July 21, 1959 E. A. FOUST 2,895,489

CLEANING AND REELING MECHANISM FOR STRIP STOCK

Filed April 18, 1955 4 Sheets-Sheet 1

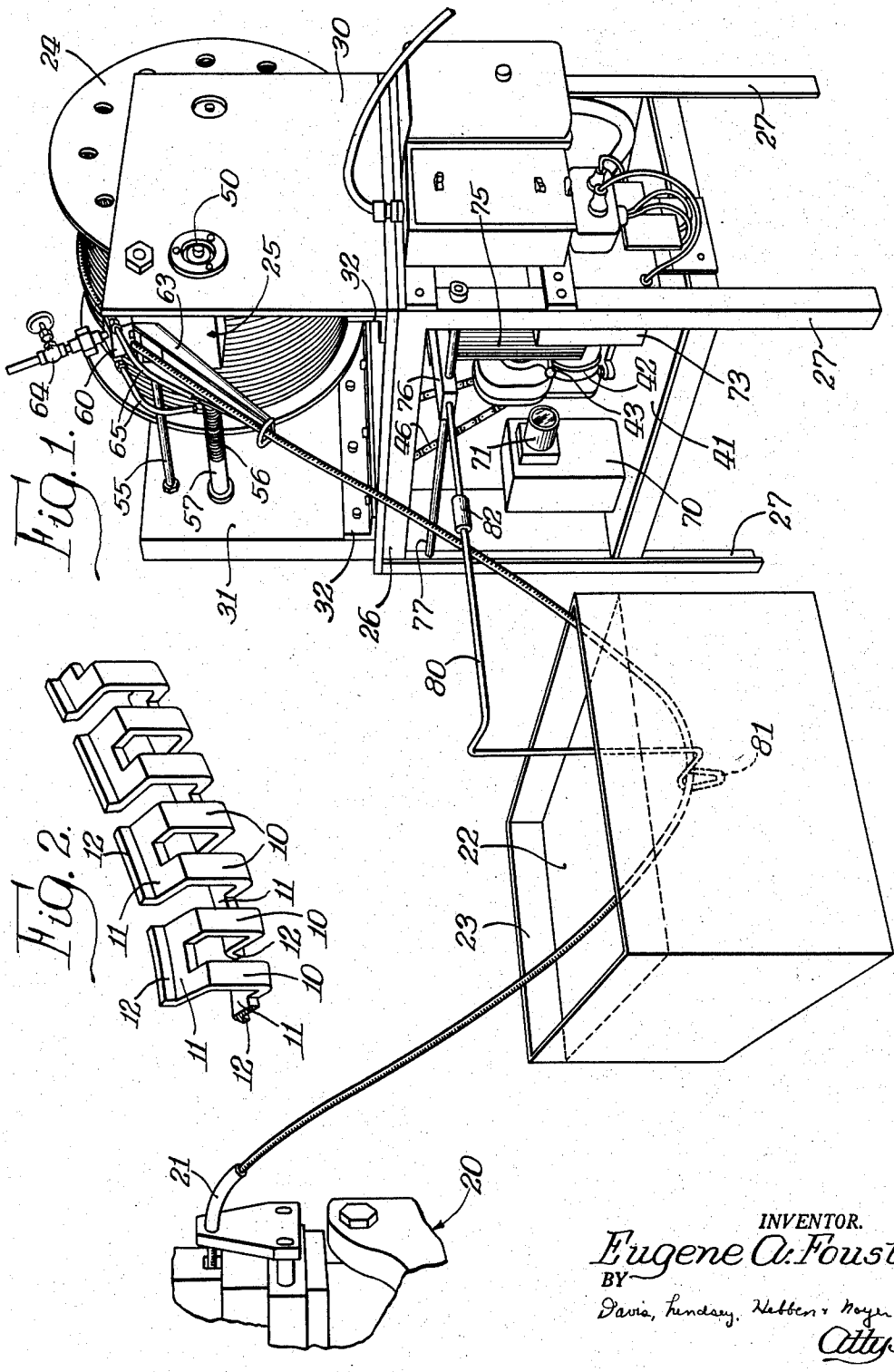


Fig. 1.

Fig. 2.

