Aug. 2, 1938. J. N. WHALEN 2,125,660

STRIP REEL

Filed June 17, 1936 4 Sheets-Sheet 1

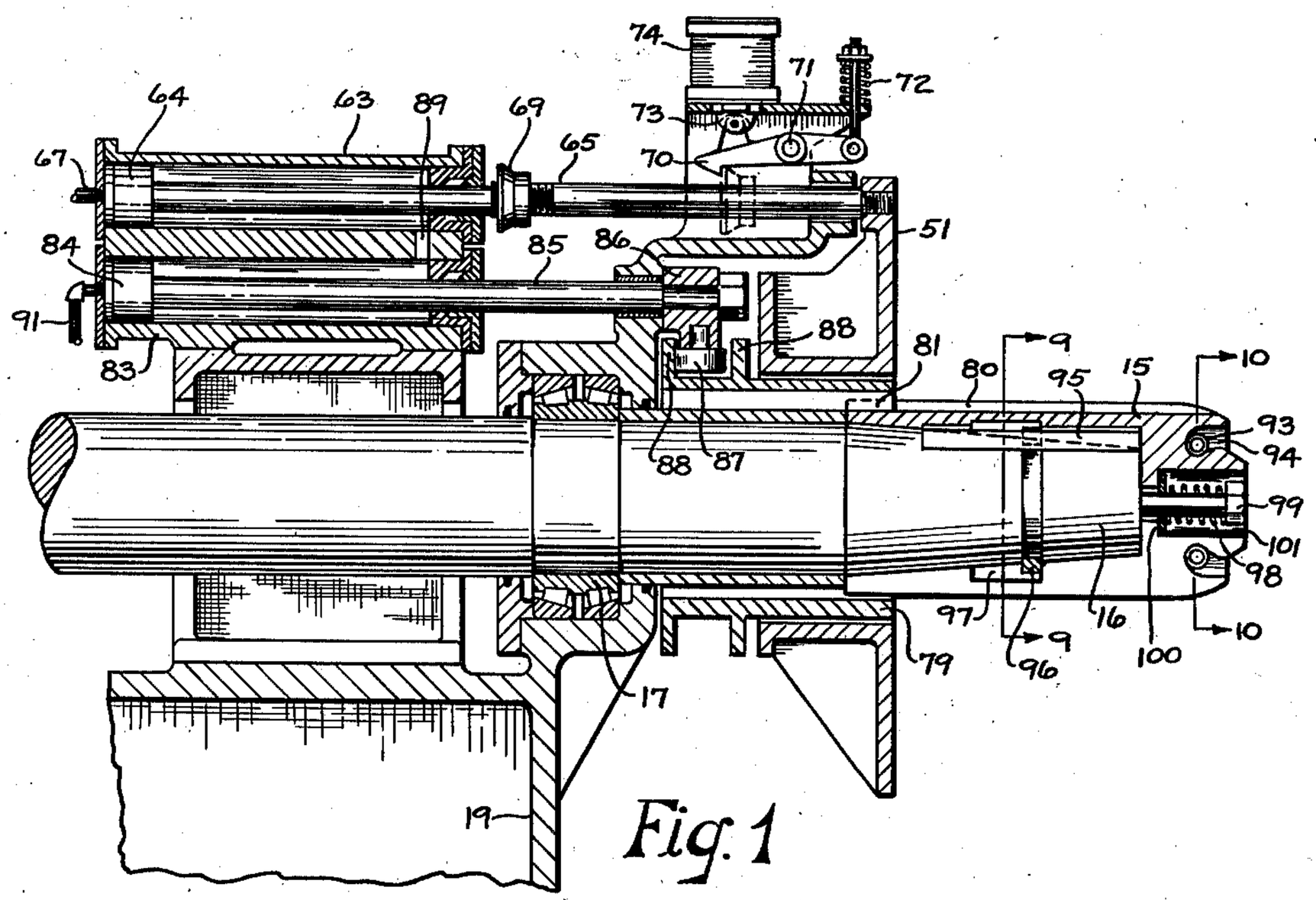
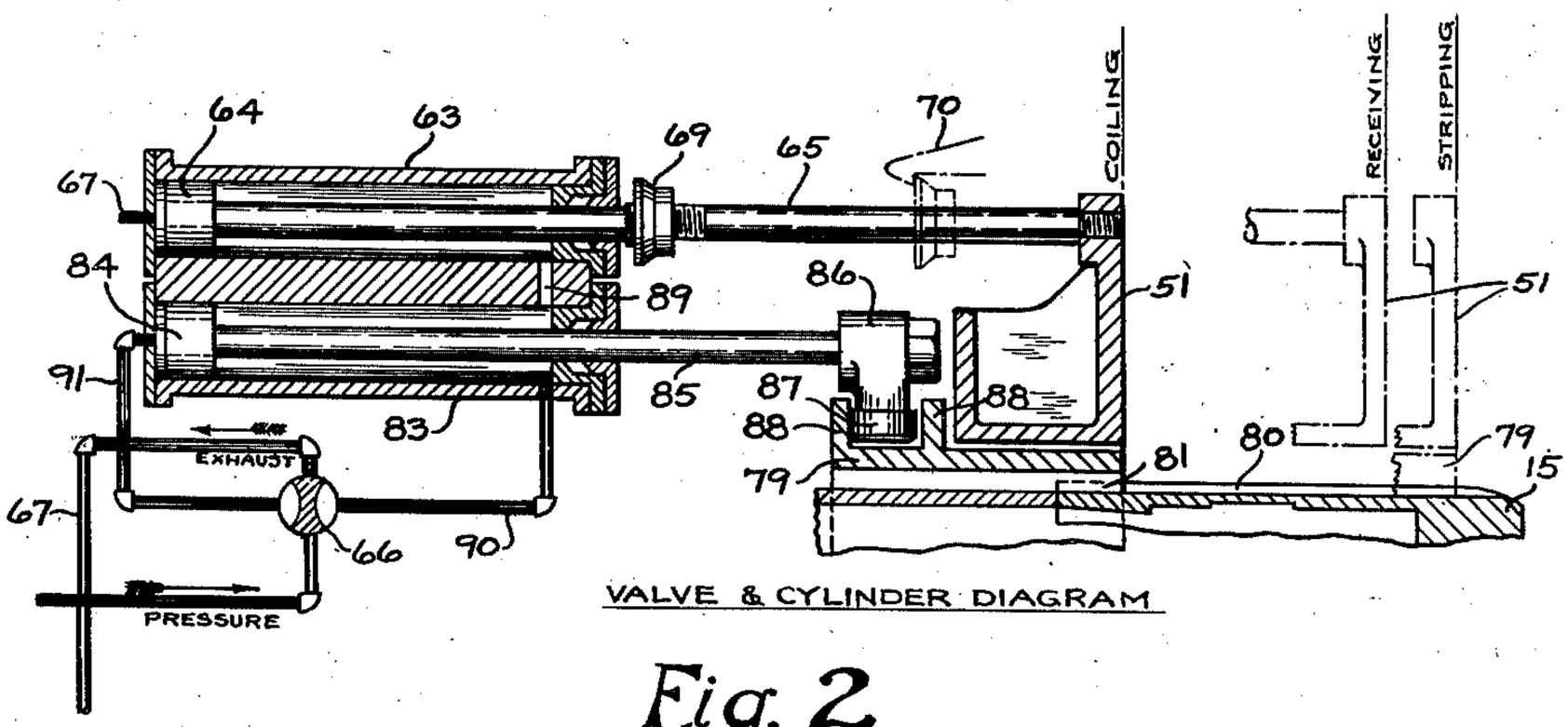


