United States Patent [19]

Wiig

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[54] **LOOP CONTROL APPARATUS FOR CONTINUOUS STRIP MATERIAL**

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[73] Assignee: **F. J. Littell Machine Company,** Chicago, Ill.

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[52] **U.S. Cl.** **226/43;** 226/118

[51] **Int. Cl.** **B65h 25/32**

[58] **Field of Search** 226/40, 41, 42, 43, 118; 242/182, 183, 184, 185

[56] **References Cited**

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Attorney, Agent, or Firm—Russell H. Clark

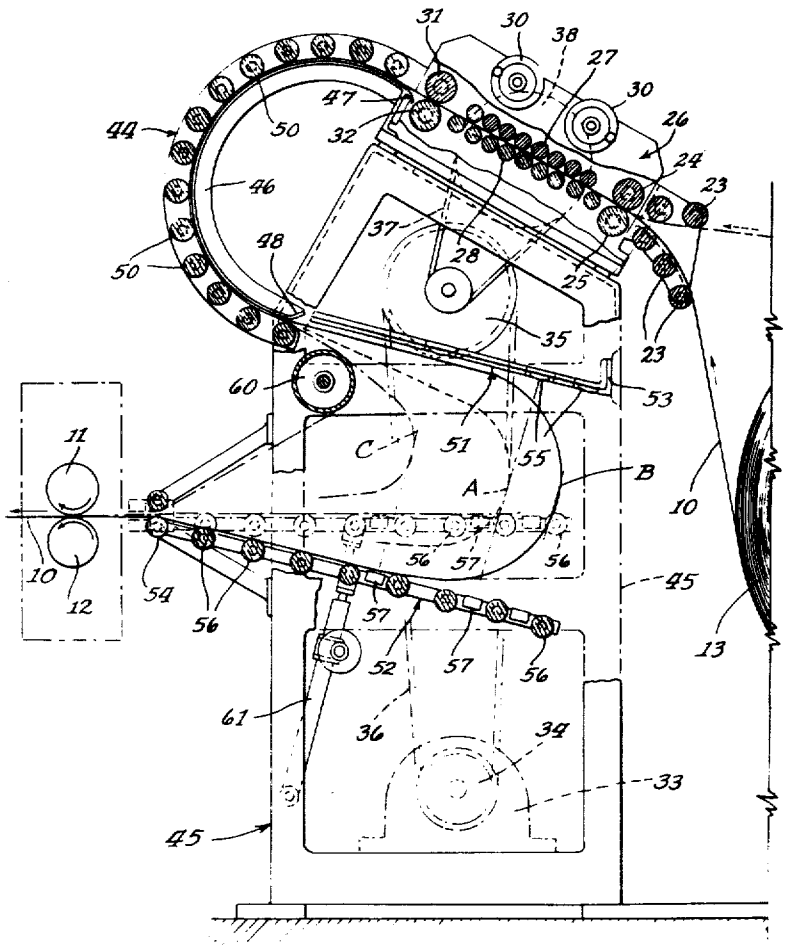
[57] **ABSTRACT**

Straightening and feeding machines receive stock material from a coil in continuous strip form and after conditioning the same the stock material is fed to reciprocating presses such as cutting, shearing and punching presses which operate on the material intermittently. Thus in the operation of such units, it is necessary to allow a loop of the strip material to form between said units.

An objective of the invention is to provide improved loop control apparatus for regulating and controlling the size of the loop and whereby the loop will be maintained substantially constant in size. More particularly the present apparatus employs top and bottom platforms which are spaced for receiving the loop therebetween and which control the loop so as to prevent flutter and flapping such as might cause damage to the material.

Another feature of the present loop control apparatus resides in the provision of electronic detecting means such as electric eyes carried by the platforms for detecting the size of the loop and in regulating the driving motor to the continuous strip feeding rollers accordingly.

