

Aug. 10, 1943.

L. L. WILSON ET AL

2,326,715

MANUFACTURE OF CENTER STRETCHED STRIPS

Filed Feb. 13, 1941

2 Sheets-Sheet 1

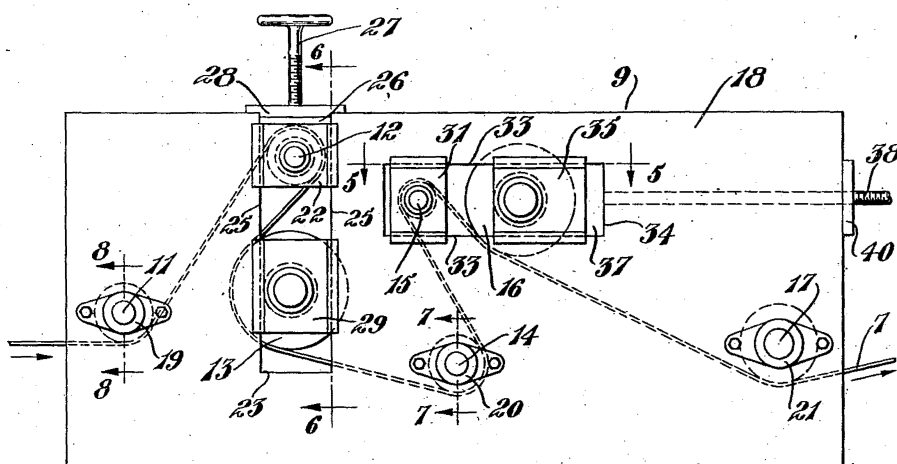


Fig. 4

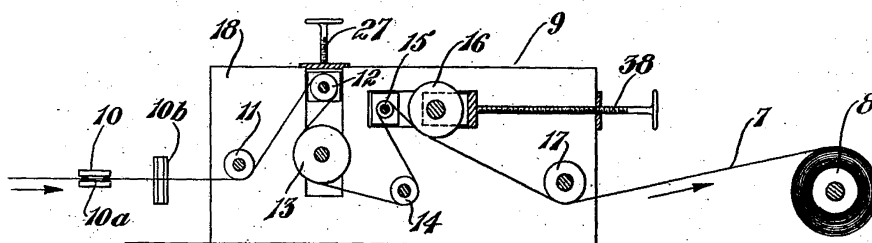


Fig. 1

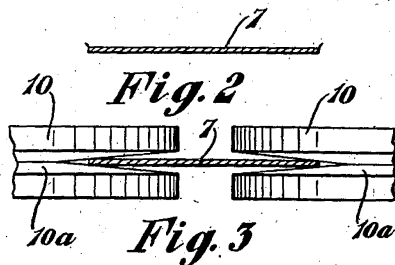


Fig. 2

Fig. 3

Inventors

Lloyd L. Wilson
Harold W. Lowmiller
and Maxwell L. Bible

By *Frederic Bishop* Attorneys

Aug. 10, 1943.

