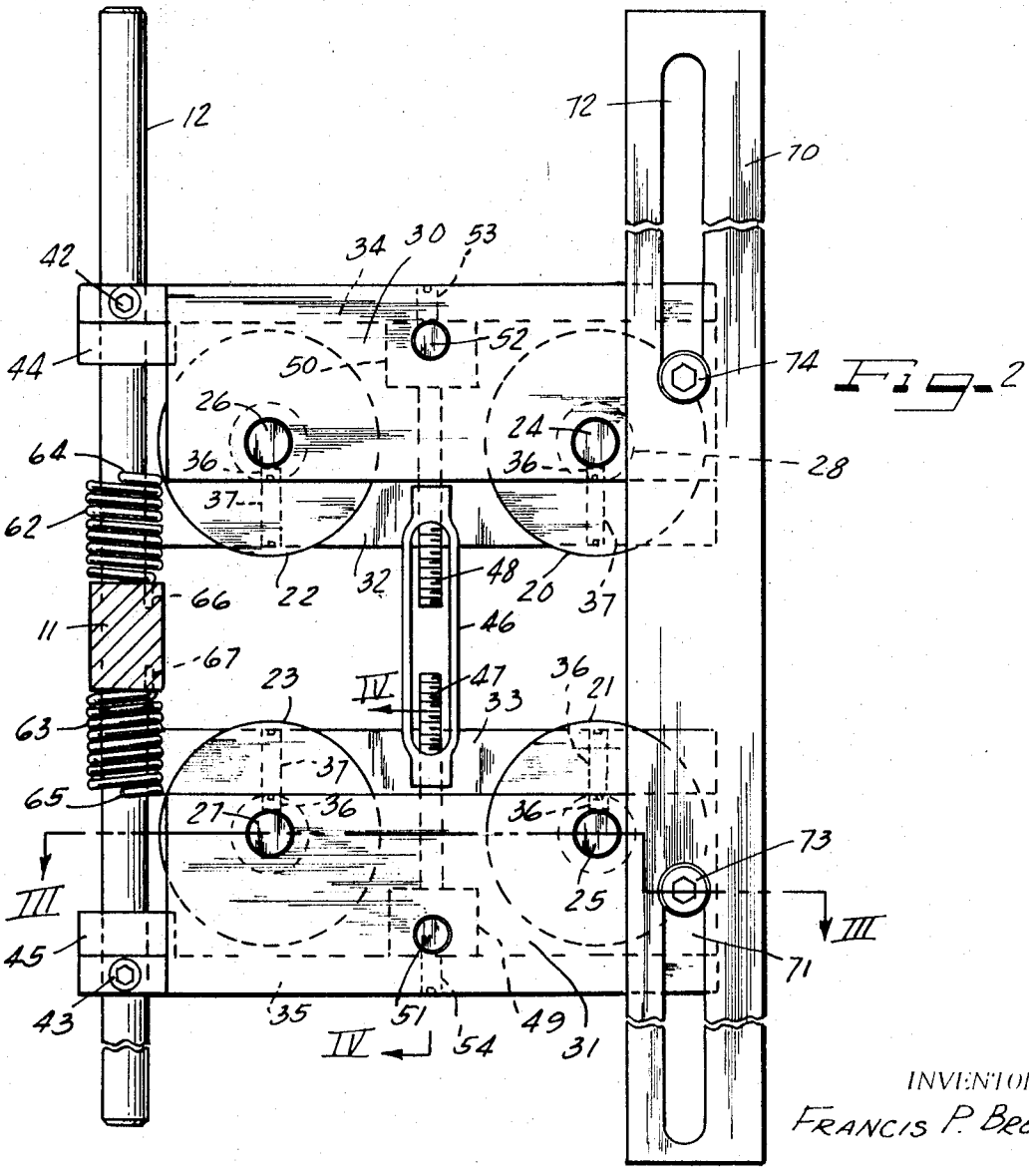
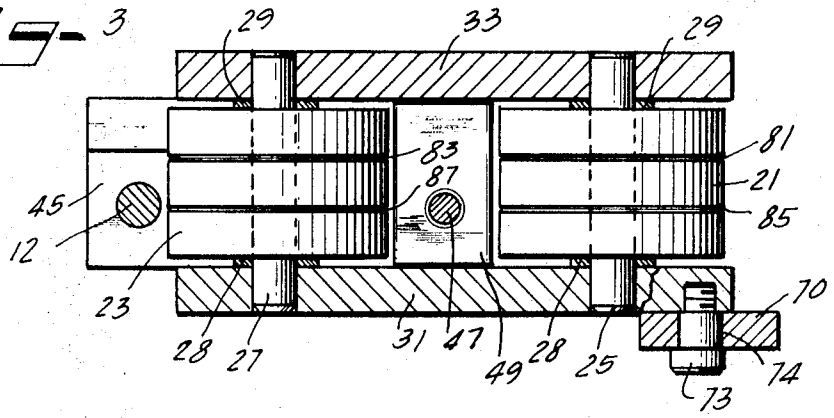