Fig. 1



VALVE & CYLINDER DIAGRAM

Fig. 2

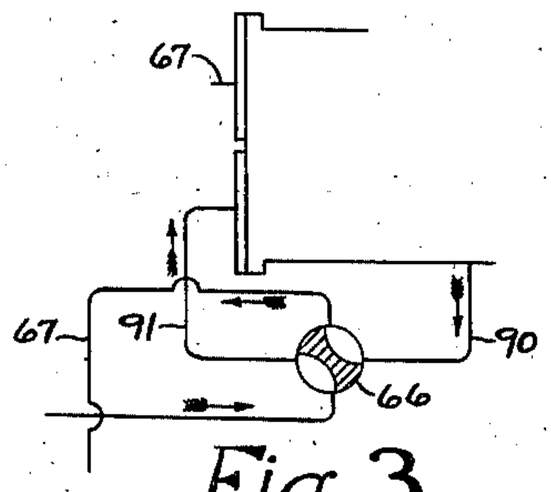


Fig. 3

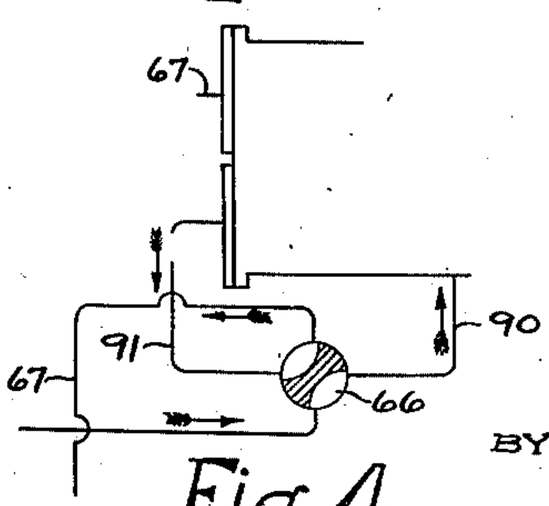


Fig. 4

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STRIP REEL

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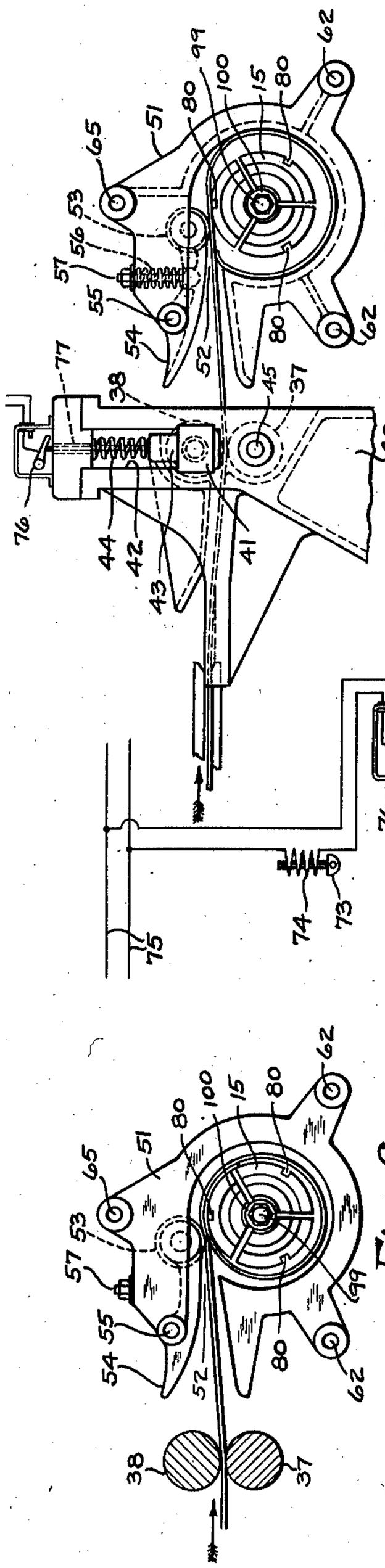

