

Jan. 3, 1961

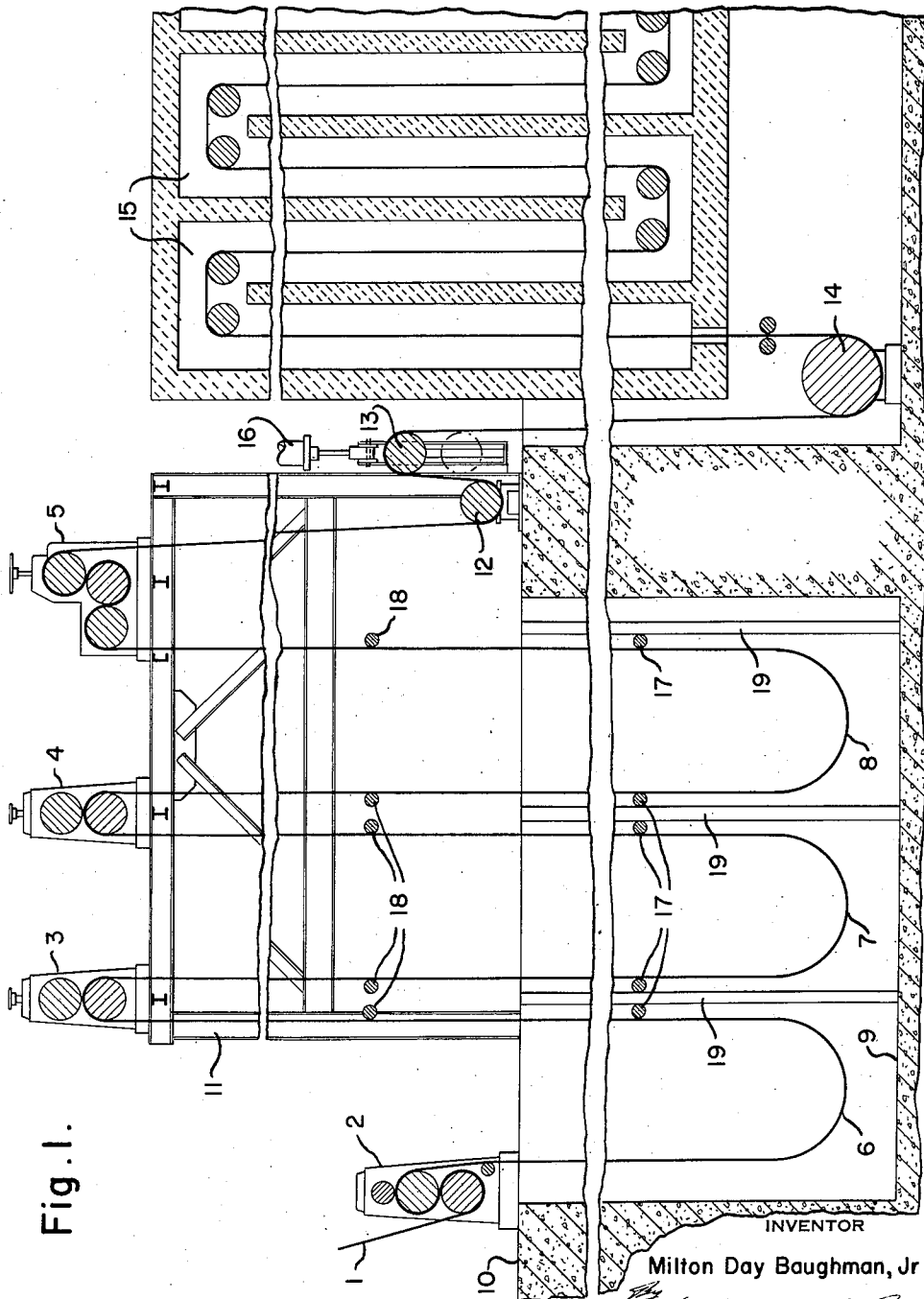
M. D. BAUGHMAN, JR

2,967,007

MEANS FOR STABILIZING HANGING LOOPS

Filed April 5, 1957

2 Sheets-Sheet 1



Jan. 3, 1961

M. D. BAUGHMAN, JR

2,967,007

MEANS FOR STABILIZING HANGING LOOPS

Filed April 5, 1957

2 Sheets-Sheet 2

Fig. 2.

