Feb. 8, 1955 J. E. ERHARDT, JR 2,701,716

APPARATUS FOR HANDLING METAL STRIPS

Original Filed Oct. 30, 1945 3 Sheets-Sheet 1

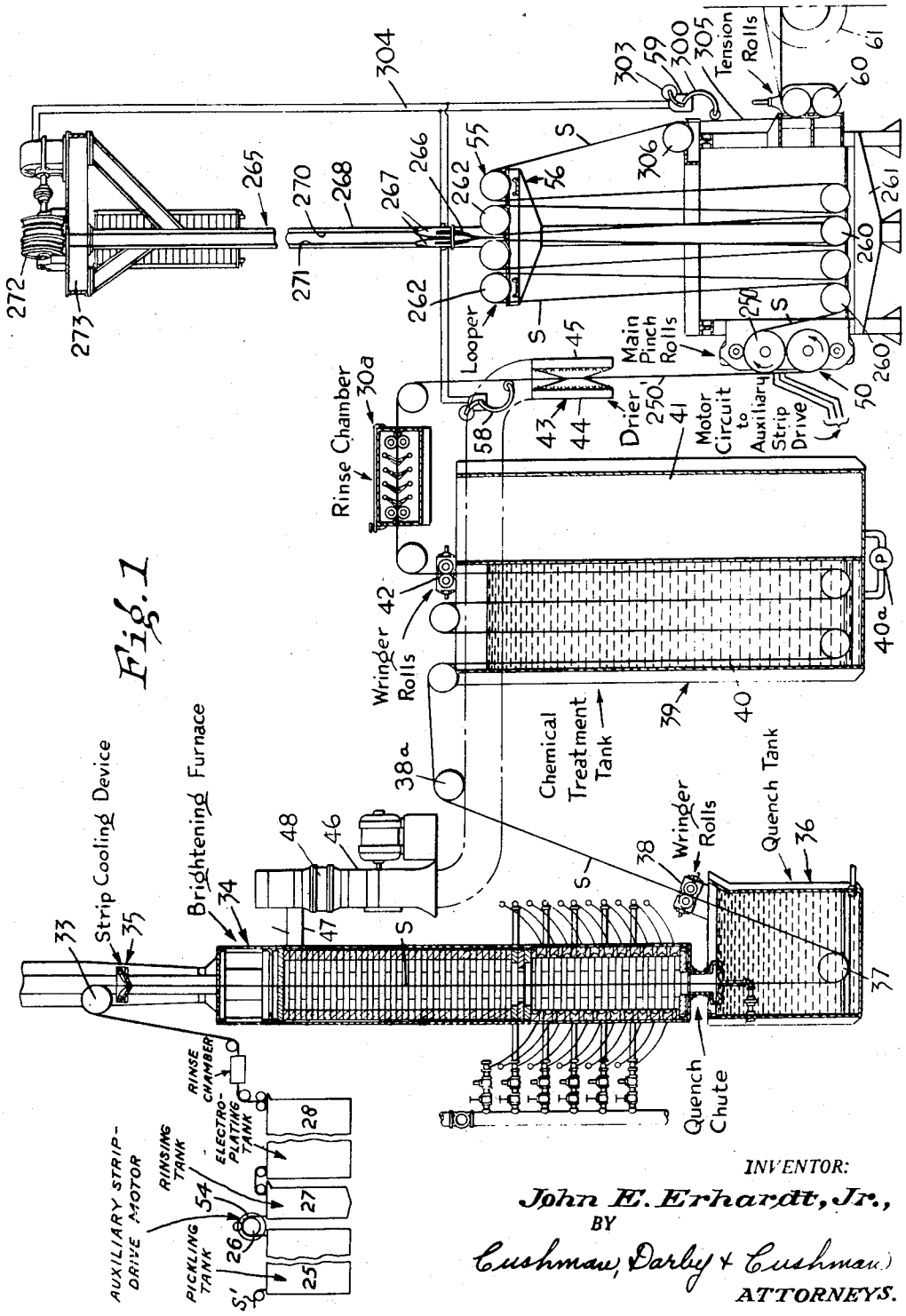


Fig. 1

INVENTOR:
John E. Erhardt, Jr.,
BY
Cushman, Darby & Cushman
ATTORNEYS.