3 Claims, 5 Drawing Figures



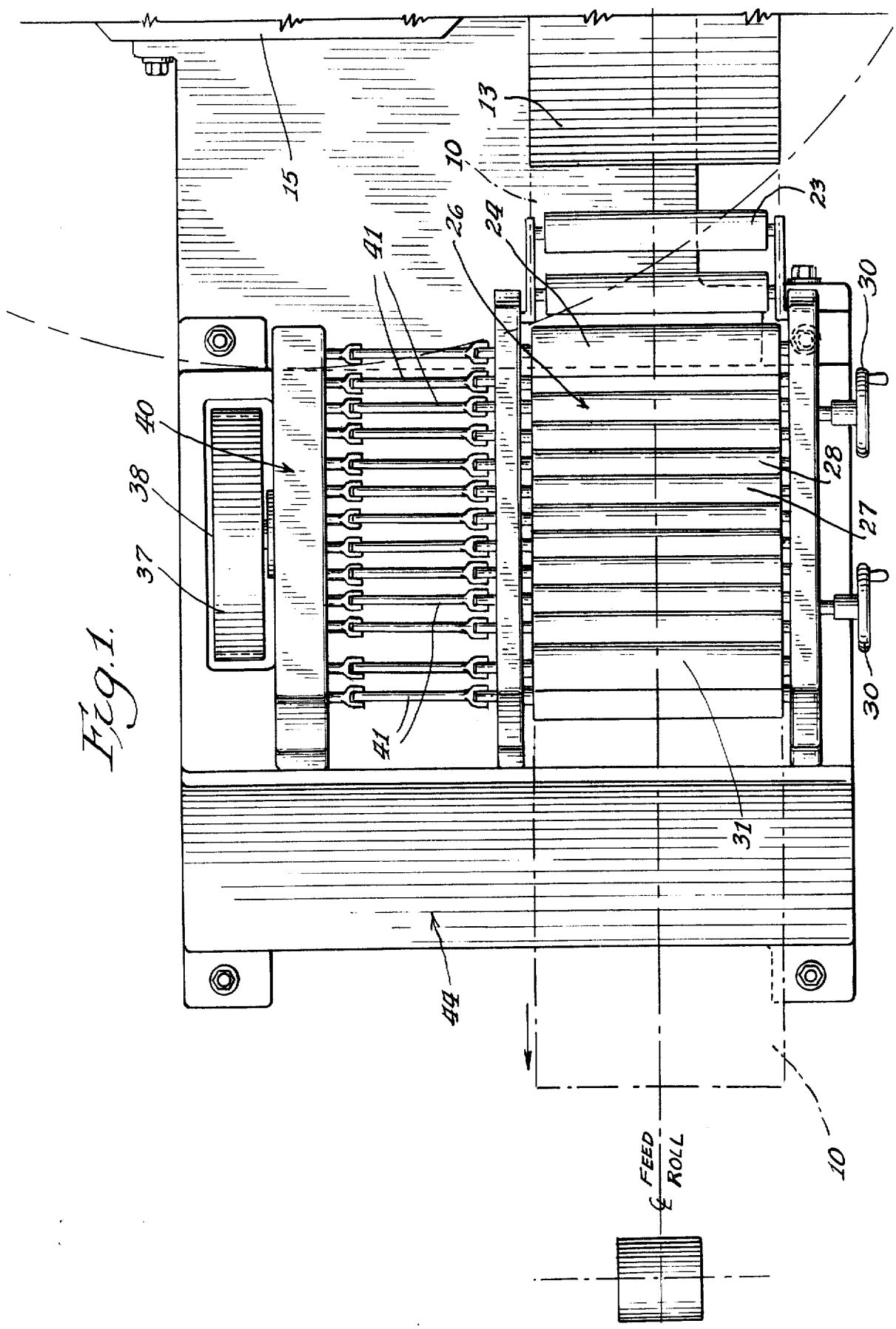


Fig. 1.

Fig. 2.