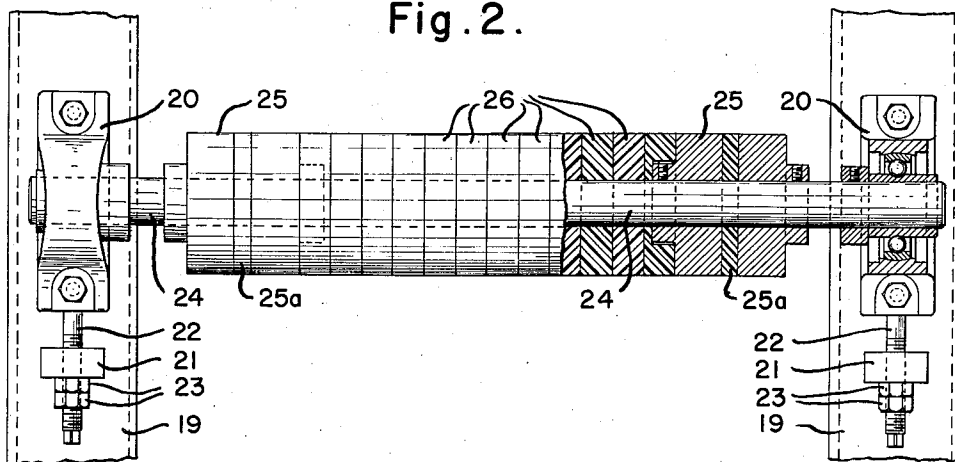
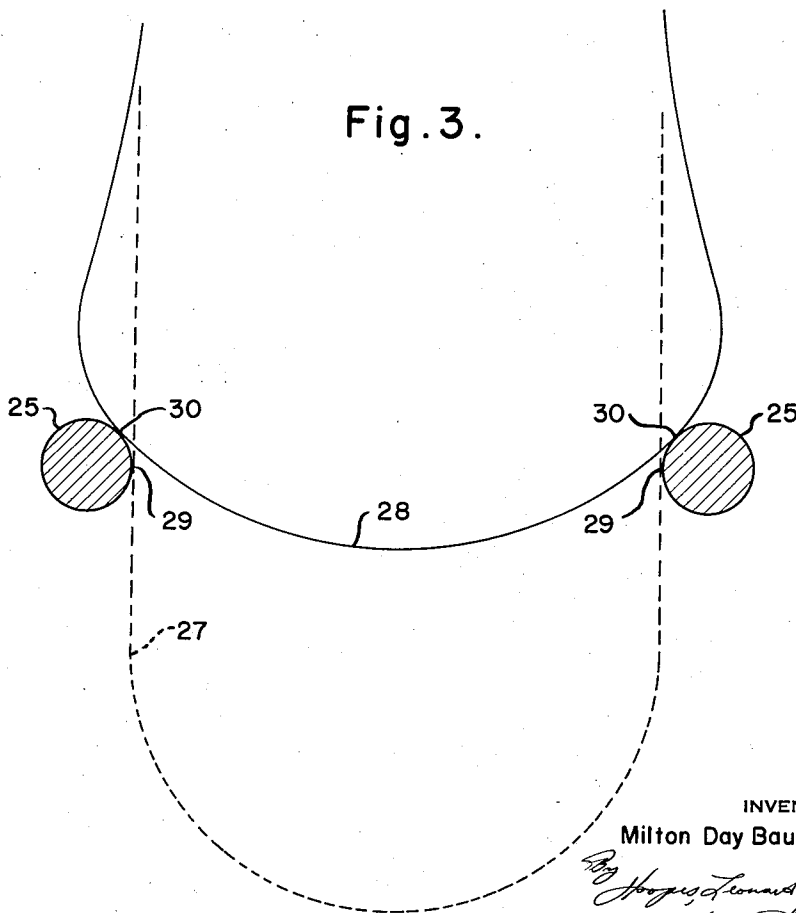


Fig. 3.



INVENTOR

Milton Day Baughman, Jr.

By Rogers, Leonard & Buell
his attorneys

1

2,967,007

MEANS FOR STABILIZING HANGING LOOPS

Milton Day Baughman, Jr., Warren, Ohio, assignor to
The Wean Engineering Company, Inc., Warren, Ohio,
a corporation of Ohio

Filed Apr. 5, 1957, Ser. No. 651,097

7 Claims. (Cl. 226—93)

This invention relates to the stabilization of hanging loops by magnetic means and is particularly useful in stabilizing loops formed in steel strip processing lines against undue lateral sway of the loops.