Fig. 2

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Fig. 3



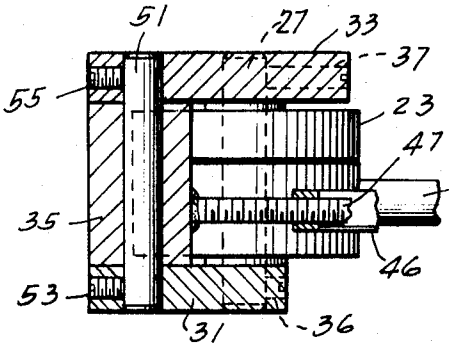


Fig. 4

Fig. 5



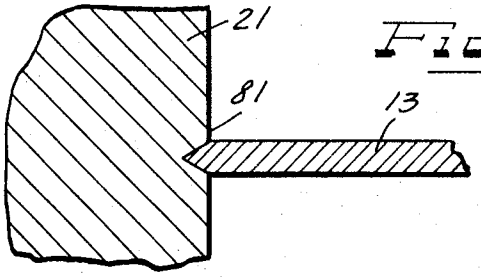


Fig. 6

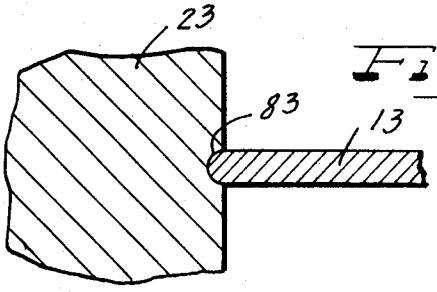


Fig. 7

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EDGE ROLLING MECHANISM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to a mechanism for conditioning the edges of coil stock so that burrs and sharp edges are minimized. In particular this invention relates to a free-floating apparatus which through a two stage rolling process converts the usually acute and rough edges of cut coil stock into round smooth edges free of burrs and sharp edges.

2. Prior Art

It is the practice to produce relatively narrow widths of coil stock say 4 to 7 inches, by cutting them from much wider stock such as 60 to 84 inches. This cutting process usually leaves the narrower rows with generally square edges that have burrs and sharp edges which may easily cut softer materials brought into contact with it. In many cases the end use of the coil stock dictates that smooth and rounded edges be used. Examples of the latter situation are where the coil stock is used to make products which are likely to come into contact with unprotected human flesh or materials which could be snagged or torn.

Heretofore stock with rounded edges has been made by rolling wire between two presses so that the rounded edges of the wire were carried out to the edges of the rolled stock. Other methods have involved abrading the edges of rough stock. Heat treating has also been used, but is very expensive and not too effective. All of the above noted methods are expensive and present serious shortcomings when the stock material is galvanized metal. Flat stock may not be formed from a galvanized wire therefore this wire forming method is eliminated. Abrading the edges leaves occasional needle points and also removes an excess amount of the protective galvanizing and therefore it also is not effective. Likewise heat-treating tends to oxidize the ungalvanized areas and may produce noxious and toxic fumes. In the area of rolling edges a generally followed solution is to double over the edges of the material, however in many applications this reduces the working capabilities of the stock and makes its impractical for use in certain areas. Conditioning of the edges of slitted or sheared material has been difficult, time consuming and expensive.

SUMMARY OF THE INVENTION

To perform the conditioning of metal edges without power of its own and especially the edges normally received in rolls, I have invented an edge rolling mechanism that is simply operated with power already available, easy to maintain and inexpensive to construct. It allows adjustability to accept a wide range of material widths, is counterbalanced to accept the input of material from various sources and angles and has a roller means that is pivotally mounted to provide even pressure and to accommodate lateral variations in the edges of the materials passing through the mechanism.

The above-noted advantages and flexibility are provided by a mechanism that comprises two sets of spaced grooved rollers mounted on axles that are held in a pivotal frame system generally including first and second upper and lower frame members and a guide means. The pivotal frame system itself is pivotally mounted on a rigid frame system that includes a mounting rod, first and second side frame members and a side frame spacing means. Since two sets of rollers are used, and since the pivot point of the frame member to which the rollers are connected is in the central position of the frame member, the rollers will always apply even pressure to the edges of the material they condition.