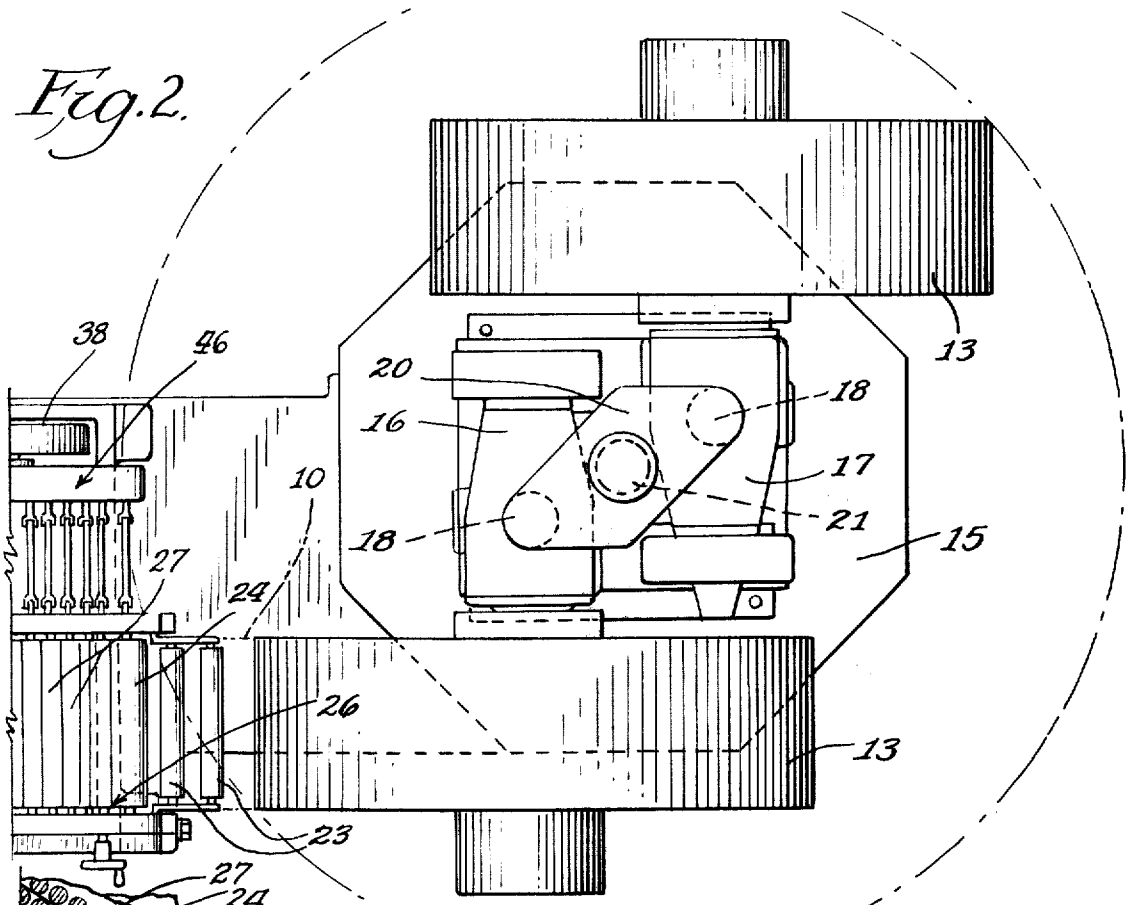

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Fig. 3.