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CLEANING AND REELING MECHANISM FOR STRIP STOCK

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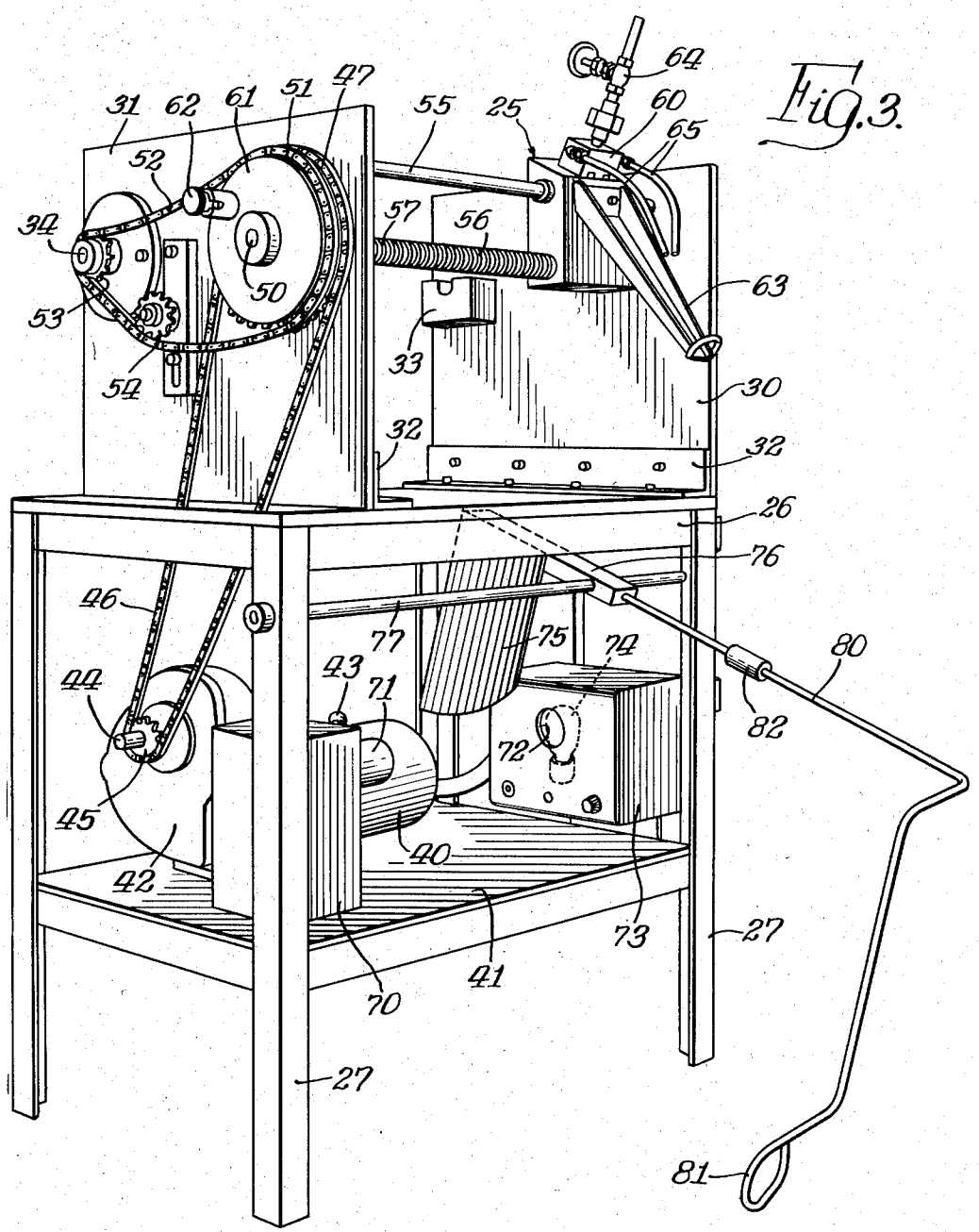


Fig. 3.