L. L. WILSON ET AL

2,326,715

MANUFACTURE OF CENTER STRETCHED STRIPS

Filed Feb. 13, 1941

2 Sheets-Sheet 2

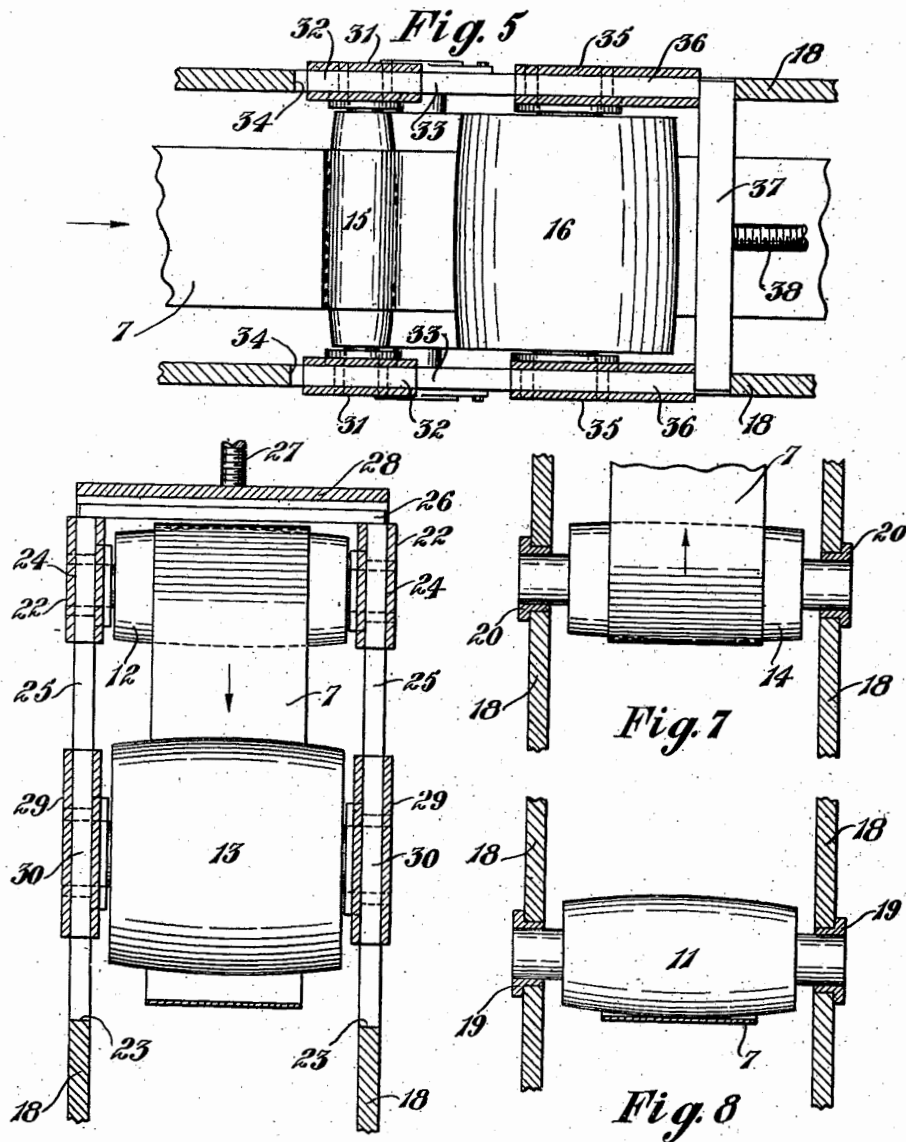


Fig. 6

Inventors
Lloyd L. Wilson
Harold W. Lowmiller
and Maxwell L. Bible
By *Frederic Bishop* Attorney

UNITED STATES PATENT OFFICE

2,326,715

MANUFACTURE OF CENTER STRETCHED STRIP

Lloyd L. Wilson, Sharpsville, and Harold W. Lowmiller, Farrell, Pa., and Maxwell L. Bible, Masury, Ohio, assignors to Sharon Steel Corporation, Sharon, Pa., a corporation of Pennsylvania

Application February 13, 1941, Serial No. 378,778

10 Claims. (Cl. 153—35)

The invention relates to the manufacture of thin, flexible strip having sufficient stiffness and resiliency to snap back or restore itself to its original position when flexed.

More particularly, the invention relates to the manufacture of thin flexible metal strip adapted to maintain itself in a longitudinally straight condition when supported over a relatively long span, and to restore itself to said straight condition when bumped or otherwise flexed between supports.

One example of a use for such strip is the slats in Venetian blinds, wherein slats of thin metal strip are supported over a span of approximately thirty-three inches, and may be curved or bent laterally to a desired shape but are required to be normally straight longitudinally and to snap back or return themselves to said straight condition when flexed or bumped.