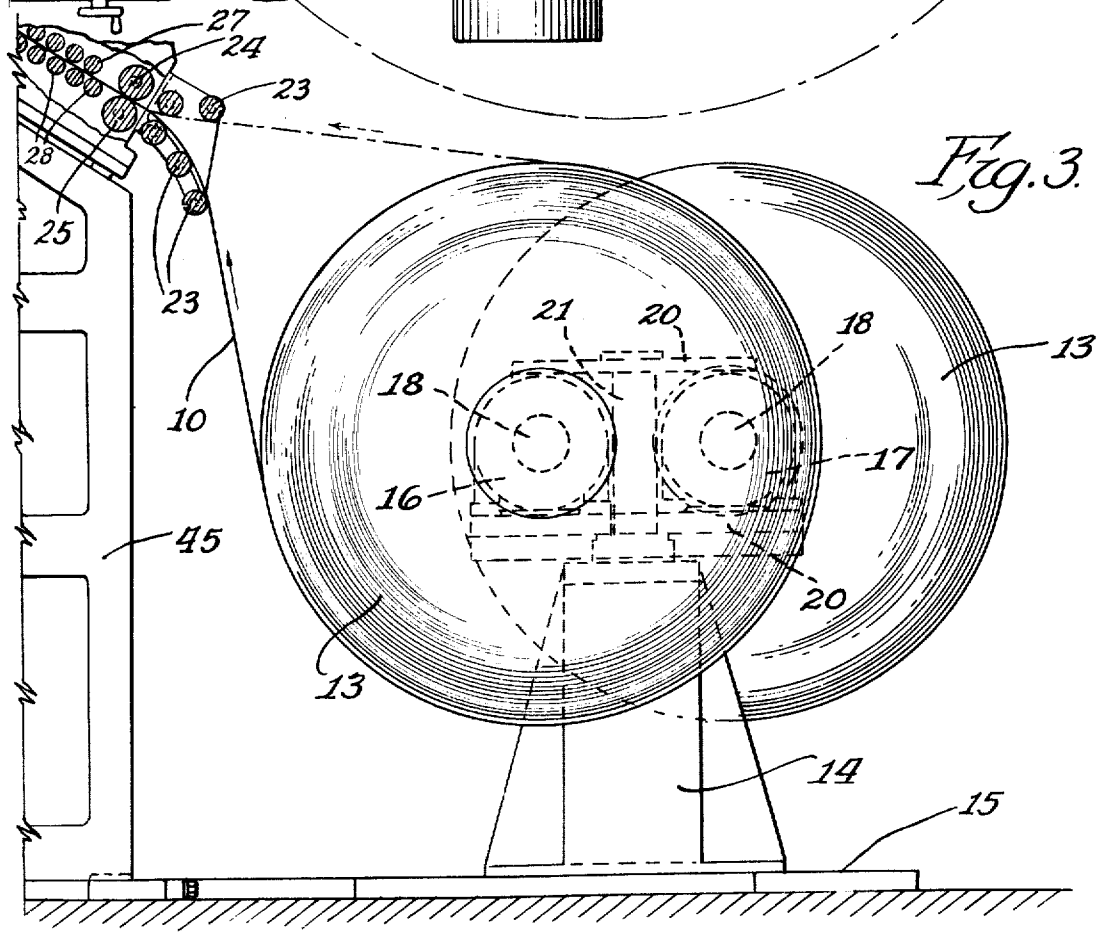
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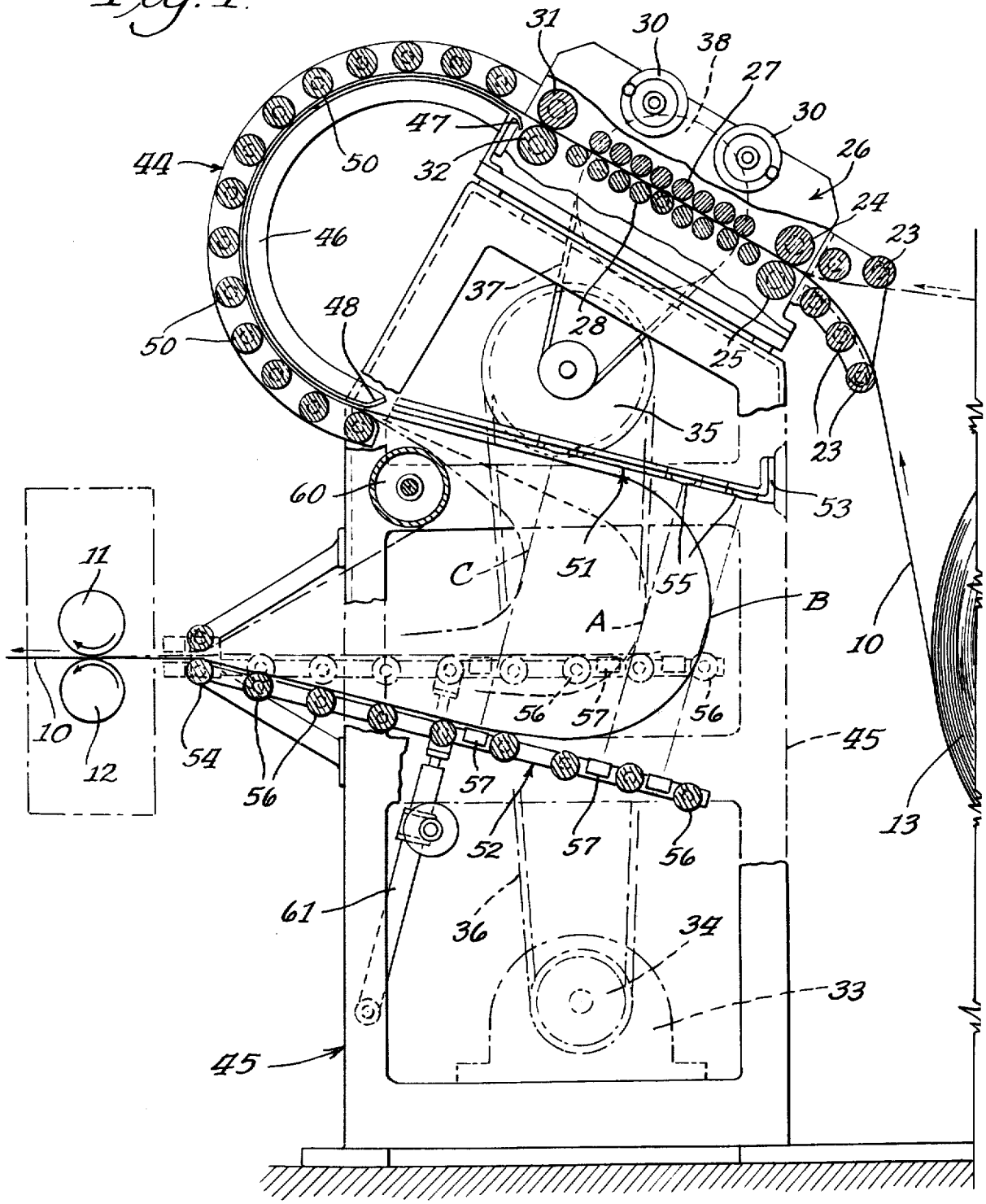
Fig. 4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