Fig. 5

Fig. 6

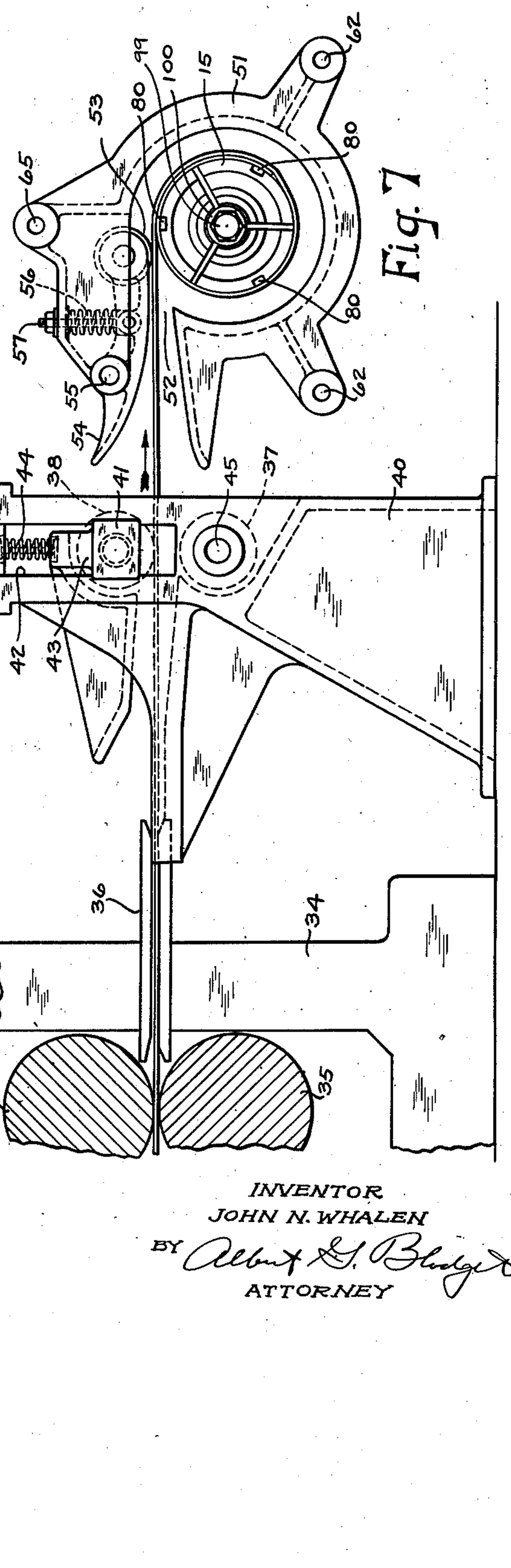

Fig. 7

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STRIP REEL

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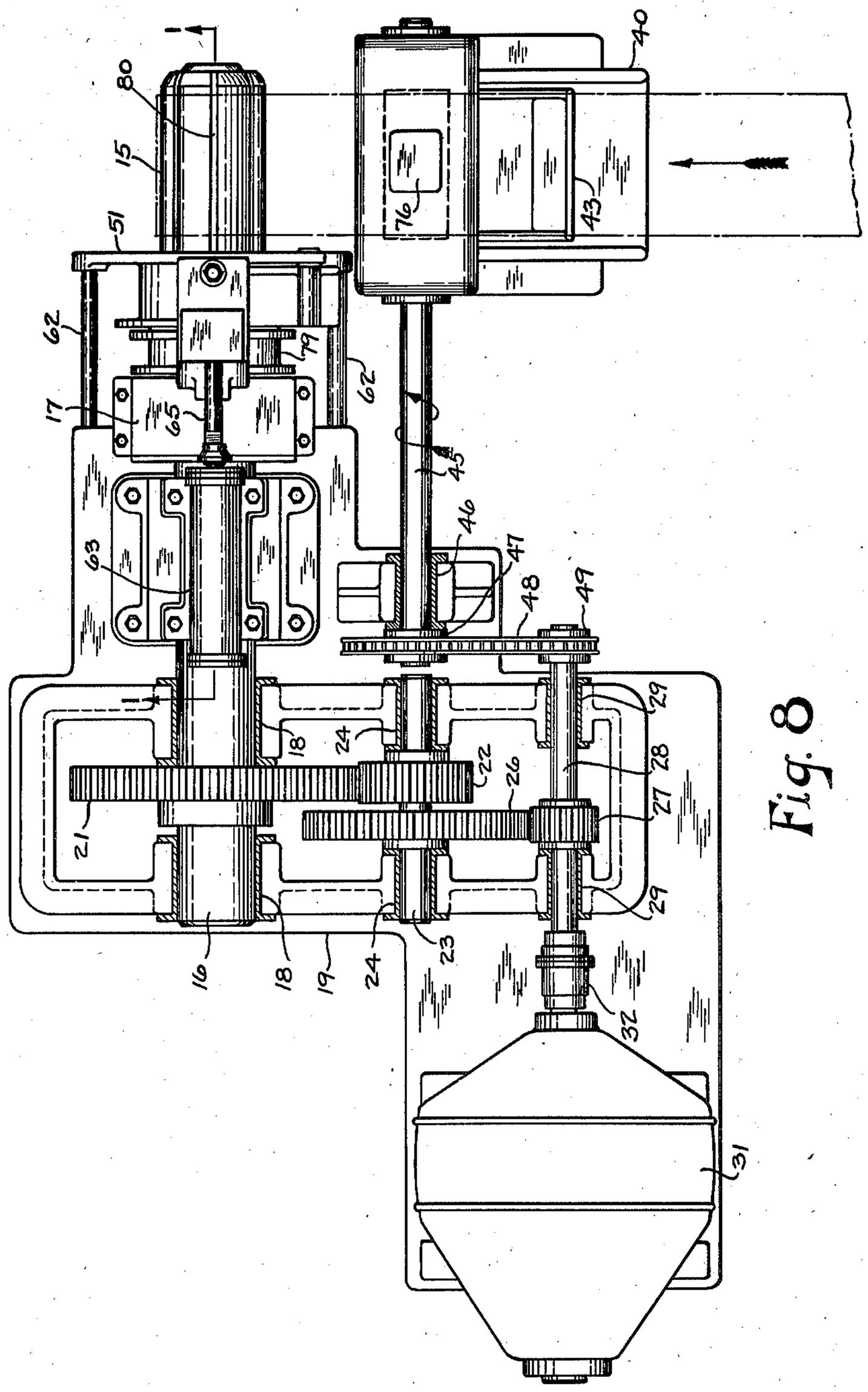