The grooves in the first set of rollers through which the edges of the material pass preferably have a V-shaped configuration. In practice for a galvanized strip material, I have found that a V-shaped groove having an included angle of about 60° gives excellent results. The final groove should be rounded to leave a smooth edge throughout the entire length of the strip. It is to be understood that the particular configuration of the grooves including the depth thereof may vary for different

materials in accordance with the principles of this invention. The grooves are generally circumferential about the roller means and will generally be in the plane of the material edges. Each roller may have one or more grooves thereon and these grooves may be of the same or different configuration. Since only one groove will probably be used at a time the other unworn or unused groove or grooves will be available for later use. Subsequent use of the stored grooves may be effected by inverting or changing the positioning of the rollers.

Flexibility in use is provided by the lateral adjustment of side frame members along the mounting rod so that various widths of material may be accommodated with uniform pressure maintained at all contact areas.

Counterbalancing the mechanism about a mounting bracket and the mounting bracket allows great flexibility in the angles of material input. The means for effecting the counterbalancing may be a torsion spring positioned around the mounting rod and having one end attached thereto and the other end attached to the mounting bracket. Other equivalent counterbalancing means may be substituted therefore in accordance with the principles of this invention. This very simple and even adjustment is accomplished through the use of a turnbuckle attached centrally to the socket frames of the pivots.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational side view of the apparatus in combination with two power rolls which pull the stock from a coil and through the mechanism;

FIG. 2 is a view of the mechanism of FIG. 1 taken along the lines II–II of FIG. 1;

FIG. 3 is a cross-sectional view taken substantially along the lines III–III in FIG. 2 with parts in elevation;

FIG. 4 is a cross-sectional view taken along the lines IV–IV of FIG. 2;

FIG. 5 is an enlarged cross section edge view of a typical stock material edge configuration;

FIG. 6 is an enlarged view of the initial V-shaped roller groove which brings the sharp side toward the smooth side of the edge; and

FIG. 7 is an enlarged view of the final U-shaped roller groove through which the stock is pulled to give it a uniformly smooth edge.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows an edge-rolling apparatus generally indicated at **10**, in combination with a set of straightening rolls of the "Littell" type having a pair of power rollers **14**, **15** which rotate in clockwise and counterclockwise direction respectively to pull the stock material **13** from a coil **19**, through the edge-rolling apparatus **10**. A motor **16** is schematically indicated as providing the driving force to the rollers **14**, **15**. A support **17** has an edge **18** adapted to receive a mounting clamp **11** that is attached to a mounting rod **12** on the edge-rolling apparatus **10**. The mounting clamp **11** is pivotally mounted on the mounting rod **12** and has torsion springs counterbalancing the weight of the apparatus **10** so that the apparatus is completely "free-floating." This free-floating position of the apparatus **10** allows the apparatus to accommodate variations in the vertical approach of the material into the rollers.

Referring to FIG. 2, the spaced positioning of a plurality of generally cylindrical rollers **20**, **21** and **22**, **23** respectively, may be seen. Each of the rollers has at least one set of grooves therein as are best seen in FIG. 3 and the grooves may have different configurations as seen in FIGS. **6** and **7**. Rollers **20** and **21** are situated opposite of each other and together provide the first stage through which the edges of the material or strip pass. The first pair of rollers **20** and **21** turn on vertical axles **24** and **25** respectively as the material passes between them. For purposes of the description of the relative relationship of the various parts of the apparatus the concepts of "vertical" and "horizontal" are used; however, this is not to be

construed as limiting the invention since other orientations are contemplated.

A second pair of rollers **22, 23** turning on vertical axles **26** and **27** respectively, form the second state through which the edges of the material pass. As may be seen from FIG. **3**, the rollers may be spaced from the frame members by lower and upper bushings **28** and **29** respectively.

The axles **24** and **26** are anchored at their lower ends in a first lower frame member **30** by lower frame member axle securing means **36**. A first upper frame member **32** and upper axle securing means **37** serve to secure the upper ends of the axles **24** and **26** so that the axles will be securely positioned between the frame members.

The opposite axles **25** and **27** likewise have their lower ends secured in a second lower frame member **31** by the securing means **36** and their upper ends secured in a second upper frame member **33** by axle securing means **37**. It is to be understood that, in the alternative, the axles may be a part of the rollers and turn with the rollers so that the axle securing means would be replaced by ball bearings or a similar friction reducing connection.

While the axles **24, 26, 25** and **27** provide rigid spacing between their respective frame members, a third connector means **52, 51** for each first and second frame respectively, is provided. The third connector means **52, 51** not only serves to space the corresponding frame members but establishes points at which pressure is applied to the side frame members **34, 35** respectively.