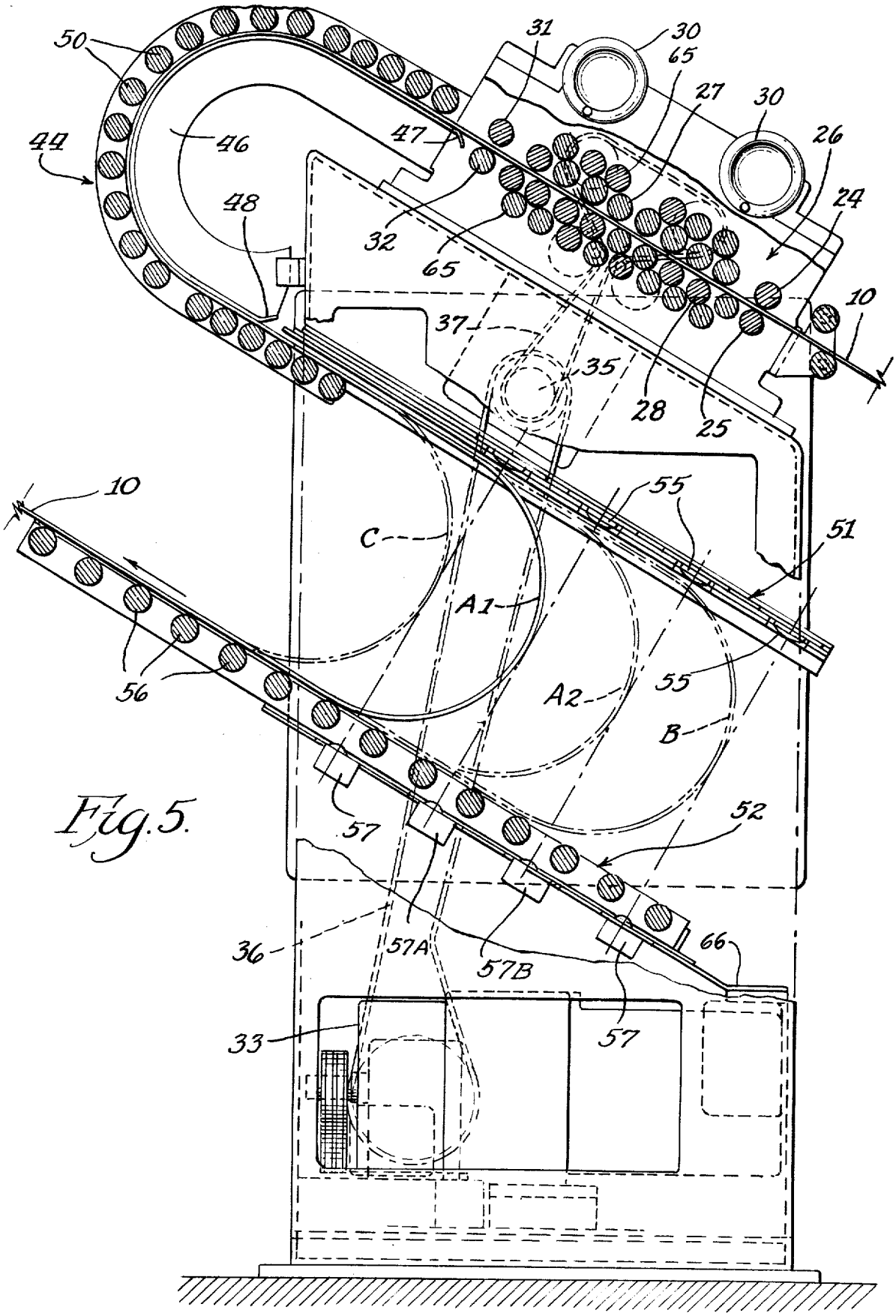
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57A
57B
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Fig. 5.