Fig. 8

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STRIP REEL

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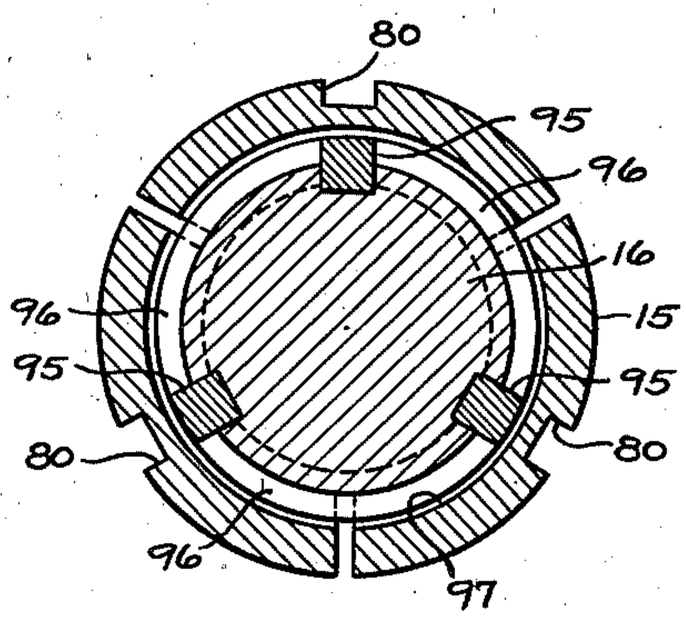