Feb. 8, 1955 J. E. ERHARDT, JR 2,701,716

APPARATUS FOR HANDLING METAL STRIPS

Original Filed Oct. 30, 1945 3 Sheets-Sheet 2

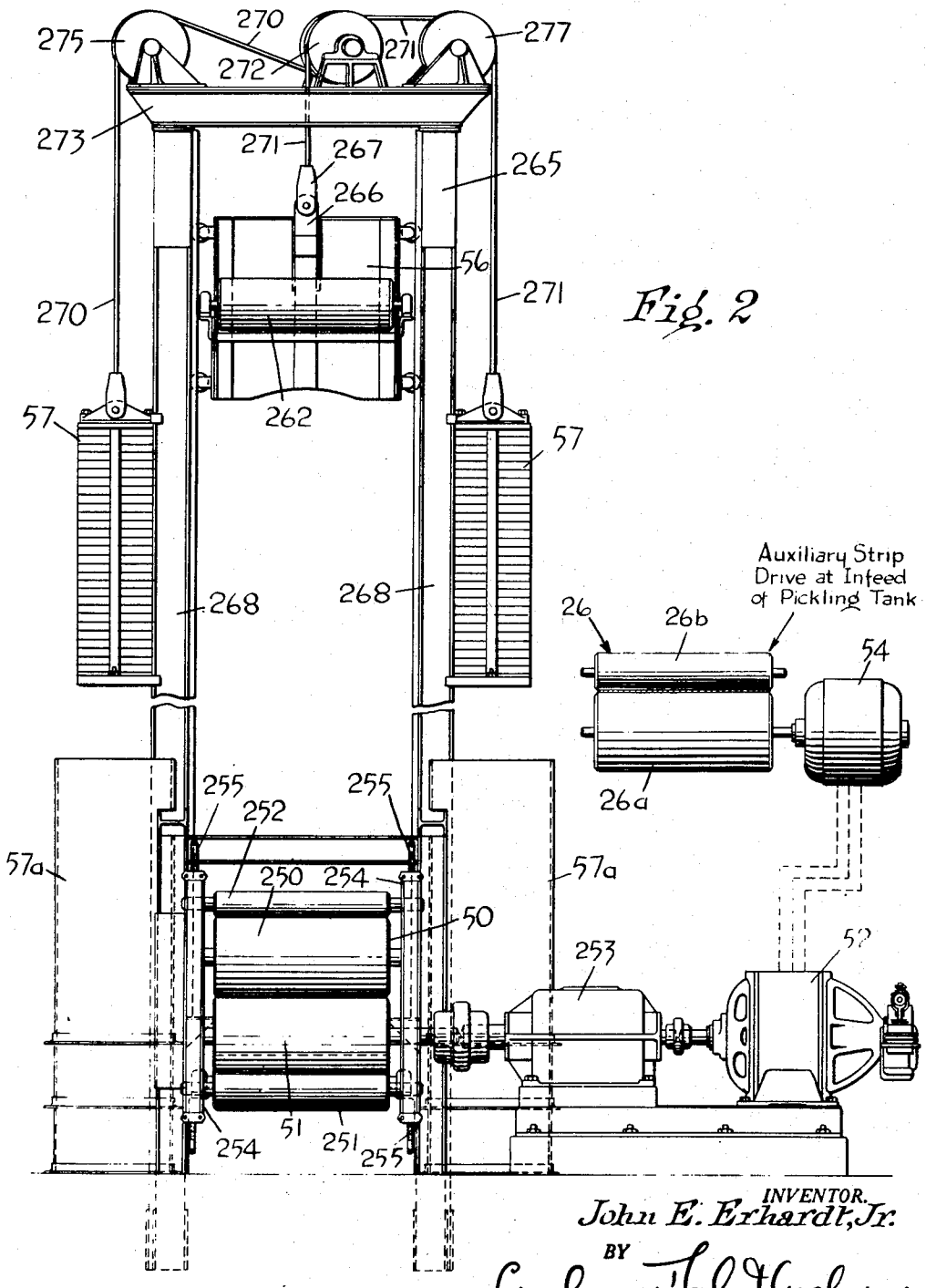


Fig. 2

INVENTOR.
John E. Erhardt, Jr.
BY
Cushman, Darby & Cushman

Feb. 8, 1955 J. E. ERHARDT, JR 2,701,716

APPARATUS FOR HANDLING METAL STRIPS

Original Filed Oct. 30, 1945 3 Sheets-Sheet 3

Fig. 3

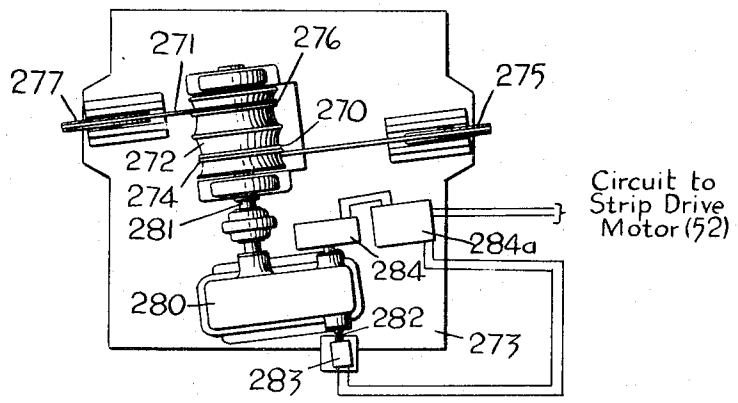
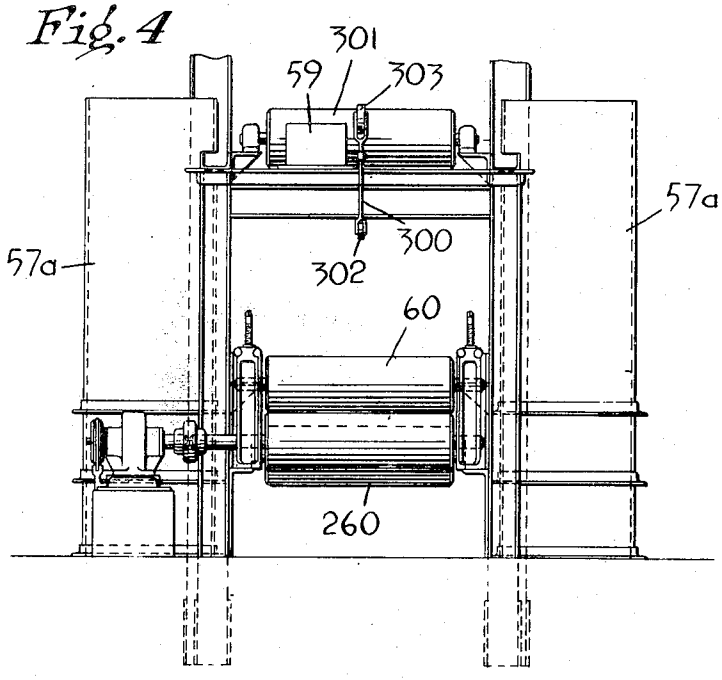


Fig. 4



INVENTOR.
John E. Erhardt, Jr.
BY
Cushman, Darby & Cushman

United States Patent Office 2,701,716 Patented Feb. 8, 1955

2,701,716

APPARATUS FOR HANDLING METAL STRIPS

John E. Erhardt, Jr., Baltimore, Md., assignor to Crown Cork & Seal Company, Inc., Baltimore, Md., a corporation of New York

Original application October 30, 1945, Serial No. 625,505. Divided and this application August 21, 1950, Serial No. 180,683

3 Claims. (Cl. 271—2.2)

The present invention relates to apparatus for handling metal strips. The application is a division of my application Serial No. 625,505, filed October 30, 1945, now Patent No. 2,546,538, issued March 27, 1951, for Apparatus for Handling and Brightening Metal.

An object of the invention is to provide a looper for use in strip handling apparatus.

Loopers are provided in strip handling lines to enable the strip to be continuously moved through the apparatus regardless of the necessity of joining new rolls to the strip and the severing of the outfeed end of the strip into rolls. Prior loopers have included involved cable and sheave arrangements which required careful adjustment. The looper structure of the present invention includes a simple cable and sheave arrangement which requires minimum adjustment.

Still another object of the invention is to provide an anti-crash control for loopers.

The loopers used in a strip treating line include counterweights which may have a weight of the order of a ton or more. If the strip becomes broken for any reason, the resultant dropping of these counterweights can result in substantial damage to the surrounding structure and possible injury to operators. The controls included in the present invention are of such design that breakage of the strip will actuate them to prevent dropping of the counterweights.

A further object of the invention is to provide an improved strip drive for use in strip handling apparatus.