LOOP CONTROL APPARATUS FOR CONTINUOUS STRIP MATERIAL

The invention relates to feeding mechanism for metal strip material of continuous length and has particular reference to loop control apparatus for regulating and controlling the feeding speed of the straightening and feeding machine and also the loop formed thereby.

In metal working machines such as reciprocating cutting presses, shear presses, and punch presses, the metal stock in continuous strip form is unwound from the coil, conditioned by a straightening machine and fed thereby to the press for cutting, punching or forming operations. The straightening and feeding machine is located some distance to the rear of the press and since the feed rollers to the press operate intermittently, whereas the straightening and feeding rollers rotate continuously, it is necessary to allow a loop of material to form between the units.

It will be understood that during operation of such units, the size of the loop must be controlled and more particularly the loop must be controlled in a manner whereby the size of the loop will be maintained substantially constant during said operation. Accordingly the straightening and feeding rolls must rotate at a speed having some relation to the speed of the press in strokes per minute. Thus an object of the invention is to provide loop control apparatus which will operate in an improved manner for regulating and controlling the size of the loop between the straightening and feeding machine and the feed rolls to the press.

Another object of the invention is to provide loop control apparatus of the character described which will form the strip material into a shape simulating the letter S and wherein the second or bottom loop is controlled as to size.

Still another object resides in the provision of apparatus so constructed and arranged as to form a loop in continuously moving strip material and which will incorporate top and bottom roller equipped platforms for controlling the loop so as to prevent flutter and flapping such as would cause undesirable bends and kinks in the material.

A further object is to provide loop control apparatus which will incorporate electronic means such as one or more electric eyes for regulating the drive motor to the straightening and feeding machine in accordance with the size of the loop.

With these and other objects in view, the invention may consist of certain novel features of construction and operation as will be more fully described and particularly pointed out in the specification, drawings and claims appended thereto.

In the drawings which illustrate an embodiment of the apparatus and wherein like reference characters are used to designate like parts.

FIG. 1 is a top plan view of the loop control apparatus of the invention showing the rollers of the straightening and feeding machine, the gear box for the drive to the rollers and the connecting drive members;

FIG. 2 is a fragmentary top plan view showing a part of FIG. 1 together with the dual support for the two coils;

FIG. 3 is a side elevational view of the structure shown in FIG. 2;

FIG. 4 is a side elevational view showing one embodiment of the S shaped loop control apparatus of the invention; and

FIG. 5 is a side elevational view showing another embodiment of the present loop control apparatus with the electric eyes for loop control being clearly indicated, and with certain parts being shown in section.

Referring to the drawings and in particular to FIGS. 1, 2 and 3, it will be understood that the loop control apparatus of the invention has been designed for association with a reciprocating cutting or punching press and wherein a continuous strip of stock material is supplied by the loop control apparatus for cutting or punching operations thereon. The numeral **10**, FIG. 3, indicates the strip of stock material and the numerals **11** and **12**, FIG. 4, indicate the feed rolls of the press which are caused to rotate intermittently for feeding a measured length of material for each stroke of the press. Depending on the width and thickness of the stock material, the feeding length may vary from one forth of an inch at approximately 1200 strokes per minute to a maximum length of around thirty-six inches at about 200 strokes a minute. In all feeding operations the strip material is removed from a coil, conditioned by being passed through a straightening and feeding machine and then formed into a loop before being supplied to the feed rolls **11** and **12** of the press. The apparatus of the invention controls the loop as regards size and also in a manner to prevent fluttering and flapping of the material such as would produce undesirable bends or kinks in the same.

As best shown in FIGS. 2 and 3, the coils **13** of stock material such as metal in relatively thin strip form, are supported for rotation by the coil support **14** having the base member **15.** Coil supporting means of the character shown are well known and essentially consist of the shaft journalling body members **16** and **17** which journal the shafts **18** FIG. 3, and each said shaft in turn supports a coil **13.** The body members are suitably fixed top and bottom to the plate elements **20** so as to form with the body members an integral unit which is mounted and journalled for rotation on the vertical axis **21.** Thus the body members **16** and **17** can rotate in a horizontal plane and provision is made to lock and hold the integral unit in position as shown in FIG. 2 so that one coil will be paying out while the other coil is held in reserve.