In many types of strip processing lines, it is desirable that strip move through the processing section of the line at a constant or nearly constant speed. In conventional practice, the strip is formed in rolling mills and is wound into coils. The coils of strip are then delivered to the processing line for further treatment. As consecutive coils are fed to the line, they are welded end to end to form a continuous thread for passage through the processing line. After passage through the line, the strip is recoiled. As each coil is built up at the delivery end of the line, the strip is cut at intervals to form new coils. It is usually desirable to continue the processing at an uninterrupted speed, and slack accumulators are provided to permit operation of the processing section of the line while coils are welded end to end or while the strip is cut after forming a full coil. Ordinarily, a looping tower or looping pits are provided on either side of the processing section of the line, to accumulate slack.

The slack accumulator at the entrance end of the processing line is normally maintained with fully formed loops. When feed to the line is stopped to weld in a new coil, feed for the processing section of the line is drawn from the slack accumulator. After the coil has been welded in, strip is fed to the slack accumulator at a faster speed than it is being fed to the processing section in order to restore the loop. The slack accumulator at the exit end of the line is normally run empty but will take the feed from the processing section when the strip is being cut to form a new coil at the exit end of the line.

In a common type of slack accumulator, free-hanging loops are suspended between pairs of driven pinch rolls. Strip is added to the loop by one pair of pinch rolls and withdrawn by a second set of pinch rolls. The continuing size of the loop will depend upon relative speeds of the pinch rolls adding and withdrawing strip from the loop. After a loop of appreciable size has been formed, vibrations and transitory forces formed by the feeding and withdrawal of strip tend to set up a lateral oscillation or pendulum motion in the strip. The oscillation can readily become pronounced and result in the strip swaying against the framework of the looping tower or the side of the looping pits. The edges of the strip are frequently damaged by the resulting impact.

To avoid the lateral sway of the loops, it has heretofore been proposed to provide permanent magnets adjacent the hanging loop to effectively damp side sway in the strip. Experiments with them have been unsuccessful. When strip is being withdrawn from the loop, the magnets continue to hold the strip as it is withdrawn. As the bottom curve of the loop is raised to the level of the magnets, they continue to hold the strip until it assumes a somewhat rectangular outline in side view instead of a free-hanging catenary. This will frequently result in bending the strip so sharply across its width that it becomes creased and is unsuitable for further use. To avoid

2

these difficulties, it has been common practice to employ electromagnets in the looping device and to shut off the power to the magnets when the bottom of the loop approaches within a short distance below the magnets. This arrangement has required elaborate control systems comprising a multiplicity of photoelectric cells, amplifiers, switches, relays and the like. The control apparatus is expensive in its first cost, and it requires periodic and continuous maintenance for proper operation. The strength of conventional electric magnets must also be carefully regulated to avoid drawing the strip too tightly to them and scoring the strip as it slides past.

I provide magnetic means for holding the strip in non-sliding contact. Preferably, I provide magnetic roll means rotatably mounted adjacent the loop with the loop tangent to the magnetic roll means. I prefer to provide roll-shaped permanent magnets placed adjacent the catenary formed by a free-hanging loop. Preferably, the roll-shaped magnets are freely rotatable on an axis parallel to the strip material.

Other details, objects and advantages of my invention will become apparent as the following detailed description of a present preferred embodiment thereof proceeds.

In the accompanying drawings I have illustrated a present preferred embodiment of my invention in which—

Figure 1 is a side view of a portion of a strip processing line showing the entrance loop accumulator and a portion of an annealing furnace;

Figure 2 is a view showing one magnetic roll assembly;

Figure 3 is a sketch showing opposed pairs of magnetic rolls in working relationship to a hanging loop of strip.

Figure 1 shows only a small portion of the strip processing line, the particular line which is illustrated being a continuous strip annealing line. The parts of the line which are illustrated are the slack accumulator at the entrance end of the line and a portion of the annealing furnace. Strip 1 enters the slack accumulator through a bridle 2 and passes over roll stands 3 and 4 through bridle 5. The accumulator is normally carried full with the strip forming free-hanging loops 6, 7 and 8. The strip wraps around the rolls of bridles 2 and 5 and it passes between the rolls of roll stands 3 and 4. All of the rolls are driven by electric motors which are controlled by well-known means to maintain the loops of desired size. The slack accumulator comprises a pit 9 below the floor 10 and a structural frame 11 erected above pit 9. Roll stands 3 and 4 and bridle 5 are all mounted on the upper level of the frame. Bridle 5 maintains a drag tension on the strip in the annealing furnace. The strip passes from bridle 5 under a deflector roll 12, over a tension roll 13, under a deflector roll 14 and into annealing furnace 15. Tension roll 13 is urged upwardly by a piston in fluid cylinder 16 to maintain a constant tension on the strip passing through the furnace.

