

[54] **METHOD AND APPARATUS FOR FORMING  
LOOPS OF METAL BAND MATERIALS  
WITH FLOOR TYPE LOOPER**

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[51] Int. Cl. .... **B65h 17/42**

[58] Field of Search ..... 226/113, 114, 118, 119,  
226/158, 160, 1

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*Primary Examiner*—Richard A. Schacher

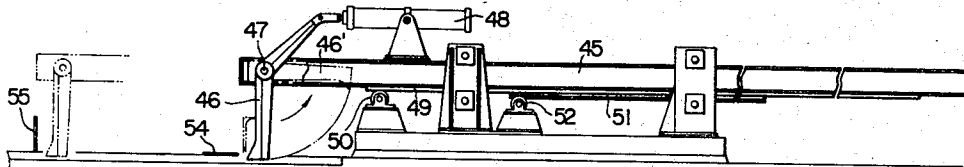
*Attorney, Agent, or Firm*—Wenderoth, Lind & Ponack

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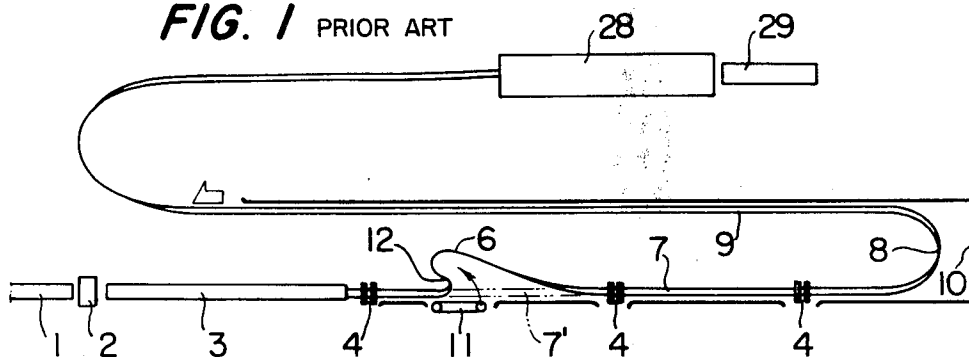
**ABSTRACT**

A method of forming loops of a metal band material, which comprises, when stocking metal band materials in quantities on the floor level of the stock yard, pushing out the side of the metal band with a loop thrower, as said metal band is progressing in its long direction, such pushing out to be done at the inlet onto the floor so as to have it stand up with its surface forming a right angle against the surface of the floor and also to form a new tip of said metal band and pushing said metal band toward the center of the floor by using a plurality of pushers so as to form corrugation patterns of said metal band in the direction of its progress, so as to have it stand stably on the floor.