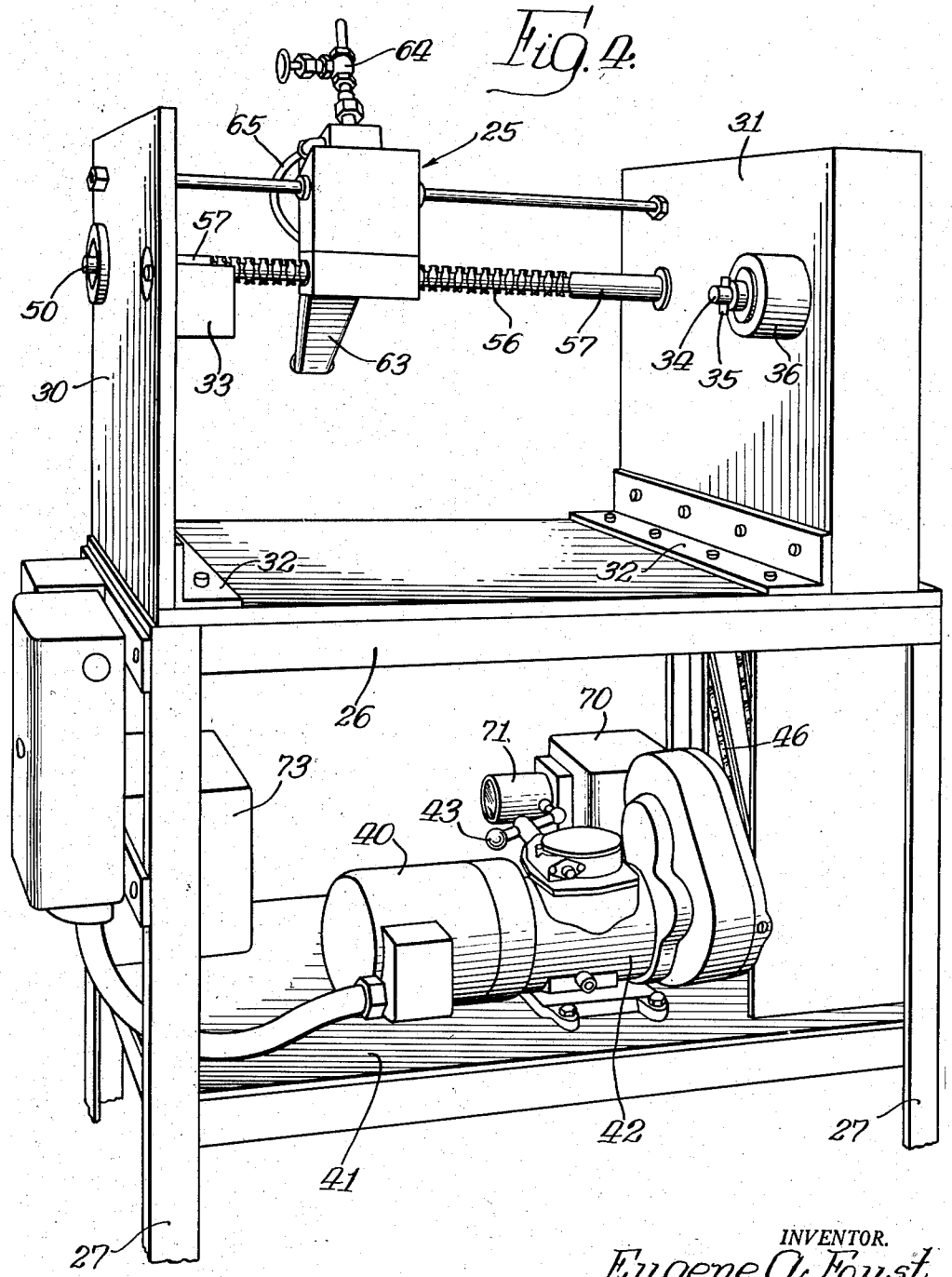
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CLEANING AND REELING MECHANISM FOR STRIP STOCK

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Fig. 4.