It has been found that a Venetian blind slat of thin metal strip made according to conventional practice has a definite tendency to sag or bend longitudinally between supports, and when curved laterally by forming between mating convex and concave rolls, this longitudinal bending may occur in the direction of the lateral curve in which case it is called "down bow," or in the opposite direction in which case it is called "back bow."

It has been found also that the down bow and back bow can be controlled by longitudinally stretching the center of the strip prior to the lateral forming operation to produce a slat which will maintain itself in a straight condition longitudinally over a given span of approximately thirty-three inches, and which when flexed will restore itself or snap back to said straight condition.

Prior to our invention, the required longitudinal center stretching of the strip has been accomplished by drawing a strip through draw blocks or dies prior to the lateral curving or forming operation. However, this drawing operation produces scratches on the surface of the strip unless the drawing dies are carefully and thoroughly cleaned at frequent intervals, which adds materially to the time and expense of the center stretching operation.

We have invented a novel method and apparatus for center stretching thin metal strip so as to eliminate the use of drawing dies and their attendant disadvantages.

It is therefore an object of the present invention to provide a novel and economical method of producing a center stretched metal strip without surface scratches.

A further object is to provide a novel method of continuously roller stretching the center of a thin metal strip longitudinally.

Likewise, it is an object of the present invention to provide a method of providing a center stretch in thin strip material without producing any permanent longitudinal bow in the material.

Another object is to provide a novel apparatus for continuously center stretching a strip longitudinally thereof without requiring the use of drawing dies.

A further object is to provide a novel arrangement of convex rolls for center stretching a metal strip when passed successively thereover to produce a longitudinally straight and flat strip which may thereafter be laterally curved to have such stiffness and rigidity as to maintain itself in straight condition, and to restore itself to such condition when flexed.

These and other objects are attained by the novel method and apparatus comprising the present invention, which is shown by way of example in the accompanying drawings and hereinafter described in detail and defined in the appended claims.

The present novel method may be stated in general terms as including roller stretching the center of the continuous strip longitudinally by pulling the strip in a sinuous path past and in contact with one after another of a series of convex rolls, and wrapping the strip around a substantial portion of the periphery of certain of said rolls, while maintaining the tension on the strip substantially equal at all of the rolls.

The present novel apparatus may be stated in general terms as including a frame, a series of convex rolls journaled in said frame, means for pulling a continuous strip in a sinuous path successively past and in contact with said rolls, certain of said rolls being so located with respect to other rolls as to cause the strip to wrap around a substantial portion of the periphery of said certain rolls, and certain of said rolls being journaled in bearings having floating mountings in the frame whereby the tensioned pull on the strip adjusts the location of said floating rolls with respect to other of said rolls so that the tension on the strip is substantially equal at all of said rolls.

Referring to the drawings forming part hereof, Figure 1 is a diagrammatic view in longitudinal section of the novel apparatus for center stretching a continuous strip;

Fig. 2 is an enlarged cross sectional view of

the strip prior to its passing through the edge rolls;

Fig. 3 is a fragmentary sectional view through the strip at the edge rolls;

Fig. 4 is an enlarged side elevation of the frame of the apparatus, showing the manner of mounting the various rolls therein;

Fig. 5 is an enlarged fragmentary plan sectional view as on line 5—5, Fig. 4;

Fig. 6 is an enlarged fragmentary vertical sectional view as on line 6—6, Fig. 4;

Fig. 7 is an enlarged fragmentary sectional view as on line 7—7, Fig. 4; and

Fig. 8 is an enlarged sectional view as on line 8—8, Fig. 4.

Similar numerals refer to similar parts throughout the drawings.

A thin continuous strip to be center stretched longitudinally is indicated at 7, and may be strip steel, although the invention may be applied to strips of other materials. The strip 7 is pulled through the improved center stretching apparatus by means of a usual coiler or take-off reel indicated diagrammatically at 8, for imposing a tensioned pull on the strip.