Fig. 9

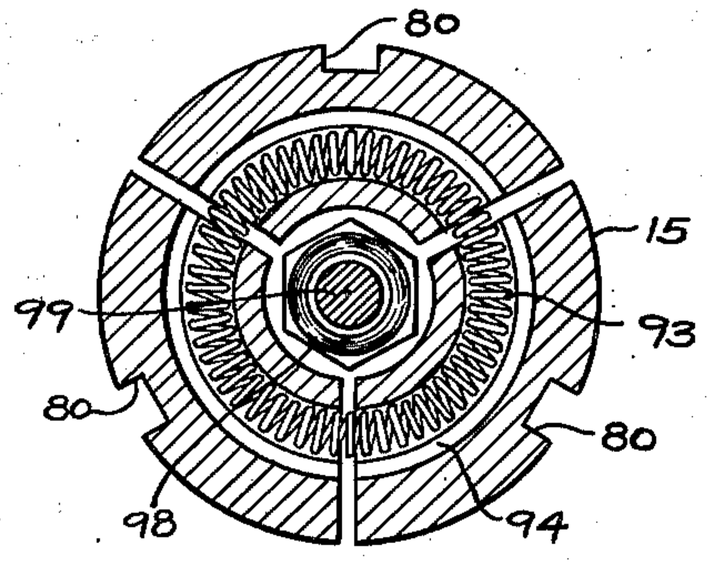

Fig. 10

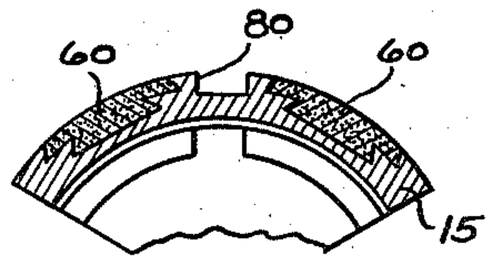

Fig. 11

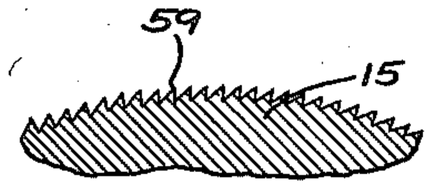

Fig. 12

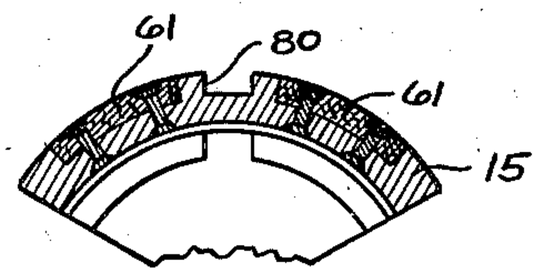

Fig. 13

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UNITED STATES PATENT OFFICE

2,125,660

STRIP REEL

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Application June 17, 1936, Serial No. 85,766

9 Claims. (Cl. 242—78)

This invention relates to strip reels, and more particularly to power driven mechanism for coiling thin flat material into bundles.

Machines of this general type are frequently used for coiling the flat rolled product of metal rolling mills, and they are usually arranged to receive the strip as it is delivered by the last stand of the mill. With the ordinary reel it is necessary to stop the mill and the reel in order to attach the front end of the strip to the reel. This is undesirable, since it reduces the capacity of the mill, marks the stock, and causes increased wear and tear on the different parts. Various arrangements have been proposed heretofore to grasp the front end of the strip automatically and without stopping the mill, but these prior constructions have been for the most part complicated, expensive and unreliable. Furthermore, with some of these machines it is not possible to maintain tension on the strip during the entire coiling operation, and as a result the bundle is not coiled with the degree of tightness desired.

It is accordingly one object of the invention to provide a comparatively simple, inexpensive and reliable mechanism for coiling strip material.

It is a further object of the invention to provide a comparatively simple, inexpensive and reliable mechanism adapted to receive the front end of a moving strip of material and coil the strip into a compact bundle.

It is a further object of the invention to provide a strip reel arranged to maintain the stock under tension during substantially the entire coiling operation.

It is a further object of the invention to provide a strip reel having a simple and effective means for ejecting the bundles from the reel.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

Referring to the drawings illustrating one embodiment of the invention and in which like reference numerals indicate like parts.

Fig. 1 is a section through a portion of a strip reel, the section being taken on the line 1—1 of Fig. 8;

Fig. 2 is a diagrammatic view of a portion of Fig. 1, showing the control valve and the connections thereto;

Fig. 3 is a diagram showing the control valve in position for stripping a bundle from the reel;

Fig. 4 is a diagram showing the control valve in position for starting the coiling operation;

Fig. 5 is an end elevation of the reel, showing the stock just starting to form into a coil;

Fig. 6 is a view similar to Fig. 5, showing the position of the stock an instant later;

Fig. 7 is a view similar to Fig. 6, showing the position of the stock an instant later, when all the slack has been taken up;

Fig. 8 is a top plan view of the strip reel;

Fig. 9 is a section on the line 9—9 of Fig. 1;

Fig. 10 is a section on the line 10—10 of Fig. 1;

Fig. 11 is a section through a modified form of drum segment;

Fig. 12 is a fragmentary section through a further modified form of drum segment; and

Fig. 13 is a section through a further modified form of drum segment.