**4 Claims, 16 Drawing Figures**

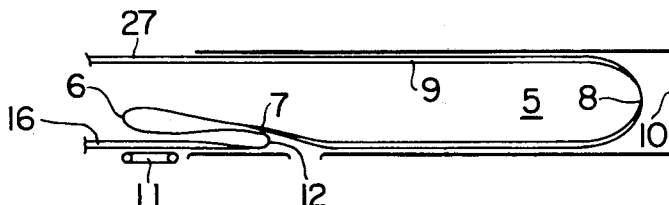


**FIG. 1** PRIOR ART



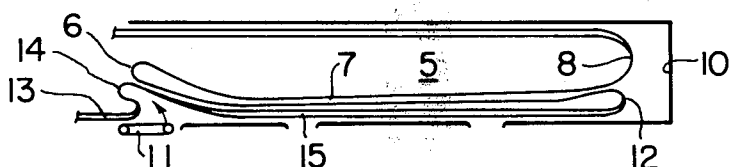
**FIG. 2**

PRIOR ART



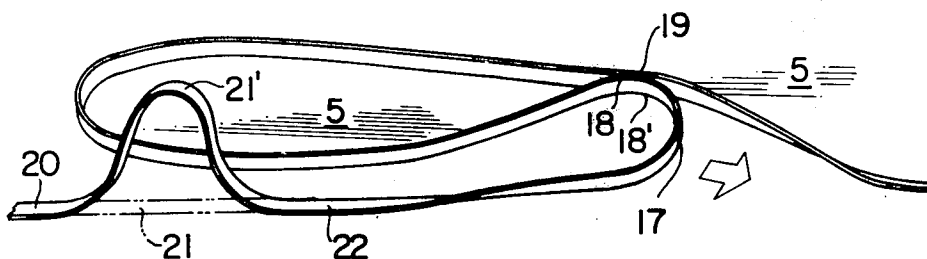
**FIG. 3**

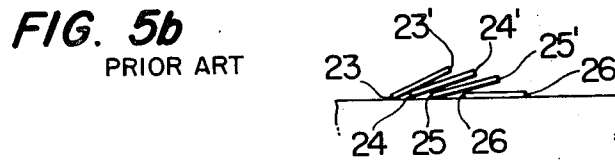
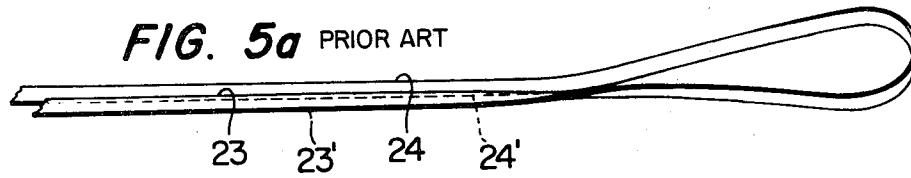
PRIOR ART