The novel center stretching apparatus is indicated generally at 9, and at the entrance side thereof combined centering, guide and edge rolls indicated at 10 are provided for removing the sharp edges or burrs from the side edges of the strip and for centering and guiding the strip into the stretching apparatus 9. These edging rolls preferably have tapered or V-shaped annular grooves 10a into which the edge of the strip is entered for being edge rolled and guided.

Wipers 10b may be interposed between the rolls 10 and stretching apparatus 9 to remove dirt and dust from the strip and may be adjusted for back tensioning the strip if desired.

As shown in Fig. 1 the center stretching apparatus 9 includes a plurality of rolls 11, 12, 13, 14, 15, 16 and 17 over which the strip 7 passes successively, and as shown in Figs. 5 to 8 inclusive, all of these rolls except 17 have convexly curved peripheries or outer rolling surfaces. Roll 17 is a cylindrical roll and has a flat rolling surface.

As shown, the rolls are journaled in side frame plates 18 and are irregularly staggered with respect to each other, so that the strip 7 in passing over and around and in contact with the rolls follows a sinuous and irregular path. Rolls 11, 14 and 17 are journaled in fixed bearings 19, 20 and 21 respectively secured to the side plates 18 in a usual fashion.

Roll 12 is located above the level and forwardly of roll 11, and is preferably journaled in end bearing plates 22 which are vertically adjustable in the side plates 18. Preferably, the side plates 18 are slotted vertically as indicated at 23 and the bearing plates 22 are provided with end grooves 24 slidably engaging the edge portions 25 of side plates 18 defining the slotted opening 23. Means for vertically adjusting the bearing plates 22 may include a transverse movable plate 26 connecting the end bearing plates 22 and having the end of an adjusting screw 27 rotatably secured therein, the screw 27 being threaded through a fixed plate 28 extending transversely between the side plates 18 and secured to the upper ends thereof.

Accordingly, the vertical position of roll 12 can be adjusted by turning the screw 27 to raise or lower the movable plate 26 and the end bearing plates 22 to which it is connected.

Roll 13 is mounted substantially directly below roll 12 and is provided with a vertically floating mounting. Preferably the end bearing plates 29 for the roll 13 are provided with grooves 30 at their side edges slidably engaging the edge portions 25 of the side plates 18 so that the roll 13 is free to move up and down in the slot 23, its position being determined by the amount of tension on the strip 7 which wraps around a portion of the periphery of said roll 13. The diameter and location of roll 13 is such as to direct the strip downwardly and rearwardly from roll 12.

Roll 14 is located in a position spaced from and forwardly of roll 13 for directing the strip forwardly and slightly downwardly from roll 13.

Roll 15 is provided with a horizontal floating mounting in the side plates 18, and as shown the roll 15 is located rearwardly of roll 14 and above the same for directing the strip upwardly and rearwardly from roll 14. The end bearing plates 31 for the roll 15 are provided with grooves 32 at their top and bottom edges, which grooves slidably engage the top and bottom edges 33 of a horizontal slot 34 formed in the side plates 18, so that the roll 15 has a horizontal floating mounting similar to the vertical floating mounting of roll 13, its position being determined by the tension on the strip 7 which wraps around approximately half of the periphery of the roll.

Roll 16 is located forwardly of roll 15 for directing the strip downwardly and forwardly from roll 15. Roll 16 preferably has a horizontally adjustable mounting similar to the vertically adjustable mounting of roll 12. The end bearing plates 35 for roll 16 preferably are provided with grooves 36 at their top and bottom edges slidably engaging the top and bottom edges 33 of the side plates 18 which define the slot 34. A transverse movable plate 37 extends between the side plates 18 and is connected to the end bearing plates 35, and an adjusting screw 38 is rotatably secured at one end in the transverse plate 37 and threaded through a fixed plate 40 extending transversely between and secured to the ends of the side plates 18.