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CLEANING AND REELING MECHANISM FOR STRIP STOCK

Filed April 18, 1955 4 Sheets-Sheet 4

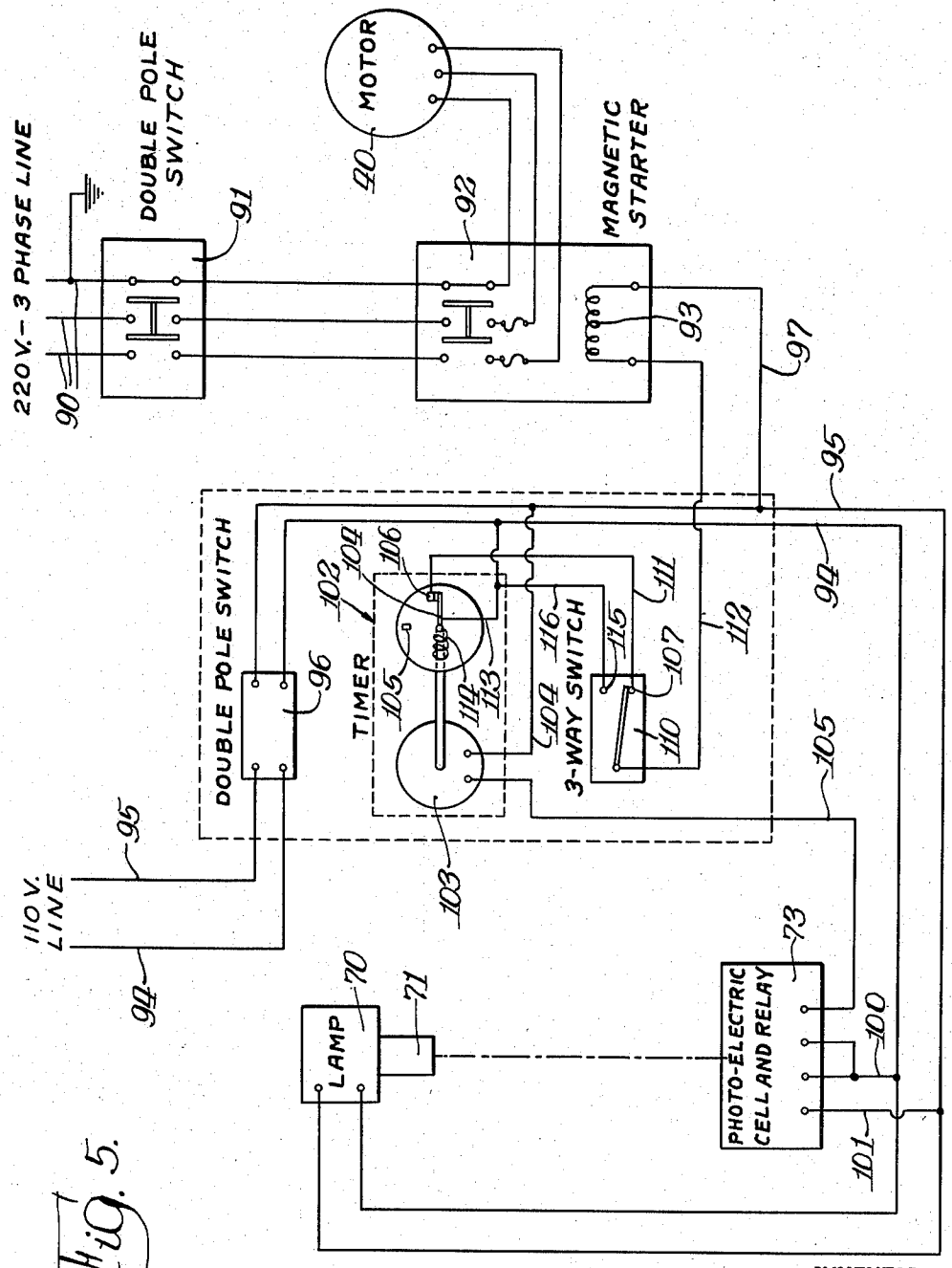


Fig. 5.

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2,895,489

CLEANING AND REELING MECHANISM FOR STRIP STOCK

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Application April 18, 1955, Serial No. 501,860

4 Claims. (Cl. 134—57)

The invention relates generally to means for handling strip stock as it is continuously fed from a forming machine or the like, and more particularly to a mechanism for carrying the stock through a cleaning bath and thence to a means for winding the stock on a reel.

The general object of the invention is to provide a novel cleaning and reeling mechanism for strip stock which is stretchable, the mechanism being automatically controlled to maintain passage of the stock through the cleaning bath and thence winding the stock on a reel without stretching the stock.

More specifically it is an object to provide a novel cleaning and reeling mechanism for stretchable strip stock, by means of which the stock as it comes from the forming machine is permitted to sag sufficiently to dip into a cleaning bath without any substantial tension on the stock and then to be drawn to a reeling means, the latter being automatically controlled so that the slack in the stock is never taken up and the stock continues to pass through the cleaning bath.

A further object is to provide a novel cleaning and reeling mechanism of the foregoing character, in which the reeling means is controlled by variations in the slack in the stock but is prevented from being energized and de-energized too frequently.

Another object is to provide a novel cleaning and reeling mechanism for strip stock, in which the stock is dried after passing through the cleaning bath and before it is reeled, and in which the stock is wound in even layers on the reel so that it will not tangle when withdrawn for further operations on it.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a perspective view of a cleaning and reeling mechanism embodying the features of the invention;

Fig. 2 is an enlarged fragmentary perspective view of a portion of a strip of material of the type for which the present mechanism is adapted;

Fig. 3 is a perspective view of the reeling portion of the mechanism at the opposite side from that shown in Fig. 1;

Fig. 4 is a perspective view of the rear of the reeling mechanism; and

Fig. 5 is a wiring diagram showing the control of the drive for the reeling means.

The mechanism disclosed herein is adapted for use with strip stock of a stretchable nature and is adapted to cause the stock to pass through a cleaning bath and then to be wound on a reel, without causing any stretching of the stock. While the mechanism may be used with various specific forms of such stock, in the present instance it is illustrated as being adapted to handle stock from which expander springs for piston ring assemblies are made. A fragmentary length of such stock is illustrated in Fig. 2 of the drawings, and it comprises a plurality of web members 10 which are bent into a U shape

and are connected at their respective ends by two rows of segments 11, the segments in the two rows being in staggered relation so as to form a continuous expansible or stretchable strip of material, the web member 10 flexing edgewise relative to each other on expansion or contraction of the strip. The segments at their edges are bent to provide flanges 12. A strip of this character, when cut into a predetermined length and formed into a circle, is utilized as a combined spacer and expander for a pair of thin washer-like elements known as "rails."