The strip material from the paying out coil may be taken from the top or bottom and in FIG. 3 the strip is shown as coming from the bottom and the same enters between the idler rollers **23** and then passes between the feeding rollers **24** and **25** at the entrance end of the straightening and feeding machine designated in its entirety by numeral **26.** In addition to said entrance rolls, said machine machine **26** incorporates a series of straightening rolls such as the top rolls **27** and the bottom rolls **28.** The top rolls are bodily movable towards the bottom rolls to effect the desired degree of bending and thus a straightening of the strip material. The hand wheels **30** control this action and from said straightening rolls the strip is caused to pass between the feeding rolls **31** and **32** at the exit end of the machine **26.** For a more detailed explanation of the construction and operation of the said straightening and feeding machine reference is made to the Wiig et al U.S. Pat. No. 2,753,183 granted July 3, 1956.

The drive motor 33 FIG. 4, provides the drive pulley 34 which drives the larger pulley 35 through the belt 36. From the large pulley 35 the belt 37 passes around 38 and drives the gear box 40 of the straightening and feeding machine. The various gears in the box 40 are operatively connected by the link members 41 to the various rolls including the top rolls 27 and the bottom rolls 28 so that all the straightening rolls are rotated in unison. Also certain link members have universal joints to permit the bodily movement of the top rolls towards and from the bottom rolls.

The rollers 31 and 32 of the straightening and feeding machine 26 feed the continuous strip material to the first loop forming structure 44 of the complete loop control apparatus of the invention. Said apparatus including the first forming structure 44 is suitably supported by the frame support 45 as is also the straightening and feeding machine 26. Said structure 44 essentially consists of an inside frame member 46, semi-circular in curvature and having a downwardly bent portion 47 at the end adjacent the rollers 31 and 32 and an upwardly bent portion 48 at its opposite exit end. The structure 44 also includes the backing rollers 50 which are suitably journalled for rotation by the structure 44 and located in spaced outward relation with the frame member 46 so as to form a passageway between the two units for passage and free travel of the strip material 10. Said strip material in passing through the first loop forming structure 44 has its direction of travel reversed, and when the strip is paying out from the bottom of the coil, the bend or curvature of the loop is also just the reverse of that when on the coil.

From the exit end of the first loop forming structure, namely at 48, the strip material is caused to travel in a direction towards the right, FIG. 4, that is, in a direction towards the coil 13 and a second loop is formed before the material enters between the rolls 11 and 12 of the press. The second loop is disposed between the platforms 51 and 52 of the apparatus, with the top platform 51 being fixed at 53 to the frame support 45 and the bottom platform 52 being pivotally supported at 54 by said frame support. The top platform 51 carries the mirrors 55 of the electric eye equipment, that is, the electronic means which controls the size of the loop. The bottom platform 52 is equipped with the support rollers 56 and with the light sources, electric eyes and monitoring means 57 of the said electronic equipment. The light beam projected by each of the units 57 is directed towards one of the mirrors 55, and if the interruption by the loop does not take place so that the beam is not cut off, then the beam is reflected by a mirror 55 back to a unit 57 which monitors the beam and thus controls the motor 33 driving the straightening and feeding machine to in turn control the size of the loop.

The loop formed by the first loop forming structure 44 is of course constant as regards size. However the second loop formed between the platforms 51 and 52 will vary as to size during operation. The function of the electric means is to regulate the speed of the feeding machine 26 to thus control loop size within minimum and maximum limits. Accordingly as shown in FIG. 4, it will be understood that A represents the preferred operating size of the loop, and the monitoring action of the middle electronic unit 57 is such as to keep the size of the loop approximately as shown. Should the loop increase in size substantially, the light beam from the middle electronic unit 57 will be interrupted and the motor 33 driving the feeding machine 26 will be caused to decrease its speed. Should conditions exist wherein the loop would increase to size B, then the light beam from the right hand unit 57 would be interrupted and the motor 33 would be stopped by the opening of its electric supply circuit. On the other hand, should the loop of magnitude A gradually decrease in size, then the action of the middle electronic unit 57 would be to increase the feeding speed of the machine 26. However, in the event conditions exist wherein the loop may decrease to size C, then the light beam from the left hand unit 57 would be reflected back and monitored in a manner to speed up the feeding action of machine 26 to a maximum extent.