Other objects and advantages of the invention will be apparent from the following specification and attached drawings wherein:

Figure 1 is a diagrammatic elevation of a brightening apparatus including the equipment of the present invention, numerous portions of the apparatus being shown in vertical section.

Figure 2 is an elevation of the strip looper at the outfeed end of the line, the view showing the strip in-feed side of the looper, i. e., its left hand side in Figure 1.

Figure 3 is a top plan view of the looper of Figure 2, and

Figure 4 is an elevation of the lower portion of the looper, the view being taken at its out-feed side.

Figure 1 diagrammatically illustrates the position and use of the present invention in a strip electroplating and brightening apparatus such as disclosed in my said original application Serial No. 625,505, now Patent No. 2,546,538. It will be understood that description of such use is simply illustrative.

Referring to Figure 1, a strip of metal S', ordinarily a steel strip of a width of approximately thirty inches, is passed through a pickling tank **25**, then between pinch rolls **26**, into a rinse tank **27**, and then through the apparatus **28** which will electro-plate a tin coating upon strip S' to produce the plated strip S. The plated strip S then moves over a roll **29** and through a rinse chamber **30** such as disclosed in my original application. In the rinse chamber the strip is subjected to a spray of water or other suitable wash liquid, the chamber **30** being of such construction that no liquid can be jetted therefrom. In addition, the rinse chamber **30** includes rubber-covered rolls which remove all surplus water or rinsing liquid from the strip before the latter leaves the rinse chamber.

The strip S then moves upwardly to a roll **33** positioned above the brightening furnace **34** and passes down about roll **33** for movement in a vertical run through

the furnace. A strip cooling device **35** shown in detail in said original application is positioned immediately below roll **33**. The purpose of device **35** is to enable water to be jetted upon the strip in the event that movement of the strip should be stopped. The water thus jetted upon the strip will flow downwardly along the vertical run to prevent the portion of the strip within the furnace **34** from being burned and thereby disintegrated by the oxidizing action which will occur when the strip is stopped while the furnace is at normal operating temperature.

Generally speaking, the brightening furnace **34** comprises a tower open to atmosphere only at its upper end and with burners positioned adjacent its lower end so that rising products of combustion will pre-heat the strip S as it moves downwardly through the upper portion of the furnace. The lower end of the furnace **34** has a water-sealed connection with a quench tank **36**. During its movement past the burners of the brightening furnace **34**, the tin coating on the steel strip will be fused so that it will flow. While the coating is in this condition, the strip moves into the quench tank **36** and the coating is thereby instantly hardened so that the strip will be brightened, i. e., all small protuberances upon or other roughness of the surface of the strip will be smoothed out and a bright mirror-like finish will be imparted to the strip.

A roller **37** is journalled at the bottom of the quench tank **36**, the roller **37** being rubber-covered and provided with a bearing structure which includes means to prevent the quenching liquid reaching the bearing surfaces. After movement about roller **37**, the strip moves upwardly and between rolls included in a wringer roll assembly **38** which removes surplus quenching liquid from the strip. After movement about a roll **38***a* and a short horizontal run, the strip moves in vertical runs through a chemical treatment tank **39**. During movement through the tank **39**, the strip will be subjected to known treatments whereby its surface will be given an adequate affinity for lacquer or other coatings. Tank **39** preferably comprises two compartments **40** and **41**. The strip moves through the compartment **40** in vertical loops, this compartment being filled with the treating solution. Compartment **41** is ordinarily empty and is used to store the treating solution when the treating solution compartment **40** is being cleaned. A pump **40***a* may be included in the tank structure to enable the treating solution to be moved from one compartment to the other.

After the strip S leaves the chemical treatment tank **39**, it will be passed through wringer rolls **42** which will remove excess treating liquid from the strip. Then, in a horizontal run, the strip passes through rinse chamber **30***a* which is identical in structure with the previously described rinse chamber **30**. Beyond rinse chamber **30***a* the strip moves in a vertical run through a drier **43** designed to remove all moisture from the strip.

Generally speaking, the drier **43** comprises two outlet boxes **44** and **45**, one positioned on each side of the strip. Each outlet box is provided with outlet openings through which air of the proper temperature is directed against the strip as it moves through the drier. The outlet boxes are supplied with air of the desired temperature by a blower and duct system, the air being forced through the ducts by the blower **46** which also serves to create a forced draft in the upper portion of the brightening furnace **34** through a duct **47**. The temperature of the air directed against the strip S by the drier **43** may be controlled by a heater **48** mounted in the duct system between blower **46** and drier **43**.