In order that an expander of this character may operate properly, each expander has a predetermined number of web members 10 and segments 11 and is set to a predetermined circumferential length in order to exert a predetermined outward pressure on the rails when placed in a groove in a piston within a cylinder. For that reason, in the forming and subequent handling of the strip in making such expanders, the unit or pitch length of the strip must be carefully controlled. The strip is formed by punching transverse slots therein and then bending it along longitudinally extending lines, and the strip as it comes off the forming machine will thus inherently have a predetermined pitch or unit length. Such pitch or unit length may be that which is desired for the finished expander, although in the present instance it is found to be preferable to stretch the stock during a heat-treating operation thereon. This operation occurs after the forming, and the stock is maintained in the same condition in which it is discharged from the forming machine, without any stretching until it reaches the above-mentioned heat-treating operation.

The stock during forming is covered with oil to facilitate the forming operations and such oil, along with the accumulation of any dirt or chips, must be removed before the stock undergoes the heat treating operation. For production reasons, it is desirable to wind the stock on reels for transfer to the subsequent operation such as the heat treating operation.

The present mechanism is arranged to receive the stock from the forming machine, submit it to a cleaning operation, and then wind it on a suitable reel. Since the stock must not be stretched during such handling and since it is difficult and impracticable to maintain the speed of the reeling means the same as the rate at which the stock is discharged from the forming machine, the present mechanism involves careful control of the reeling means without placing any tension on the stock. The forming machine, in the present instance, is of a type in which the stock is fed into the machine for a given length, the feeding of the stock is then stopped to permit performance of the forming operation, and the stock is then advanced through a similar increment. The discharge from the forming machine thus may be said to be intermittent. In reeling, it is desirable to have the reel operate continuously, except for periods of automatic adjustment, so that the intermittent movement of the stock as it comes off the forming machine is converted into continuous movement of the stock when placed on the reel.

Since the stock must not be stretched and consequently no substantial tension can be placed thereon, it cannot be caused to move through a cleaning bath by means of submerging rolls because of the friction involved and the consequent tension that would be necessary on the stock for such mode of handling. It is therefore desirable, in order to minimize any chance of tension being placed on the stock, to permit it to sag between the forming machine and the reeling mechanism so that it can merely dip into a cleaning bath without substantial tension on the stock. The sagging arrangement also facilitates the conversion of the intermittent motion of the

stock as it leaves the forming machine to the continuous motion as it is placed on the reel.

The present mechanism provides for a predetermined amount of sag in the stock and is provided with a means which is highly sensitive to any change in the amount of sag to control the reeling mechanism. The reeling mechanism is driven by an electric motor, the control of which is responsive to variations in the sag of the stock, but means is included in the control circuit of the motor to prevent the motor from being turned on and off too frequently. The mechanism also includes means for drying the stock after it passes through the cleaning solution to avoid corrosion when placed on the reel, as well as means for winding the stock in even layers on the reel so that it will not become tangled and cause difficulty later when it is withdrawn therefrom.

In the drawings, the stock is shown as being discharged from a forming machine indicated fragmentarily at **20** (see Fig. 1). To permit the stock to sag without catching on the discharge portion of the forming machine **20**, it is arranged to be passed through a bent tube **21** which directs the stock downwardly at an angle toward a bath of cleaning solution **22** contained in an open-top tank **23**. The stock sags sufficiently to cause a substantial portion of the length of the stock to dip into the cleaning solution **22**, the stock then moving to a reel **24** to be wound thereon. To cause the stock to be wound in even layers on the reel **24**, a level wind device, indicated generally at **25**, is provided. As the stock moves through the level wind device **25**, air is blown thereon to dry up any cleaning solution remaining on the stock at that point.

The reel **24** and its driving and control means, as well as the level wind device, are preferably carried on a table **26** having legs **27**. The tank **23** is positioned below the level both of the discharge tube **21** of the forming machine and of the reel **24** so that the stock is free to sag therebetween and dip into the cleaning solution **22** in the tank **23**. The reel **24** is adapted to be supported on the table **26** by a pair of end plates **30** and **31** extending upwardly from the top of the table and rigidly secured thereto as by angle irons **32**. The plate **30** supports one end of the reel **24** by means of a block **33** (see Figs. 3 and 4) mounted on the inner face of the plate **30** and having a U-shaped notch in its upper surface to receive a trunnion (not shown) extending from the end of the reel. The other end of the reel is supported by means which also effects drive thereof. Thus, the reel at that end is provided with a socket adapted to fit over a shaft **34** (see Fig. 4) which has a cross pin **35** adapted to fit into a notch formed in the end of the socket means on the reel. The shaft **34** is journalled in a housing **36** carried by the plate **31**. Thus, a reel may be removably and rotatably mounted on the table **26** between the end plates **30** and **31**.