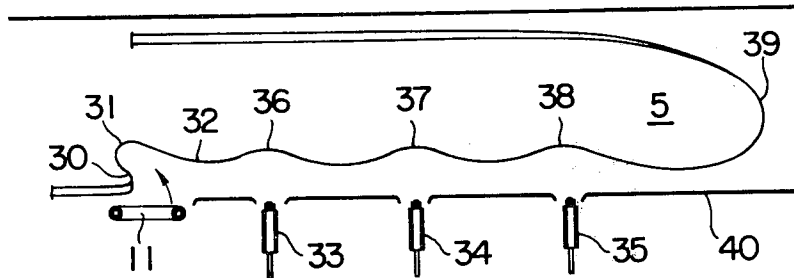
**FIG. 4**

PRIOR ART

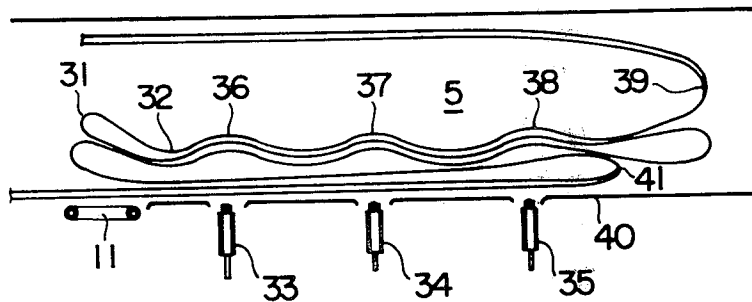




**FIG. 6**



**FIG. 7**



**FIG. 8a**

**FIG. 8b**

**FIG. 8c**

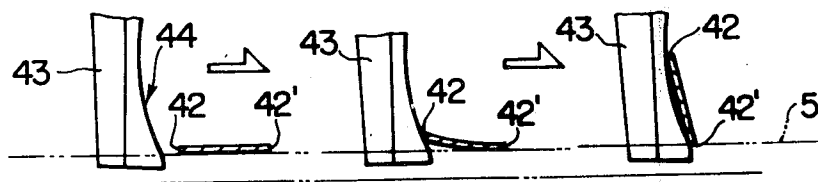


FIG. 9

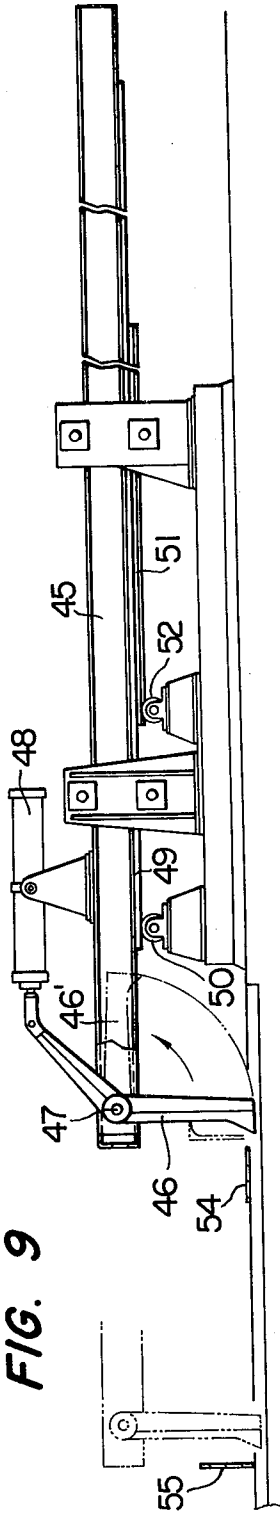


FIG. 10

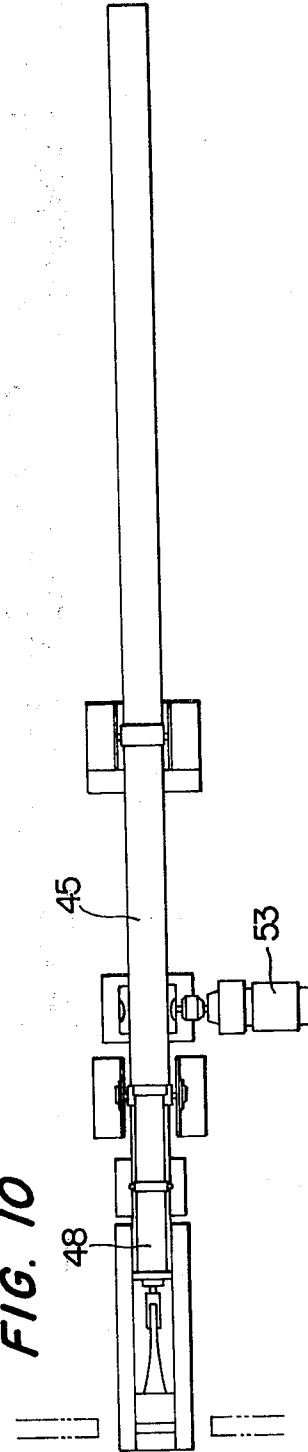


FIG. 12

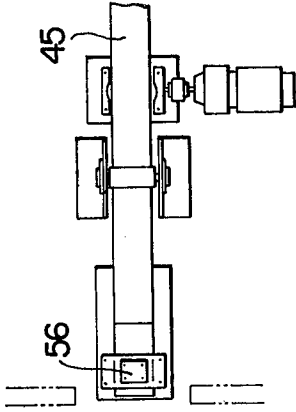


FIG. 11

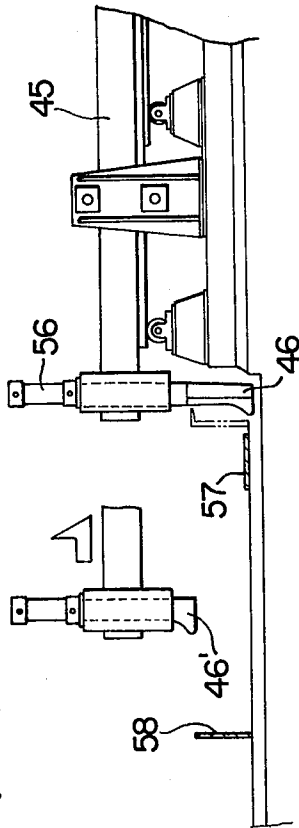
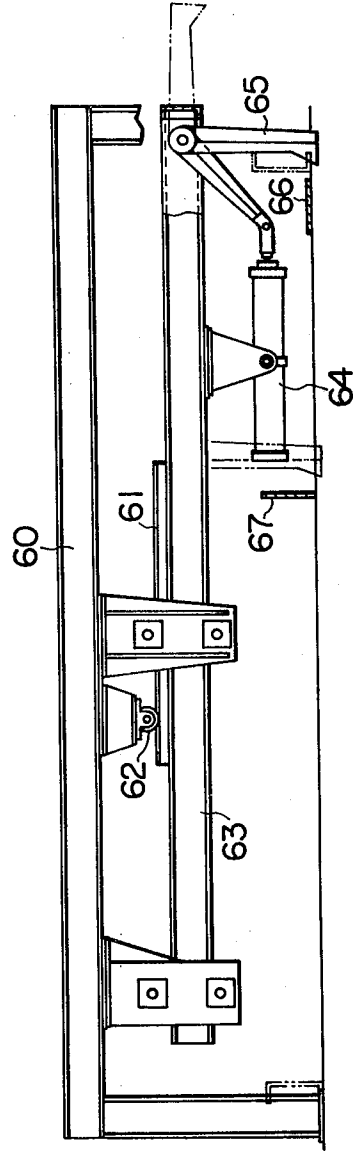


FIG. 13



# METHOD AND APPARATUS FOR FORMING LOOPS OF METAL BAND MATERIALS WITH FLOOR TYPE LOOPER

## BACKGROUND OF THE INVENTION

The present invention relates to a method and an apparatus for forming loops of metal band material such as hoop steel or slitted material to be stocked on the floor.