A plurality of lower magnet roll installations 17 are mounted in pit 9 with the rolls tangent to the hanging loops of strip. A plurality of upper magnet roll installations 18 are mounted upon structural frame 11 in the same manner. One of the magnet roll installations is shown in detail in Fig. 2. It comprises supports 19 which are mounted upon the side walls of the pit or upon the structural framework as may be appropriate. Pillow blocks 20 are mounted on supports 19 in slotted holes and may be shifted along the supports for purposes of squaring up the roll. A lug 21 on each support receives an adjusting screw 22 having lock nuts 23. Each screw 22 is rotatably mounted in pillow block 20 and is used to align the pillow blocks. A shaft 24 extends between the two pillow blocks and is freely rotatable therein. Two roll-shaped permanent magnet rolls 25 are

mounted upon shaft 24 to engage the edges of strip passing through the line. As indicated in the drawings, each magnet roll is conveniently formed of two sections having an insulating spacer 25a between them. A number of spacers 26 of an insulating material such as Micarta having the same diameter as magnet rolls 25 are fitted on shaft 24 between the magnet rolls. The magnet rolls 25 are held on the shaft by set screws and may be adjusted outwardly or inwardly on the shaft for different widths of strip. Additional spacers 26 may be inserted or removed.

In Figure 3, one pair of the magnet rolls is shown in end elevation, and their action on the strip is illustrated. When the lower end of the loop is well below magnet roll 25, the strip will take the position indicated in dotted outline 27. The rolls will draw the strip to it at points 29. As strip is added to one side of the loop and withdrawn on the other, the strip will travel past the magnet rolls causing the magnet rolls 25 and shafts 24 to rotate in pillow blocks 20. As strip is withdrawn from the loop, the bottom of the loop will be raised to the level of the magnet rolls. The strip will no longer hang downwardly from the magnets, but will pull toward the opposite side of the loop as indicated at 28. This will cause the point of contact with the magnetic rolls to be at point 30 on the upper surface of the roll. The curve at the bottom of the loop will be somewhat distorted as indicated by the figure, but the curve will be smooth without subjecting the strip to sharp bends. As additional strip is withdrawn from the loop, the strip will pull away radially from magnet rolls 25 without becoming creased or otherwise deformed.

The processing line is operated in the same general manner as previous lines have been operated. The loops 6, 7 and 8 are normally maintained at full length at the entrance end of the processing line. The magnets will hold the strip steady against lateral sway or a pendulum-like motion. As a new coil is welded in, feed to the slack accumulator is stopped and strip is withdrawn from the loops to maintain a constant rate of feed to annealing furnace 15. As the lower end of each loop draws adjacent the magnet rolls, the curve will be gradually changed to the position indicated in solid line in Figure 3. As the loop is further shortened, the strip will pull radially away from magnet rolls 25 and will be drawn upwardly. The rolls will hold the strip only along a line contact, and the line of contact is freely shiftable around the circumference of the rolls to conform to the position of the strip and size of the loop. As a result the strip always assumes a gentle curve when the loop is drawn up past the rolls. The rolls will always rotate with the strip avoiding any possibility of marking of the strip by sliding contact of the strip against the magnets.

The Micarta spacers 26 may in some cases be omitted when a hard strip such as silicon steel is processed. When a soft steel is processed, however, and the Micarta spacers are omitted, the inner edges of the magnet rolls may cut into the steel as the unsupported center section between a pair of magnet rolls 25 is drawn toward shaft 24. The spacers 26 will support the center section of the strip to avoid such deformation and scoring of the strip.

The invention replaces conventional magnets and control means at a substantially lower initial cost. Once installed there is no maintenance required as is necessary for the proper functioning of conventional control apparatus. It will be seen, therefore, that the invention produces substantial savings both in capital and running expenses.

While I have illustrated a present, preferred embodiment of my invention, it is to be understood that I do not limit myself thereto and that my invention may be otherwise practiced within the scope of the following claims.

I claim:

1. A processing line for magnetic strip material subject to damage at the edges and from bending, said line having a processing section through which strip is passed and at least one section where passage of the strip is retarded, and slack accumulating means therebetween in which at least one loop of strip material may be formed, strip being substantially continuously passed between the processing section and the slack accumulating means, the improvement comprising means for stabilizing an extended free-hanging loop of magnetic material subject to oscillating motions comprising material support means supporting said material and between which it hangs free by its own weight and at least one rotatable magnetic roller disposed with its circumference adjacent a vertically disposed section of said free-hanging loop an appreciable distance below said material support means.