After the strip S has been dried, it moves through a series of main pinch rolls **50**. As is shown in Figure 2, the lower pinch roll **51** of the series **50** is driven by a motor **52**. The pinch roll structure **50** imparts the necessary drive and tension to move the strip through the elements shown in Figure 1 and which are in advance of the rolls **50** and to the rear of the auxiliary pinch rolls **26** of Figure 1. The auxiliary pinch rolls **26** diagrammatically illustrated in Figures 1 and 2 exert tension upon the strip to move it through the pickling tank **25** and the usual elements in advance of tank **25**.

In short, the strip is driven by the auxiliary pinch rolls **26** while it is moving through the infeed portion of the electrolytic coating apparatus and the portion of the strip moving through the remainder of the electrolytic apparatus and through the other apparatus of Figure 1 is driven by the main pinch rolls **50**. The motor **54** for the auxiliary pinch rolls is electrically connected with the motor **52** of the main pinch rolls **50** as schematically shown in Figure 2 so that both sets of pinch rolls will be driven in synchronism. The provision of main pinch rolls at a point in the brightening apparatus which is beyond all of the strip treating elements is highly advantageous because it insures that the strip will be under uniform tension during its movement through all of these elements.

As is shown in Figure 1, the strip S moves from the main pinch rolls **50** directly to the outlet looper **55**. Looper **55** includes an upper vertically movable sheave carrying platform **56**. As best shown in Figures 2 and 3, the platform **56** is connected by suitable cables passing through a main sheave and auxiliary sheaves to counterweights **57**. An improved system of connecting the platform **56** to the counter-weights **57** is hereinafter described. In addition, the anti-crash brake system provided is of importance and is subsequently described. In order to control the anti-crash braking system, strip breakage detectors **58** and **59** (Figure 1) are provided immediately in advance of the drier **43** and immediately beyond the looper **55**, respectively. These detectors are electrically connected with the brake. Location of these detectors at the points specified, i. e., the points of greatest tension, insures that the anti-crash devices will be highly responsive to any breakage.

Immediately beyond the second detector **59** the strip S moves through a pair of rolls designated by the numeral **60** and by means of which the strip may be gripped. From the roll **60** to the strip is directed to coiling drum **61** upon which the strip may be wound into a coil. Shearing means, not shown, will be positioned between the tension rolls **60** and the coiling drum **61**. In accordance with usual practice, when a full coil has built up on the coiling drum **61**, the tension rolls **60** will be held against movement so that the strip will be clamped between these rolls. The strip will then be sheared between the tension rolls and the coiling drum and the full coil removed from the coiling drum. During this interval of time, the looper **55** will take up the supply of strip which is moving through the apparatus. The sheared end of the strip will then be connected to the coiling apparatus and the tension rolls **60** released for normal operation and during which operation the looper will gradually feed out the strip which has accumulated thereon during the stoppage.

Referring now to the details of the invention hereinafter claimed, as is shown in Figure 1, the vertical run **250'** of the strip which passes through the drier **43** extends downwardly about the lower pinch roll **51** (Figure 2) of the main pinch roll assembly **50**. The strip moves about this roll in the direction of the arrow appearing thereon in Figure 1 and then moves about a roll **250** in the direction of the arrow provided thereon in Figure 1. A small roll **251** is mounted directly below lower pinch roll **51** and a second small roll **252** is mounted directly above the upper pinch roll **250**, the strip passing between each small roll and the adjacent large roll. As shown in Figure 2, the lower roll **51** is driven from the motor **52** through a gear reduction unit **253** and the upper roll **250** is geared to roll **51**. The small rolls **251** and **252** are driven by engagement of the strip therewith.

The lower pinch roll **51** and the upper pinch roll **250** are of the same diameter and are journalled at fixed distances apart with their opposed surfaces spaced about one-eighth of an inch from each other. However, the small rolls **251** and **252** are journalled in slides vertically movable in slideways **254** (Figure 2) and the positions of the roll-carrying slides in the slideways is determined by studs **255** threaded at the upper and lower ends of the two slideways. Adjustment of the position of the respective rolls **251** and **252** with relation to the rolls **51** and **250** will determine the drive imparted to the strip S.