As clearly shown in Figs. 1 and 4, the strip 7 passes under and with its upper surface in contact with roll 11 and then upwardly over and with its lower surface in contact with roll 12 and then downwardly and rearwardly around and with its upper surface in contact with roll 13. The relative sizes and locations of rolls 11, 12 and 13 are such that the strip wraps around a substantial portion of the periphery of roll 12, said portion being approximately half of the periphery of said roll.

From under the floating roll 13, the strip passes forwardly under and around fixed roll 14 with its upper surface in contact with a portion of the periphery thereof and thence upwardly and rearwardly to wrap around and over floating roll 15 with its lower surface in contact with a substantial portion thereof, and then downwardly and forwardly under and with its upper surface in contact with roll 16, from which it passes under and with its upper surface in contact with cylindrical roll 17 and thence to the take off reel 8. The relative sizes and locations of rolls 14, 15, and 16 are such as to cause the strip to wrap around a substantial portion of the periphery of floating roll 15, and in the illustrated positions of the rolls the strip wraps around slightly less than half of the periphery of floating roll 15.

The several rolls of the novel apparatus have

different diameters and different degrees of convex curvature in order to roller stretch the center portion of the strip longitudinally in such manner that the strip emerges from the apparatus with its center portion longitudinally stretched to the desired extent of imparting such resiliency and stiffness to the strip after subsequently being laterally curved as will cause it to maintain itself in a longitudinally straight condition and to restore itself to such condition when bumped or flexed.

With the particular arrangement of rolls shown in the drawings, we have found that best results are obtained by making the rolls of the following specific diameters (measured at center of roll face) and specific radii of convex curvature:

Roll	Diameter	Radius of curvature
	Inches	Inches
11.....	1.490	10
12.....	1.470	16
13.....	2.992	10
14.....	1.465	20
15.....	.900	12
16.....	2.990	24
17.....	2	Flat

The tensioning pull on the strip 7 causes the floating rolls 13 and 15 to automatically adjust their positions to equalize the tension on the strip and control the direction of the strip between the fixed rolls adjacent thereto, and when the rolls 12 and 16 are adjusted by means of screws 27 and 38 respectively, the floating rolls 13 and 15 will change their positions accordingly under the tension on the strip to equalize the tension on the strip between the next preceding and following rolls, that is, floating roll 13 equalizes the tension between fixed rolls 12 and 14, and floating roll 15 equalizes the tension between fixed rolls 14 and 16.

According to the present invention, thin metal strip having the desired amount of center stretch and after being subsequently laterally curved, having the corresponding snap back and stiffening characteristics, has been produced in actual practice by pulling the same through the novel apparatus shown and in the manner described herein.

The degree of convex curvature of the various rolls in combination with the amount of wrapping around the peripheries of certain of the rolls due to their relative sizes and locations is largely responsible for producing the required amount of center stretching in the strip. This amount of center stretching can be varied by adjusting the location of the adjustable rolls 12 or 16 and by varying the size or degree of convex curvature of one or more of the rolls.

Moreover, an increment of the stretch occurs in each strip portion extending between each successive pair of rolls, and particularly between rolls 12 and 13, 14 and 15, and 15 and 16, as the strip is being pulled past and in contact with the rolls under tension. Also an increment of the total center stretch occurs in the portion of the strip which is in contact with each roll and particularly at rolls 12, 13, 15 and 16. The sum or total of these stretch increments equals the total amount of center stretch imparted to the strip.

As the total amount of center stretch is a minute quantity and difficult to measure, no exact value of the same can be stated. However, its existence in the strip is evident by pressing the

center of a center stretched strip and visibly and audibly noting the snap occurring in the strip.