The third connector means **51, 52** have their lower ends secured to the first and second frame members **30, 31** respectively by a securing means **53, 54**. Their upper ends are similarly secured to frame members **32, 33** by a securing means **55, 56** to provide rigidity between the frame members. These securing means may be of any conventional construction and as shown are Allenhead set screws.

The first and second side frame members **34, 35** have attached thereto a side frame connector block **50, 49** respectively which provides a sturdy and convenient means for allowing pivotal movement between the side frames and the first and second upper and lower frames about the third connector means. This pivotal movement is important in obtaining maximum effectiveness to assure that uniform pressure is applied to the edges of the stock by each of the four rollers.

One end of each of the side frame members **34, 35** may have a thickened portion **44, 45** in the area where the mounting rod **12** passes through the side frame. This extra thickness may be provided to insure adequate bearing on the mounting rod **12** and to lend rigidity to the aligned connection therebetween. The side frame members are slidably mounted on rod **12** and are locked in place by a frame mounting rod securing means **42, 43** on each side frame member **34, 35** respectively. A side frame spacing means and frame rigidifying means is provided by the roller width adjustment means **46** which operates in cooperation with the first and second width adjustment connectors **48** and **47** respectively. The connectors **47, 48** are mounted at one end to their respective side frame blocks and project towards each other so that these other ends, normally threaded, may be engaged by the width adjustment means shown by way of example in the drawings as a turnbuckle structure.

There is thus provided a rigid frame work including the mounting rod **12**, the first and second side frame members **34, 35** and the side frame width adjustment means **46, 47** and **48** that are secured in fixed relation to each other. This frame work is secured to a set of motor driven straightening rolls at the entrance side here shown (FIG. **1**) in the configuration of an upstanding edge **18**, by means of the spring biased mounting clamp **11**. The mounting clamp **11** is of an appropriate configuration and construction at its support engaging end to completely and securely mount the apparatus with one screw in less than 20 seconds.

An upper portion of clamp **11** slidably receives the mounting rod therethrough (FIG. **2**). To provide what may be termed a "free-floating" mounting, a first and second torsion spring means, **62** and **63**, are provided adjacent the clamp, with each spring means **62, 63** having an end **66, 67** respectively mounted in the clamp and an end **64, 65** attached to the mounting rod. In effect, this spring counterbalances the weight of the mechanism **10** about the mounting rod **12** so that the mechanism will appear to float.

To keep the pivotal first and second frame members in spaced relation I have provided at the rear portion of the frame members **30** and **31** a frame member guide means **70**. Slots **71, 72** are of slightly greater width than the shoulder portion of shoulder bolt-type connectors **73, 74** which extend through the slots **71, 72** respectively to connect the guide means **70** to the frame members **30, 31**. As may be seen in FIGS. **2** and **3**, the slots **71** and **72** accommodate a wide range of roller width adjustment movement.

It may now be seen that my invention embodies two frame systems, a rigidly connected one and a pivotally connected one. The rigid frame system includes the mounting rod **12**, the first and second side frame members **34, 35** adjustably connected at one end to the rod **12** and the side frame width adjustment means **46—50** rigidly connected to the side frame members **34** and **35**. In the pivotally connected frame the first frame members **30, 32** and the second frame members **31, 33** are each kept in vertically spaced relation by the roller axles **24, 26** and **25, 27** respectively. The first frame members **30, 32** pivot about the connector **52** while the second frame members **31, 33** pivot about the connector **51**. The lower frame guide means **70** tends to coordinate the movement of the pivotal frame members **30, 31** in relation to each other. With the pivot points **51, 52** fixed in the rigid frame system the pivotal system and the rollers supported thereon may move to compensate for possible lateral curvature of the coil stock passing therethrough. Flexibility of the apparatus is thus present in the lateral width adjustment of the rollers, in the pivotal "free-floating" suspension which allows the mechanism to adjust to possible variations in the angle of feed input and in the pivotal mounting of the roller supports that allows the apparatus to compensate for minor lateral deviations in the material passing through the rollers.

I have found a two-stage apparatus to provide excellent edge conditioning where the grooves **81** in the first set of rollers **20, 21** or first stage, have a V-shaped configuration as is shown in FIG. **6** while grooves **83** in the second set of rollers **22, 23** or second stage have a U-shaped configuration as shown in FIG. **7**. FIG. **5** illustrates in enlarged detail a typical edge configuration that may be present in unconditioned stock. These burrs are smoothed, for example, and the edges are rounded as shown in FIGS. **6** and **7**, so that the edges will not cut materials which may come into contact with them.