According to previous practice, pinch rolls such as **51** and **250** have been adjustable with respect to each other so that they would press the strip between them to thereby exert tension upon the strip. However, this

prior adjustment of one roll with respect to the other permits the rolls to be tilted with respect to each other, resulting in an uneven pull upon the strip, with possible resultant buckling and stretching. By having the rolls **51** and **250** mounted on fixed centers and applying the necessary tension by means of the small rolls **251** and **252**, all possibility of tilting the large rolls is prevented.

The above pinch roll assembly comprises the main drive for the strip S. Applying the principal drive to the strip at this point and beyond all of the strip treating elements insures that the strip will be under uniform tension during its movement through all of the treating elements. Also, the main pinch rolls cannot scuff the strip because its plating will be hard at this point. However, as mentioned above and as is diagrammatically indicated in Figures 1 and 2, an auxiliary drive is imparted to the strip by the pinch roll assembly **26** positioned at the out-feed end of the pickling tank **25** and the motor **54** for this latter assembly may be in circuit and synchronized with the motor **52** so that a proper tension will be exerted on the strip by the main pinch roll assembly **50** with respect to that exerted on the strip by the auxiliary pinch roll assembly **26**.

As shown in Figure 2, the auxiliary pinch roll assembly **26** comprises a lower large roll **26*a*** driven by motor **54** through reducing gearing, and a smaller upper roll **26*b*** which is slidable toward large roll **26*a***. However, assembly **26** may be of the same form as the main drive assembly **50**.

Referring to Figure 1, after the strip has moved about the upper pinch roll **250**, it moves downwardly to the first of a series of rolls **260** mounted on the base **261** of the looper **55**. In accordance with customary practice, the strip moves in vertical runs between the rolls **260** and rolls **262** provided on the movable carriage **56** of the looper. Also in accordance with known practice, the movable carriage **56** is connected to counterweights **57** which are vertically movable with respect to the tower **265** of the looper and brake mechanism is provided on the tower to prevent the counter-weights from dropping in the event that the strip S breaks. The present invention includes an improved manner of connecting the counterweights to the carriage **56**, as well as novel brake control for the carriage and counter-weights.

As is illustrated in Figure 1, the movable carriage **56** of the looper has two strap elements **266** extending upwardly therefrom and these strap elements have cable clamps **267** secured thereto at points adjacent the center or vertical axis of the carriage. That is, as shown in Figure 1, the clamps are directly between the two vertical beams **268** on which the carriage is guided and, as is shown in Figure 2, they are midway of the beams **268**. Cables **270** and **271** extend upwardly from the respective clamps. As shown in Figure 3, both of these cables pass about a main sheave **272** journalled on the fixed platform **273** at the top of the looper tower **265**.

It will be perceived that the portions of the cables extending from the sheave **272** to the clamps **267**, extend closely adjacent to each other in a vertical plane which is midway between two sides of the looper carriage. This plane is also midway between the counter-weights **57**.

The cable **270** passes up about the sheave to have one bight **274** completely encircling the sheave and the cable then passes off the lower surface of the sheave and over an auxiliary sheave **275**. Beneath auxiliary sheave **275**, the cable is connected to one of the counter-weights **57**. The other cable **271** passes upwardly about the sheave **272** and has one bight **276** completely encircling the latter, this cable then extending off the top of the sheave to an auxiliary sheave **277** and then down to the other counter-weight **57**. Guard walls **57*a*** (Figure 4) enclose the lower portion of the paths of movement of the counter-weights.

It will be observed that the two cables **270** and **271** are wound in opposite directions about the sheave **272**. In addition, as shown in Figure 3, the axis of sheave **272** is at an acute angle to one of the parallel planes in which the counterweights move, so that portions of the cables which extend downwardly from the auxiliary sheaves and to the counter-weights lie in a single plane which is at right angles to the planes in which the counter-weights move.