With the present improved method and apparatus, we have found that metallic strip which has been coated, such as for example galvanized, tin coated, terne coated, and painted strip steel, can be satisfactorily center stretched. This due to the fact that the stretching is done entirely by rolling contact, whereas any prior center stretching methods and apparatus of which we are aware cause a drag on the coating and produce scratches and the like on the surface of the strip.

The novel method and apparatus of the present invention provides a novel and economical method of producing longitudinally center stretched strip which is free from surface scratches, without requiring the use of drawing dies, such strip after being subsequently laterally curved having sufficient stiffness and rigidity to maintain itself in longitudinally straight condition and to restore itself or snap back to such condition when flexed.

We claim:

1. Apparatus for center stretching a strip longitudinally thereof including a frame having laterally spaced side plates, a series of irregularly staggered convex rolls journaled at their ends in said side plates, means for pulling a continuous strip in a sinuous path successively past said rolls with its upper surface in contact with certain of said rolls and with its lower surface in contact with others of said rolls, and floating mountings in said side plates for certain of said rolls whereby the tensioned pull on the strip adjusts the location of said floating rolls with respect to the non-floating rolls to control the direction and equalize the tension on the strip between said non-floating rolls.

2. Apparatus for center stretching a strip longitudinally thereof including a frame having laterally spaced side plates, a series of irregularly staggered convex rolls journaled at their ends in said side plates, means for pulling a continuous strip in a sinuous path successively past said rolls with its upper surface in contact with certain of said rolls and with its lower surface in contact with others of said rolls, certain of said rolls being so located with respect to others of said rolls as to cause the strip to wrap around a substantial portion of at least one roll to substantially reverse the direction of the path of the strip at said one roll, and floating mountings in said side plates for certain of said rolls whereby the tensioned pull on the strip adjusts the location of said floating rolls with respect to the non-floating rolls to control the direction and equalize the tension on the strip between said non-floating rolls.

3. Apparatus for center stretching a strip longitudinally thereof including a frame having laterally spaced side plates, a series of irregularly staggered convex rolls journaled at their ends in said side plates, means for pulling a continuous strip in a sinuous path successively past said rolls with its upper surface in contact with certain of said rolls and with its lower surface in contact with others of said rolls, certain of said rolls being so located with respect to others of said rolls as to cause the strip to wrap its upper surface around one of said rolls to substantially reverse the direction of the path of the strip at said one roll, and to wrap its lower surface around another of said rolls to substantially reverse the direction of the path of the strip at said other

roll, and floating mountings in said side plates for certain of said rolls whereby the tensioned pull on the strip adjusts the location of said floating rolls with respect to the non-floating rolls to control the direction and equalize the tension on the strip between said non-floating rolls.

4. Apparatus for center stretching a strip longitudinally thereof including a frame, a series of convex rolls journaled in said frame, means for pulling a strip past and in contact with one after another of said rolls, said series of rolls including a first roll for engaging the upper surface of said strip, a second roll journaled above and forwardly of said first roll for engaging the lower surface of said strip, a third roll spaced below said second roll for engaging the upper surface of said strip and directing the strip downwardly and rearwardly from said second roll, means providing a vertically floating journal mounting for said third roll, a fourth roll journaled forwardly of said third roll for engaging the upper surface of said strip, a fifth roll spaced above and rearwardly of said fourth roll for engaging the lower surface of said strip and directing the strip upwardly and rearwardly from said fourth roll, means providing a floating journal mounting for said fifth roll, and a sixth roll spaced forwardly of said fifth roll for engaging the upper surface of said strip and directing the strip downwardly and forwardly.