As may be seen in FIG. **3** the rollers have at least two sets of grooves thereon while in FIG. **4** it may be seen that a strip would pass through only one set of grooves. I have provided multiple grooves in this arrangement so that as the grooves wear, the rollers may be inverted to obtain "new" grooves. The "stored" grooves **85, 87** need not be of a similar configuration as the other groove or grooves on the same roller, but may be varied as suits operational design. While I have shown two grooves it is contemplated that a greater or lesser number may be provided.

From the foregoing description of the construction of my invention, it may be seen that I have produced a simple, convenient flexible and economical edge rolling mechanism. Although minor modifications might be suggested by those versed in the art, it should be understood that I wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of my contribution to the art.

I claim:

1. A material edge conditioning mechanism including a rigid frame system, said rigid frame system being pivotally connected to a rigid mounting means so that it is substantially free floating for movement in a first plane a pivotal frame

system mounted on said rigid frame system for pivotal movement relative to said rigid frame system in a second plane normal to said first plane, a roller means including at least a pair of spaced rollers, said roller means being rotatably connected to said pivotal frame system, said spaced rollers each having grooves therein, said grooves being adapted to receive and condition the opposite edges of a strip of material passing therebetween.

2. A material edge conditioning mechanism according to claim 1 wherein said rigid frame system includes a mounting rod positioned generally transverse to said strip of material passing therebetween, first and second side frame members adjustably connected at one end to said rod, said side frame members being generally normal to said mounting rod, a side frame width adjustment means connecting said side frame members; said pivotal frame system including a first lower frame member, a first upper frame member, a second lower frame member, and a frame member guide means; said first frame members being spaced on opposite sides of said first side frame member and pivotally connected thereto in their mutually central areas, said second frame members being spaced on opposite sides of said second side frame member and being pivotally connected thereto about their mutually central areas, said frame guide means being connected between said first and second lower frame members to coordinate the movement therebetween, at least one roller being rotatably connected between said spaced upper and lower first frame members and at least one roller being rotatably connected between said spaced second upper and lower frame members whereby the opposite edges of a strip of material pass between said rollers.

3. A material edge conditioning mechanism according to claim 1 wherein said mounting means includes torsion spring means for counterbalancing said rigid frame system about said mounting means whereby said rollers may accommodate themselves to varying longitudinal angles of entry of said strip material between said rollers.

4. A material edge conditioning mechanism according to claim 1 wherein said roller means comprises first and second pairs of oppositely spaced rollers, said rollers of each pair being adapted to receive the edge of the material passing therebetween and condition said edges to a desired configuration, a first roller of each of said pairs of rollers being supported by first upper and lower frame members, and a second roller of each of said pairs of rollers being supported by second upper and lower frame members, said first and second frame members being pivotally attached to said rigid frame system so that the first and second frame members may move relative to each other to accommodate lateral variations in the angle of entry of the strip material passing through said first and second pairs of rollers, and to provide even pressure on the material edges.

5. A material edge conditioning mechanism according to claim 4 wherein the first and second frame members each comprise an upper and lower portion, axles extending between said upper and lower members, said first roller of each pair being mounted on said axles of said first frame between said upper and lower portions and said second roller being mounted on said axles of said second frame between said upper and lower portions.

6 A material edge conditioning mechanism according to claim 4 wherein said first pair of roller means has generally V-shaped grooves therein and said second pair of roller means has generally U-shaped grooves therein so that the conditioning of the material passing therebetween occurs in two stages,

said first and second frame members having a common frame member guide means attached thereto so that said frame members tend to move together.

7. A material edge conditioning mechanism according to claim 6 wherein each said roller means has at least two generally circumferential grooves thereon, one of said grooves being the operative groove and one of said grooves being a "stored" groove so that the position of said roller means may be changed to reverse the functioning of the grooves from operative to stored and stored to operative.

8. A material edge conditioning mechanism according to claim 4 wherein said rigid frame system comprises a mounting rod, first and second side frame members adjustably connected to said mounting bar and side frame spacing means rigidly connected to said side frames,

said side frame members being adapted to be rigidly secured to said mounting rod along a portion of the length of said rod to vary the space between said side frame members, said side frame spacing means also being adjustable to the varying spacing of the side frame members, and

said side frame member having a pivot means along its length to which said first and second frame members are pivotally attached.

9. A material edge conditioning mechanism according to claim 8 wherein said mounting rod has pivotally attached thereto a resiliently biased mounting clamp, said resilient bias acting between said mounting clamp and said mounting rod to counterbalance the weight of said mechanism about said mounting clamp so that said mechanism is free floating.