When initially threading the strip material 10 through the straightening and feeding machine 26, the top rolls 27 are spaced from the bottom rolls 28 to permit free passage of the strip and the strip may be caused to pass around the idler roller 60 provided for the purpose. Also when initially threading the material, the bottom platform 52 will preferably be elevated to a horizontal position by activating the power cylinder 61.

The modification of the present loop control apparatus as shown in FIG. 5 is substantially the same as FIG. 4 both in structure and mode of operation. The strip material is bent to form two loops and which simulate the letter S. The strip material 10 being supplied to the apparatus of FIG. 5 is somewhat greater in thickness than contemplated for the apparatus of FIG. 4. However the material is directed into the straightening and feeding machine 26 which incorporates the top straightening rolls 27 and the bottom straightening rolls 28 with the hand wheels 30 being provided for adjusting the top rolls towards and from the bottom rolls. In the machine of FIG. 5, both top and bottom rolls are provided with backing-up rolls 65. Also in this modification the motor 33 drives the pulley 35 by means of the belt 36 and from the said pulley the belt 37 drives the rolls 27 and 28 of the machine 26 in addition to driving the feeding rolls 24–25 at the entrance end and 31–32 at the exit end.

From the machine 26, the strip material is supplied in a continuous manner to the first loop forming structure 44 and here also the same essentially consists of the inside frame member 46 of semi-circular curvature and having the bent portions 47 and 48 at respective ends. The backing rollers rotate freely, being identified by numeral 50 and the same are disposed in spaced relation with respect to frame 46 to form a passageway for the free movement of the strip material.

The two platforms 51 and 52 of FIG. 5 are similar in most respects to the platforms shown in FIG. 4, with the top platform 51 being fixed in position and in this modification the bottom platform 52 is also fixed to the frame support at 66. The reflecting mirrors 55 are carried by the top platform 51 and the electronic units 57 are carried by the bottom platform 52. In FIG. 5, four units for the electronic equipment are employed, with two units namely 57A and 57B being provided to control the intermediate position or, in other words, the normal and preferred operating range of the loop. When the loop reaches the extreme position of B then the motor 33 is stopped. Should the loop reach the position of C then the motor is caused to drive at its maximum speed. The intermediate positions of the loop A1 and A2 are controlled by the electronic units 57A and

57B which monitor the reflected light beams to either increase the speed of motor 33 or to decrease its speed.

Although electronic units are employed in both FIGS. 4 and 5, it is entirely possible to substitute therefor proximity switches and which could be so located as to detect the expanding or decreasing size of the loop and control the electric driving motor accordingly. However apart from the loop-size detecting means, the invention provides loop control apparatus wherein two loops are formed having somewhat opposing relation to each other and which approximates the letter S. In addition to regulating loop size, the spaced platforms confine and control the loop in a manner to prevent flutter and flapping of the metal or other material such as would cause undesirable bends and kinks in the same.

I claim:

1. In loop control apparatus of the character described, in combination, a pair of feeding rolls having rotation for feeding continuously a strip of stock material, a second pair of feeding rolls spaced from the first mentioned pair and adapted to have intermittent rotation for advancing the strip material in an intermittent manner, loop forming structure located between the first and the second pair of feeding rolls and having operation to produce a pair of loops in the strip material approximately equal in size and which are formed in opposed relation whereby to simulate the letter S, said loop forming structure including first loop forming means and a pair of spaced platforms between which the second loop is formed, the loop forming means essentially consisting of a semi-circular frame member having a plurality of idler backing rollers journalled thereby and against which the strip material is caused to contact to thus form said first loop, the idler backing rollers being disposed transversely of the strip material and being spaced along the length of the first loop, the bottom platform of said spaced platforms also journalling a plurality of idler rollers against which the bottom part of the second loop is caused to engage, and loop-size detecting means carried by the platforms including a plurality of detecting units for detecting the size of the second loop and for controlling the speed of the first pair of feeding rolls accordingly.

2. Loop control apparatus as defined by claim 1, wherein the detecting units carried by the platforms consists of light beam projecting means, photo-electric cells and associated parts.

3. Loop control apparatus as defined by claim 1, additionally including a straightening and feeding machine located in advance of the semi-circular frame, and wherein the first pair of feeding rolls form part of the said straightening and feeding machine.

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