To drive the reel **24**, a driving means comprising an electric motor **40** is mounted on a shelf **41** extending between the legs **27** of the table. The motor **40** is connected to an adjustable variable speed drive **42** which is provided with a handle **43** by means of which the ratio of speed reduction may be adjusted. The variable speed drive **42** has an output shaft **44** (see Fig. 3) provided with a sprocket **45** connected by a chain drive **46** to a sprocket **47** journalled on a shaft **50** rotatably supported at its ends and extending between the two end plates **30** and **31**. The sprocket **47** is mounted on the shaft **50** adjacent the outer face of the plate **31**. Rigidly connected to the sprocket **47** is a second sprocket **51** which is connected by a cahin drive **52** to a sprocket **53** carried on the shaft **34** which supports and drives the reel **24**. An idler sprocket **54** is adjustably mounted on the end plate **31** to maintain the desired tension in the chain drive **52**. Thus, reel **24** is driven by the motor **40** through the variable speed drive **42**, and the speed of rotation of the reel **24** may be varied by adjustment of the handle **43** on the variable speed drive.

The level wind device **25** is slidably supported on a rod **55** extending between the end plates **30** and **31** and located above and parallel to the shaft **50**. The level wind device is a well-known mechanism and comprises shiftable pawl means (not shown) adapted to cooperate with a pair of oppositely directed threads **56** which in this instance are formed on the shaft **50**. At each end of the threaded portion **56** of the shaft **50** is a sleeve **57** having an end surface adjacent the threads which causes camming action on the pawl means to reverse the direction of movement of the level wind device **25**. By means of the reverse threads **56**, the level wind device **25** is adapted to be moved back and forth parallel to the reel and causes the stock to be wound in even layers on the reel **24**. The level wind device **25** carries the guide block **60** through which the stock passes in moving toward the reel **24**. Since a level wind device of this character is well known, further details thereof need not be described. The shaft **50** which carries the threads **56**, at its outer end rigidly carries a driving disc **61** in face-to-face relation with the sprocket **51**. To drive the shaft, the disc **51** carries an eccentric spring pressed plunger **62** adapted to engage in a hole in the sprocket **51**, the plunger **62** being manually removable therefrom to disengage the drive for the level wind device. Thus the level wind device **25** is driven from the same source of power as is utilized for driving the reel **24** and will be operated in timed relation therewith.

The level wind device **25** is provided with a guide chute **63** through which the stock passes to the guide block **60**, and the stock as it passes through the chute **63** is adapted to be dried so that no cleaning solution will remain on the stock when it is reeled. To this end, an air hose connection **64** is mounted on the guide block **60** and communicates with a pair of curved nozzles **65** directing streams of air against opposite sides of the strip as it passes through the guide chute **63**. The air thus directed onto the stock dries off all traces of cleaning solution that may be carried upwardly by the stock.

As heretofore mentioned, the portion of the stock between the forming machine **20** and the reel **24** is permitted to sag into the cleaning solution **22** and in the tank **23**. So long as the sag in the stock is maintained, there will be no substantial tension placed on the stock by the reeling means. The sag in the stock, however, must be sufficient to cause a substantial portion of the length of the stock to dip into the cleaning solution. To maintain this condition, the drive means for the reel **24** is so controlled that a sufficient sag will be maintained in the stock to permit it to dip into the cleaning solution. Since it is difficult to cause the reel to operate at exactly the same rate as the rate of discharge of the forming machine, the variable speed drive is adjusted to cause the reel to be operated at a slightly higher rate than the forming machine and the reel is momentarily stopped when the sag is insufficient. A means is therefore provided which is actuated by a variation in the amount of sag, to control the rotation of the reel **24**. Such means is highly sensitive to a change in the amount of sag so that it does not place any restraint on the stock that would increase the tension thereon materially.

In the present instance a photo-electric means is utilized to control the drive for the reel **24**, and such photo-electric means is adapted to be energized and deenergized by means of a shield carried by a delicately balanced lever responsive to the amount of sag in the stock in passing through the cleaning solution. To this end, I provide a source of light mounted in a box **70** carried on the shelf **41** and provided with tubular lens means **71** adapted to direct a beam of light horizontally toward an opening **72** provided in a box **73** supported on one of the legs **27** opposite the box **70**. Within the box **73** is a light-sensitive photo-electric cell, indicated in dotted lines at **74** in Fig. 3. The light-sensitive cell **74** is adapted to control the

current supplied the motor **40** in response to the beam of light from the source in the box **70**.

In the present instance, operation of the motor **40** is stopped when no light is permitted to reach the photo-electric cell **74** from the source in the box **70**, and when light does reach such cell from the source, the motor operates to cause rotation of the reel. The means responsive to the amount of sag in the stock in passing through the cleaning solution is provided with a shield which will intercept the beam of light to the photo-electric cell **74** when the amount of sag decreases to an extent where an insufficient length of stock dips into the cleaning solution. To this end, a flat plate-like shield **75** is suspended on one end of a lever **76** which is pivotally supported by a rod **77** extending between two legs **27** of the table. The shield is so positioned that when it is lowered from the position shown in Fig. 3 it will intercept the beam and cause the motor **40** to stop, and when raised will permit the beam to energize the photo-electric cell **74** to cause operation in the motor **40** and hence rotation of the reel **24**.