2. A processing line for magnetic strip material subject to damage at the edges and from bending, said line having a processing section through which strip is passed and at least one section where passage of the strip is retarded, and slack accumulating means therebetween in which at least one loop of strip material may be formed, strip being substantially continuously passed between the processing section and the slack accumulating means, the improvement comprising means for stabilizing an extended free-hanging loop of magnetic material subject to lateral oscillations comprising material support means supporting said material and between which it hangs free by its own weight and rotatable magnetic roller means disposed adjacent a vertically disposed section of said free-hanging loop, the loop portion of said magnetic material being tangent to said roller means.

3. A processing line for magnetic strip material subject to damage at the edges and from bending, said line having a processing section through which strip is passed substantially continuously and at least one other section where passage of the strip is intermittently interrupted, and slack accumulating means between said sections in which at least one free-hanging loop of strip material may be formed, strip being substantially continuously passed between the processing section and the slack accumulating means, the improvement comprising means for stabilizing an extended free-hanging loop of magnetic material subject to oscillating motions comprising material support means supporting said material and between which it hangs free by its own weight, roll mounting means positioned adjacent vertically disposed portions of said free-hanging loop, and magnetic roll means rotatably positioned upon said mounting means with said vertically disposed portions tangent thereto.

4. A processing line for magnetic strip material subject to damage at the edges and from bending, said line having a processing section through which strip is passed substantially continuously, and at least one other section where passage of the strip is periodically interrupted, and slack accumulating means between said sections in which at least one free-hanging loop of strip material is formed when slack is accumulated, strip being substantially continuously passed between the processing section and the slack accumulating means, the improvement comprising means for stabilizing an extended free-hanging loop of magnetic material subject to oscillating motions under the influence of vibrations and transitory forces caused by feeding strip to or withdrawing it from the loop comprising material support means supporting said material and between which it hangs free by its own weight, magnetic mounting means adjacent vertically disposed section of said free-hanging loop, and magnetic loop attracting means supported thereby in non-sliding rolling contact with said vertically disposed sections of said loop holding successive sections of said loop and then releasing them.

5. A processing line for magnetic strip material subject to damage at the edges and from bending, said line

5

having a processing section through which strip is passed at substantially constant speed, and at least one section where passage of the strip is intermittently interrupted, and slack accumulating means between said sections in which at least one free-hanging loop of strip material is formed when strip is accumulated, strip being substantially continuously passed between the processing section and the slack accumulating means, the improvement comprising means for stabilizing an extended free-hanging loop of magnetic material subject to oscillating motions comprising material support means supporting said material and between which it hangs free by its own weight, magnetic mounting means adjacent vertically disposed sections of said free-hanging loop, and magnetic material attracting means in non-sliding contact with the vertically disposed sections of the loop.

6. A processing line for magnetic strip material subject to damage at the edges and from bending, said line having a processing section through which strip is passed substantially continuously and at least one other section where passage of the strip is intermittently interrupted, and slack accumulating means between said sections in which at least one loop of strip material is formed when strip is accumulated, strip being substantially continuously passed between the processing section and the slack accumulating means for continuous passage through the processing section, the improvement comprising means for stabilizing an extended free-hanging loop of magnetic material subject to oscillating motions comprising material support means supporting said material and between which it hangs free by its own weight and a plurality of separate spaced rotatable magnetic rollers disposed with

6

their circumferences adjacent vertically disposed sections of said free-hanging loop when it is fully formed.

7. A processing line for magnetic strip material subject to damage at the edges and from bending, said line having a processing section through which strip is passed substantially continuously and at least one other section where passage of the strip is intermittently interrupted, and slack accumulating means between said sections in which at least one loop of strip material may be formed, strip being substantially continuously passed between the processing section and the slack accumulating means, the improvement comprising means for stabilizing in extended free-hanging loop of magnetic material subject to oscillating motions comprising material support means supporting said material and between which it hangs free by its own weight and a plurality of rotatable magnetic rollers disposed with their circumferences adjacent vertically disposed sections of strip material of a fully formed free-hanging loop and with their axes parallel to the plane of the strip material.

References Cited in the file of this patent

UNITED STATES PATENTS

1,442,718	Free	Jan. 16, 1923
1,651,744	Van Derhoef	Dec. 6, 1927
2,338,143	Taylerson	Jan. 4, 1944
2,409,770	Lorig et al.	Oct. 22, 1946
2,837,331	Feick	June 3, 1958

FOREIGN PATENTS

996,354	France	Aug. 29, 1951
---------	--------	---------------