The following description of the present invention is made by using, as an embodiment, the case of forming loops of a skelp by using a floor type looper in preparation for forge welding into tube. It is noted, however, that the practice of the present invention is possible otherwise than mentioned as the embodiment in the specification.

In the application of skelp to the arrangement for continuous welded tube, the looper functions as follows:

In case a steel tube of 21.7 to 114.3 mm ( $\frac{1}{2}$  in. to 4 in.) in diameter is to be produced, a material skelp is 160 to 420 mm in width, 1.9 to 8.2 mm in thickness and 600 to 700 m in length; in order to have the tube producing machine work most effectively, the length of skelp should desirably be endless.

In other words, while one skelp of the abovementioned dimensions is produced into tube in 7 to 10 minutes by a tube producing machine of high efficiency, the time required for placing the top of the skelp on the machine for the start of the operation is as much as 60 minutes. Needless to say, the more number of skelps of limited length to be set to the machine, the more inefficient; in order to solve such problem, skelps of limited length are welded one after another to make one as long as possible.

In this case, as for skelps of limited length, they are usually coiled. Thus, the time required for welding the end of one skelp with the top of a next one, is about 3 minutes, for which time it is necessary that the supply of skelp should stop or the welder should move in pace with the supply of skelp. As the supply of skelp is made at a high speed (200 m/min. max.), it normally stops for welding. But to stop the tube forming machine during the welding operation is uneconomical, so it becomes necessary to install facilities to stock the so welded skelps in quantities to be set to the tube forming machine while the supply of skelp stops for welding, that is, a looper is provided, thereby making it possible to continue operation of the machine independently from the welding of skelps.

For the conventional method of forming loops of a band material (skelp in this case), refer to FIGS. 1-4, according to which a skelp progresses along the looping floor 5, the skelp being shown by reference numerals 7', 7, 8 and 9. The skelp is moved by means of an entry section 1, a pinch roll 2, a guide roll 3, a magnet roll 4, etc. When the end 8 of a skelp comes near the end 10 of the looping floor 5, the loop thrower 11 set at the inlet onto the floor 5 rotates counter-clockwise to push the skelp to the center of the looping floor 5 for the curve as shown by numerals 12-6-7. As the supply of skelp on the floor 5 continues during this time, the new top 12 of skelp progresses as it pushes aside the preceding part 7 of skelp, forming a new loop. When the top 12 approaches the end 10 of the looping floor 5, the loop thrower 11 works as mentioned above, so that the

skelp takes the position defined 19-14-15-12 as shown in FIG. 3.

The repetition of such action several times makes loops one after another. The quantity of skelp stocked in the form of loops is determined according to the time for welding skelps, as mentioned above. For the supply of skelp at the normal rate of 100 m/min., the stock should be about 300 m, which means six loops if each is 50 m.

This work has the following problems:

A. In FIG. 2, the new top 12 of the skelp pushes aside the preceding part 7 of the skelp, as it progresses. However, it meets great resistance, causing buckling between the parts 16 and 12, which may cause the operation to stop.

More in detail, referring to FIGS. 1 and 2, skelp is pulled by the magnet roll 4 as it is extruded from the entry section 1, but it is driven mainly by the entry section 1 and subsidiarily by the magnet roll 4. As shown in FIG. 4, the top 17 of the skelp progresses in the direction of the arrow, and the parts 18 and 18' of the skelp push the preceding part 19 of the skelp to the middle part of the looper. In this situation, this side of the top 17 of the skelp should take the form of a straight line, as shown by numerals 20-21-22, but it it meets great resistance in pushing aside the preceding part of the skelp, buckling may occur, as shown by numerals 20, 21 and 22. If buckling takes place, the skelp 22-17 stops, making the skelp 20-21'-22 build up so rapidly that the operation has to be stopped.

B. It sometimes happen that the pushed part of the skelp falls down on the floor (the skelp lie flat on the floor), causing overlapping of skelps as the number of loops increase.

As shown in FIGS. 5 a and b, the skelp 23-23' lies over the skelp 24-24' and the skelp 24-24' over the skelp 25-25' and 26-26'.

It is because of such overlapping that skelp is subjected to degradation of quality in contact with the edge of skelp, as it is pulled in the direction of from 9 to 27 to be put into a heating furnace 28 and a continuous weld mill 29. This is the case particularly with a skelp of thin thickness and narrow width (for the production of a steel tube of  $\frac{1}{2}$  in. to 2 in. in diameter).