The lever **76** carries a rod **80** which extends forwardly towards the tank **23** and thence downwardly with its lower end portion dipping into the cleaning solution **22** in the tank. The lower end portion is adapted to engage the stock and in the present instance is formed into a loop **81** through which the stock passes. Thus, when the sag in the stock decreases, the loop **81** will be raised so that the shield **75** intercepts the beam of light to the light-sensitive cell **74** to stop the drive for the reel. The amount of sag in the stock thereupon immediately increases since the forming machine **20** continuously feeds stock and the reel **24** is momentarily stopped. The increase in the amount of sag thus causes the lever **80** to swing downwardly and to move the shield **75** out of intercepting position with the light beam so that the motor **40** will again rotate the reel. In order to delicately balance the lever **76** with its rod **80** so that the slightest change in the amount of sag in the stock will swing the shield **75**, a counterbalancing weight **82** is adjustably mounted on the rod **80** so that a minimum of force is required to swing the shield **75**.

While the control of the motor **40** is highly sensitive to the amount of sag in the stock to avoid placing any substantial tension on the stock, the control is such that too frequent energization and de-energization of the motor is prevented. It was found that, if the motor were started immediately by an increase in the amount of sag of the stock after the motor had been stopped by an insufficient sag, the motor would be started and stopped too frequently, resulting in undue wear on the motor, the control or starter switch for the motor, and on the photo-electric cell **74**. Moreover, the too frequent starting and stopping of the reeling means would cause the control rod **80** to bounce and would thereby tend to stretch the stock. With one of the forming machines with which the present mechanism has been used, the forming machine operates at a rate of 160 strokes per minute, and after each stopping of the motor, one stroke of the forming machine feeds sufficient stock to increase the sag in the stock to the point where the photo-electric cell is re-energized. For this reason, a time delay is provided in the motor control circuit to prevent immediate energization of the motor.

In Fig. 5 of the drawing, I have shown a wiring diagram for supplying current to the motor **40** and for controlling operation thereof. The motor **40** is adapted to be connected to a power line such as a 220 volt 3-phase line indicated at **90**. In the line **90**, a manually operable disconnect switch **91** is provided. The latter is connected to the motor **40** through a magnetic starter **92** having a coil **93** connected to the control circuit and effecting opening and closing of the starter **92**.

The control circuit is energized by a 110 volt line comprising the leads **94** and **95** which have a manually operable disconnect switch **96** connected therein. The coil **93** of the magnetic starter **92** is connected to one side of the 110 volt line, in this instance to the lead **95**, by a branch line **97**. The leads **94** and **95** are also connected by branch lines **100** and **101** to the photo-electric cell and relay in the box **73** and extend to a lamp in the box **70** which constitutes the source of light for energizing the photo-electric cell **74**.

The time delay in the motor control circuit is provided by a timer indicated generally at **102**. The timer **102** includes a timer motor **103** which in this instance is connected by a line **104** to the lead **95** and by a line **105** to the photo-electric cell and relay, and the latter is adapted to energize the motor **103** whenever the photo-electric cell is subjected to light from the lamp in the box **70**. The timer motor is adapted to close a normally open switch in the circuit for the coil **93** of the magnetic starter **92** after an adjustable period of delay. In the present instance, the timer motor **103** is shown as rotatably driving a switch arm **104** counterclockwise from a position in engagement with a stop **105** to a position where the arm **104** engages a fixed contact **106**. The latter is connected to a contact **107** of a switch **110** by a line **111**, and the movable member of the switch **110** is connected by a line **112** with the coil **93** of the magnetic starter **92**. The switch arm **104** of the timer is connected by a line **113** to the lead **94** of the 110 volt line. Thus, when the switch arm **104** engages the contact **106** and the movable member of the switch **110** engages the contact **107** as shown in Fig. 5, the coil **93** is energized and the magnetic starter closes the circuit for the motor **40** to drive the reel.

When the sag in the stock decreases and the shield **75** shuts off the beam of light to the photo-electric cell, the timer motor **103** is de-energized. A torsion spring **114** in the timer then rotates the arm **104** clockwise out of engagement with the contact **106**, and the circuit to the coil **93** is thereby broken to stop the motor **40**. The arm **104** is rotated clockwise by the spring **114** until it engages the stop **105**. When the sag in stock again increases by the next operation of the forming machine and the light beam again energizes the photo-electric cell, the timer motor **103** is started but the main motor **40** is not started until the arm is rotated to the point where it engages the contact **106** to close the circuit for the coil **93**. A delay is thus provided by the time required for the arm **104** to move from the stop **105** to the contact **106**. The position of the stop **105** may be adjusted to vary the time delay in starting the motor **40**. When the arm **104** engages the contact **106**, movement thereof as well as movement of the timer motor **103** is prevented, but the timer motor is of a type which may be stalled while energized without damaging the motor.