As is indicated in Figure 3, a speed reducer **280** is connected to the shaft **281** which carries the main sheave **272**. The high speed shaft or element **282** of the speed

reducer **280** has a centrifugal switch **283** associated with one thereof. The other end of shaft **282** is equipped with a magnetic brake **284** actuated from housing **284***a* and controlled by the centrifugal switch **283**. Whenever high speed shaft **282** of the reducer **280** moves at a greater than predetermined speed, the centrigugal switch will actuate a circuit to operate brake **284** to hold the sheave **272** against rotation. In other words, if the strip should break from any cause, so that the movable looper carriage **57** may move upwardly at high speed by the action of the counter-weights **57**, this movement will be detected by the switch **283** and the brake **284** will be applied to the high speed shaft **282**. The provision of the speed reducer **280** and the use of its high speed shaft **282** in the brake device, with a consequent reduction in torque, permits the use of a relatively small brake. The centrifugal switch **283** is also connected to the circuit of strip driving motor **52** to stop operation of this motor as well as all other strip driving motors when the strip breaks. For example, if the auxiliary strip drive **26** is used, its motor **54** would also be stopped at this time.

A further control of the looper is provided by the strip breakage detectors **58** and **59** illustrated in Figure 1. Each of these detectors includes an arm **300** (Figure 4) fixed to a shaft **301** extending into the switch box of the detector, the arm carrying a roller **302** adapted to bear upon the strip S. The arm is weighted as indicated at **303** so that if the strip breaks, the arm may move past the normal plane of the strip. This movement will close an electrical circuit through the lines generally designated **304** to also apply the brake **283**. The strip driving motors will also be stopped as described above. The solenoid actuated valves controlling gas flow to the brightening furnace burners and a solenoid actuated valve of the strip cooling device **35** also may be controlled from switch **283** and the detectors **58** and **59** so that the supply of gas to the burners will be shut off and cooling water applied to the strip when movement of the strip is stopped by switch **283** and the detectors.

The detector **58** is provided in the vertical run **250'** of the strip which extends directly to the main pinch rolls **50**. This run will be particularly sensitive to any breakage of the strip in advance of these pinch rolls. The other detector **59** is positioned in a vertical run **305** of the strip which moves from a roll **306** to the usual tension rolls **60**. The strip S moves to roll **306** from the outfeed roll **262** of the looper carriage and roll **306** is journalled on the stationary frame of the looper. The run **305** will be particularly affected by any breakage of the strip between the tension rolls **60** and the main pinch rolls so that actuation of the detector **59** will promptly occur in the event of breakage.

It will be observed from the above that the detectors **58** and **59** are so arranged that one of them will be immediately actuated if the strip breaks on either side of the main pinch rolls **50**.

The terminology used in the specification is for the purpose of description and not of limitation, the scope of the invention being indicated in the claims.

I claim:

1. A looper for strip material including a tower structure, a take-up platform vertically movable in said tower structure, a sheave on said tower structure, a cable extending upwardly from said platform and wound about said sheave, a counter-weight on the free end of said cable, a speed reduction unit including high and low speed shafts and having its low speed shaft connected to said sheave, brake means for the high speed shaft of said unit, and means actuated by the high speed shaft of said speed reduction unit to control said brake means.

2. A looper for strip material including a tower structure, a take-up roll platform vertically movable in said tower structure, a sheave on said tower structure, a pair of cables extending from the center of said platform and about said sheave, each cable having a bight thereof passing about the sheave, and counter-weights carried at the free ends of said respective cables, one cable extending from said sheave to its counter-weight in a direction opposite to that in which the other cable extends to its counter-weight.

3. A looper for strip material comprising a tower structure, a looper roll carriage vertically movable in said tower structure, a sheave at one upper portion of said tower structure, a pair of cables extending from said carriage, about said sheave and thence downwardly, and a counter-weight on each of two opposite sides of said tower, said counter-weights being respectively slidable in parallel planes, the axis of said sheave being at an acute angle to one of said planes so that the portions of the cables extending downwardly to the counter-weights may lie in a plane normal to the planes in which the counter-weights move and the counter-weights may be positioned directly opposite each other.

References Cited in the file of this patent

UNITED STATES PATENTS

614,069	Wimmer	Nov. 8, 1898
1,688,789	Comiskey	Oct. 23, 1928
1,964,170	Mikaelson	Feb. 6, 1934
2,010,122	Wikle	Aug. 6, 1935
2,078,800	Juchter	Apr. 27, 1937
2,179,517	Pelosi	Nov. 14, 1939
2,240,265	Nachtman	Apr. 29, 1941
2,266,330	Nachtman	Dec. 16, 1941
2,280,943	Ferm	Apr. 28, 1942
2,454,021	Wilson	Nov. 16, 1948
2,494,402	Mursch	Jan. 10, 1950
2,561,165	Arcement	July 17, 1951