In order to solve this problem, there are normally several operators stationed on the looping floor 5 for manually removing the skelp 6-7-8 to the center of the floor. This is a heavy and unsafe work.

## SUMMARY OF THE INVENTION

In order to overcome the abovementioned complications, the present invention has an object to provide a loop forming method such that loops of a metal band material can be easily formed without buckling and overlapping.

Another object of the present invention is to provide a loop forming method, whereby loops of a metal band material can be formed automatically without the treatment of skelp by operators.

A further object of the present invention is to provide an apparatus for effecting good practice of the abovementioned method of forming loops of a metal band material.

In order to achieve the abovementioned objects, the metal band loop-forming method of the present invention is so characterized that, when stocking metal band materials in quantities on the floor of the stock yard,

pushing out the side of the metal band with a loop thrower, as said metal band is progressing in its long direction, such pushing out is done at the inlet onto the floor so as to have its stand up with its surface forming a right angle against the surface of the floor and also to form a new tip of said metal band and pushing said metal band toward the center of the floor by using a plurality of pushers so as to have it stand stably on the floor.

In order to practice the abovementioned method, the loop forming apparatus of the present invention comprises a loop thrower set at the inlet onto the looping floor, and a plurality of pushers for forming corrugation patterns of such metal band in the direction of its progress.

The abovementioned and other objects of the present invention will be made by the following embodiments of the present invention in reference to attached drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1, 2 and 3 are views for illustrating the description of the skelp loop formation by using a looper of the conventional, floor type.

FIGS. 4 and 5a and 5b are views for a detailed description of the loop formation by using a looper of conventional type.

FIGS. 6 and 7 are views for illustrating the description of the loop formation in an embodiment of the present invention.

FIG. 8 is a view for illustrating the description of a metal band to stand on its edge in the order of *a*, *b* and *c* in the embodiment of the present invention.

FIGS. 9 and 10 are respectively a side view and a plane view of an apparatus as an embodiment of the present invention.

FIGS. 11 and 12 are respectively a side view and a plane view of an apparatus as another embodiment of the present invention.

FIG. 13 is a side view of an apparatus as another embodiment of the present invention.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

The following is a detailed explanation of an embodiment of the present invention by reference to attached drawings:

Referring to FIGS. 6 and 7, a skelp, as it is going into a looping floor 5, is made to stand with its surface forming a right angle against the surface of the floor 5 through pushing-out of the side of the skelp by the rotation of a loop thrower 11 set at the inlet onto the floor 5, so that a curve 30-31-32 is formed. At the same time (or somewhat later on), a plurality (three sets in this case) of pushers 33, 34 and 35 arranged along the direction of progress of the skelp (on the side of the floor 5) start pushing the skelp. The so pushed skelp is returned from the situation of having fallen down or falling to a standing position (in which the surface of the skelp forms a right angle against the surface of the floor), thus forming a corrugation pattern 31-32-36-37-38 with the edge of the skelp along the direction of progress of the skelp. The repetition of such process several times finally forms loops of the skelp as shown in FIG. 7.

According to the method of the present invention, the skelp stands on the edge and no problem of overlapping one skelp by another occurs. As there is a suf-

ficient space between the end of the first skelp 31-32-36-37-38 and a side guide 40, the progress of a second top 41 of the skelp can be made without buckling, overlapping and other complications, requiring no hands taking care of it.

In order to keep the skelp standing on edge, it is scooped by the loop former (pusher) with its curve 44 formed on its tip 43 as shown in FIG. 8, as the tip 43 of the loop former moves from the right to the left against the skelp 42-42' so that the skelp is handed, as shown in the sequence of FIGS. 8b and 8c, such that it stands up nearly at a right angle against the floor 5. In other words, the skelp can be kept standing by making it stand up at the same time with the pushing out of the same in the order of *a*, *b* and *c* of FIG. 8. In this case, the lower end of the pusher should be placed below the position of the skelp.

In FIG. 6, the number and arrangement of the pushers (33, 34 and 35 in this case), which compose the loop forming apparatus in combination with the loop thrower, should be determined according to the size of the loop thrower, so that an ideal corrugation pattern can be obtained. In further regard to the number of pushers required, it should be determined according to its stroke and the length of the loop thrower; if its stroke is 3m for instance, the appropriate distance between two pushers should be 8 to 12 m.