5. Apparatus for center stretching a strip longitudinally thereof including a frame, a series of convex rolls journaled in said frame, means for pulling a strip past and in contact with one after another of said rolls, said series of rolls including a first roll having a maximum diameter of 1.49" and a radius of convex curvature of 10" for engaging the upper surface of said strip, a second roll having a maximum diameter of 1.47" and a radius of convex curvature of 16" journaled above and forwardly of said first roll for engaging the lower surface of said strip, a third roll having a maximum diameter of 2.992" and a radius of convex curvature of 10" spaced below said second roll for engaging the upper surface of said strip and directing the strip downwardly and rearwardly from said second roll, means providing a vertically floating journal mounting for said third roll, a fourth roll having a maximum diameter of 1.465" and a radius of convex curvature of 20" journaled forwardly of said third roll for engaging the upper surface of said strip, a fifth roll having a maximum diameter of .900" and a radius of convex curvature of 12" spaced above and rearwardly of said fourth roll for engaging the lower surface of said strip and directing the strip upwardly and rearwardly from said fourth roll, means providing a horizontally floating journal mounting for said fifth roll, and a sixth roll having a maximum diameter of 2.990" and a radius of convex curvature of 24" spaced forwardly of said fifth roll for engaging the upper surface of said strip and directing the strip downwardly and forwardly.

6. Apparatus for center stretching a strip longitudinally thereof including a frame, a series of convex rolls journaled in said frame, means for pulling a strip past and in contact with one after another of said rolls, said series of rolls including a roll for engaging the lower surface of said strip, a second roll spaced below said first roll for engaging the upper surface of said strip and directing the strip downwardly and rearwardly from said first roll, means providing a

vertically floating journal mounting for said second roll, a third roll spaced above and forwardly of said second roll for engaging the lower surface of said strip and directing the strip upwardly, means providing a horizontally floating mounting for said third roll, and a fourth roll journaled forwardly of said third roll for engaging the upper surface of said strip and directing it downwardly from said third roll.

7. Apparatus for center stretching a strip longitudinally thereof including a frame, a series of convex rolls journaled in said frame, means for pulling a strip past and in contact with one after another of said rolls, said series of rolls including a roll having a maximum diameter of 1.47" and a radius of convex curvature of 16" for engaging the lower surface of said strip, a second roll having a maximum diameter of 2.992" and a radius of convex curvature of 10" spaced below said first roll for engaging the upper surface of said strip and directing the strip downwardly and rearwardly from said first roll, means providing a vertically floating journal mounting for said second roll, a third roll having a maximum diameter of .900" and a radius of convex curvature of 12" spaced above and forwardly of said second roll for engaging the lower surface of said strip and directing the strip upwardly, means providing a horizontally floating journal mounting for said third roll, and a fourth roll having a maximum diameter of 2.990" and a radius of convex curvature of 24" journaled forwardly of said third roll for engaging the upper surface of said strip and directing it downwardly from said third roll.

8. The method of continuously longitudinally center stretching a strip to impart a permanent longitudinal center stretch therein, which includes continuously looping the strip under tension substantially upon itself in alternately opposite directions, maintaining the strip laterally curved as it is being looped, and yieldingly deflecting the path of the strip between said loops to equalize the tension on the strip between said loops and to longitudinally stretch the center of the strip.

9. The method of continuously longitudinally center stretching a strip to impart a longitudinal center stretch therein, which includes continuously looping the strip under tension alternately in substantially opposite directions while maintaining the strip laterally curved, and yieldingly deflecting the path of the strip between said loops to equalize the tension on the strip between loops and to longitudinally stretch the center of the strip, and maintaining the strip laterally curved where it is yieldingly deflected.

10. Apparatus for center stretching a strip longitudinally thereof including a frame, a series of irregularly staggered convex rolls journaled at their ends in said frame, means for pulling a continuous strip in a sinuous path successively past said rolls with its upper surface in contact with certain of said rolls and with its lower surface in contact with others of said rolls, and floating mountings in said frame for certain of said rolls whereby the tensioned pull on the strip adjusts the location of said floating rolls with respect to the non-floating rolls to control the direction and equalize the tension on the strip between said non-floating rolls.

LLOYD W. WILSON.
HAROLD W. LOWMILLER.
MAXWELL L. BIBLE.