The switch **110** is utilized to provide for manual operation of the reeling means, as when setting up the device. To this end, the switch **110** is provided with a second contact **115** engageable by the movable member of the switch and connected by a line **116** to the line **113** which in turn is connected to the lead **94**. Thus, when the movable member of the switch **110** is shifted to the contact **115**, current is supplied to the coil **93** of the magnetic starter without having the timer in circuit.

With the foregoing structure, it will be evident that I have provided a cleaning and reeling mechanism which places no substantial tension on the stock and thus avoids any chance of stretching it. The stock is permitted to sag into the cleaning solution for a sufficient length to effect the desired cleaning and any decrease in the amount of sag will cause the motor **40** to stop and thus stop rotation of the reel **24**. Since the stock is continuously fed from the forming machine **20**, the sag in the stock will quickly increase and when there is sufficient sag, the motor is again started for operating the reel **24**. As the stock is wound on the reel, even layers thereof are formed by the level wind device **25** so that no tangling of the

stock will occur. The stock is dried before being placed on the reel by means of the air jets from the pipes 65. The time delay provided in the control circuit for the motor prevents too frequent stopping and starting of the motor.

I claim:

1. A cleaning and reeling mechanism for stretchable strip stock fed continuously from a forming machine comprising an open top tank for cleaning solution adjacent the discharge of said machine, a rotatable reel mounted adjacent said tank on the opposite side from said machine, said tank being located so that its open top is below the levels of the discharge of said machine and the reel to permit the stock to sag into the cleaning solution, drive means for the reel for winding the stock thereon as it emerges from the cleaning solution, and control means for said drive means including a control member having a loop submerged in the cleaning solution and through which the stock passes, said control member also having a shield, and photo-electric means for controlling said drive means, said control member being counter-balanced and freely movable by the stock when the sag thereof decreases to avoid tension on the stock to move said shield into deenergizing relation with said photo-electric means to stop said drive means and increase the sag in the stock and thereby hold the stock in the cleaning solution.

2. A cleaning and reeling mechanism for stretchable strip stock fed continuously from a forming machine, comprising an open top tank for cleaning solution adjacent the discharge of said machine, a rotatable reel mounted adjacent said tank on the opposite side from said machine, said tank being located so that its open top is below the levels of the discharge of said machine and the reel to permit the stock to sag into the cleaning solution, drive means for the reel for winding the stock thereon as it emerges from the cleaning solution, and control means for said drive means including a pivoted control member having a loop on one end submerged in the cleaning solution and through which the stock passes, and a shield on its other end, said control member being counterbalanced to freely swing when the sag in the stock changes, and photo-electric means for controlling said drive means and adapted to be deenergized by said shield to stop said drive means when the sag in the stock decreases and adapted to be re-energized by movement of said shield to start said drive means when the sag in the stock increases sufficiently for the stock to pass through the cleaning solution.

3. A cleaning and reeling mechanism for stretchable strip stock fed continuously with a step by step movement from a forming machine, comprising an open top tank for cleaning solution to receive stock as it is discharged from said machine, a rotatable reel for withdrawing stock from the tank, said tank being located so that its open top is below the levels of the discharge of said machine and the reel to permit the stock to sag into the cleaning solution, drive means for the reel for winding the stock thereon as it emerges from the cleaning solution, comprising a drive motor having a driving connection with said reel, a circuit for supplying current thereto, and control means for said motor including a vertically movable control member adapted to engage the portion of the stock passing through said tank, said member being vertically movable in response to vertical movement of said portion, said control member being adapted to stop said motor on a predetermined decrease in the amount of sag, and time delay means cooperating with said control member to start said motor when the sag in the stock has increased to a predetermined extent.

4. A cleaning and reeling mechanism for stretchable strip stock fed continuously with a step by step movement from a forming machine, comprising an open top tank for cleaning solution to receive stock as it is discharged from said machine, a rotatable reel for withdrawing stock from the tank, said tank being located so that its open top is below the levels of the discharge of said machine and the reel to permit the stock to sag into the cleaning solution, drive means for the reel for winding the stock thereon as it emerges from the cleaning solution, comprising a drive motor having a driving connection with said reel, a circuit for supplying current thereto, and control means for said motor including a control member adapted to engage the portion of the stock passing through said tank and movable in response to vertical movement of said portion, a shield carried by said control member, photo-electric means adapted to be de-energized by said shield when the sag in stock decreases with the increase in sag due to one step of feeding movement of the stock reenergizing said photo-electric means, and timer means actuated in response to de-energization of said photo-electric means to open the motor circuit and having time delay means actuated in response to reenergization of said photo-electric means to close the motor circuit after a predetermined period of time to permit the sag in the stock to increase to the extent provided by a plurality of steps of feeding movement thereof.

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