FIG. 9 and FIG. 10 are respectively a side view and a plane view of the loop former of the present invention. The pushing bar 45, which is the main part of said loop former, has the tip equipped with a skelp pushing arm 46, for free rotation on a pin 47 by means of a power cylinder 48. On the bottom surface of the pushing bar 45 is set a guide bar 49 which mounts on a guide roller 50.

On the bottom surface of the middle part of the guide bar 49 is set a rack 51, which is to move the pushing bar in the direction at a right angle to the longitudinal direction of the skelp, by means of a pinion 52 and a motor 53. A screw can be used instead of a rack and pinion.

By using the abovementioned device, the skelp 54 which is in the situation of having fallen down, is pushed to stand up in the position indicated by reference numeral 55. At that time, the skelp pushing arm 46 has turned to stay at the position 46', leaving a space open for a skelp to traverse.

When the pushing bar 45 has returned to the set position, the skelp pushing arm 46 also is at its own set position.

The above description is made on the use of a motor for driving the pushing bar 45; but a power cylinder or power motor can be used in place of a motor. The skelp pushing arm is described as rotating on a pin 47; but a vertical movement at its fixed position can be used therefore.

This is explained, as follows, by reference to FIGS. 11 and 12.

According to this mechanism, the pushing bar 45 has its tip equipped with a skelp pushing arm 46 for free vertical movement (for free going-in and-out) by means of a power cylinder 56. A motor or a power motor can be used in place of a power cylinder.

Its action is so made that the skelp 57 which has fallen down, contacts and is pushed up by the skelp pushing arm 46 which has been pushed by the pushing bar 45 to this position, so as to stand up at the position

58. When the skelp pushing arm 46 has been raised to the position 46', the pushing bar 45 moves back to its original position and then the skelp pushing arm 46 returns to its own position.

In further regard to the loop forming system, there is no limitation, so that besides the abovementioned system in which a loop forming apparatus is set by the side of a floor-type looper, such apparatus as shown in FIG. 13, which is constructed as follows, can be used.

A frame 60 is mounted on the top of the looper, and from said frame is suspended a bar 63 through rack 61 and a pinion 62 for free horizontal movement; and at one end of said bar 63 is set a skelp pushing arm 65 positioned for free rotation and activated by a cylinder 64. The arm 65 is adapted to push a skelp at a right angle against the direction of its progress by means of the motion of said bar 63, thereby standing up the skelp from the position indicated by 66 to the position indicated by 67 and forming corrugation patterns. In place of the bar 63, a chain is usable for putting such arm into motion.

As the tip of the skelp pushing arm 46 is subjected to abrasion by the skelp edge, it is recommended that the tip be surface-hardened and made replaceable. Moreover, the arm should have such a curve as shown in FIG. 8 to make easier standing-up of skelp, or should be of the roller type to reduce abrasion and resistance.

What is claimed is:

1. A method of forming loops of metal strip on a looping floor, as said strip has its flat surface trailing over said floor, which comprises the steps of:

pushing up the side of said strip at a point near an inlet of said floor as said strip is progressing along said floor, so as to make the thus pushed portion of said strip stand vertically on the surface of said

floor and to form a bend in said strip at said portion; and

pushing said strip, at a plurality of points therealong, toward the center of said floor, so as to cause the forerunning part of said strip to form waves along the direction of progress, the so waved part of said strip standing vertically on the surface of said floor.

2. An apparatus for forming loops of a moving metal strip, comprising:

a loop thrower mounted for free rotation at a position near the inlet of a looping floor, said metal strip progressing thereabout with its flat surface trailing over the surface of said loop thrower to kick up the side of said metal strip progressing straightly; and a plurality of pushers positioned downstream of said loop thrower along the direction of progress of such metal strip, each of such pushers comprised of a bar adapted for free reciprocal motion at substantially a right angle to the longitudinal direction of said strip, and an arm mounted on the tip of said bar and adapted to extend downwardly therefrom to contact said metal strip, said arm having a curve on its portion contacting said metal strip to push on said metal strip, thereby making said strip stand vertically on the surface of said floor.

3. The apparatus claimed in claim 2 wherein said pusher has the tip of the bar connected with one end of said arm by means of a pin, and further comprising a driving means mounted on said arm for free rotation about the pin.

4. The apparatus claimed in claim 2, wherein said pusher has the arm set for free vertical movement on the tip of the bar, and further comprising driving means mounted on said arm to drive the arm vertically.

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