The embodiment illustrated comprises a drum 15 substantially cylindrical in shape and arranged to be rotated about a horizontal axis. This drum is mounted on the overhung or projecting end portion of a horizontal spindle 16 which is rotatably supported in a bearing 17 located near the drum and in a pair of spaced bearings 18 (Fig. 8) located near the other end of the spindle. The bearings 17 and 18 are mounted in a suitable frame 19. A gear 21 is secured to the spindle 16 between the bearings 18, and this gear is driven by a pinion 22 secured to a shaft 23 rotatably supported in bearings 24 in the frame 19. A gear 26 is secured to the shaft 23, and this gear is driven by a pinion 27 secured to a shaft 28 rotatably supported in bearings 29 in the frame 19. The shaft 28 is driven by an electric motor 31 which is directly connected thereto by means of a suitable coupling 32. It will be apparent that with this construction the motor 31 will serve to rotate the drum 15 through the medium of the various gears.

The drum 15 serves as a core upon which the coil is formed, and the stock may be delivered to the drum by any suitable means. As shown in Fig. 7, the drum may receive the stock from the last stand of a rolling mill, this stand comprising a housing 34, a pair of horizontal rolls 35, and a delivery guide 36. Between the rolling mill and the drum 15 there is preferably provided a lower horizontal pinch roll 37 and an upper horizontal pinch roll 38 cooperating therewith. The lower roll 37 is rotatably supported in a housing 40, while the upper roll 38 is rotatably supported in bearings 41 which are slidable vertically in windows 42 in the housing 40. The bearings 41 are connected by a bridge piece 43

which is urged downwardly by means of coiled compression springs 44. The lower roll 37 is driven by means of a shaft 45 (Fig. 8) supported in a bearing 46 on the frame 19 and provided with a sprocket wheel 47. The sprocket wheel 47 is connected by means of a chain 48 to a sprocket wheel 49 on the shaft 28. The springs 44 cause the advancing front portion of the stock to be gripped between the upper idler roll 38 and the lower driven roll 37.

After leaving the pinch rolls the front end of the stock is guided around the outside of the rotating drum 15, and for this purpose I preferably utilize an annular wrapping guide 51 which surrounds the drum 15 in spaced relation therewith. The guide 51 is provided with a tangentially located opening or slot 52 through which the stock enters the annular space between the drum and the guide. A small idler roll 53 is arranged to engage the outer surface of the stock as it enters this space and urge the stock into contact with the drum. This roll is mounted on an arm 54 which is pivotally secured to the guide 51 by means of a pin 55. A coiled compression spring 56 engages the arm 54 and maintains the desired pressure between the roll 53 and the stock, the expansion of this spring being limited by a bolt 57. It will be apparent that after leaving the pinch rolls the front end of the stock will travel through the opening 52 and pass between the idler roll 53 and the drum 15 into engagement with the inner surface of the guide 51, which will compel the stock to bend into a coil loosely surrounding the drum as indicated in Fig. 5. Immediately thereafter the front ends of the stock will be forced into contact with the outer surface of the drum 15 by the pressure of the idler roll 53.

This first coil or layer of stock is very loose upon the drum 15 and in fact contacts with the drum only adjacent to the roll 53. It is accordingly necessary to provide means to take up the slack in the stock and to form a tight initial coil. For this purpose the peripheral speed of the drum 15 when running idle is somewhat higher than the speed of delivery of the stock from the rolls 35, and the peripheral surface of the drum 15 is of such a character as to ensure a coefficient of friction between the drum and the stock which is substantial and preferably greater than that between two layers of the stock. This coefficient of friction may be obtained in various ways. For example, the peripheral surface of the drum may be roughened by knurling the same parallel to the axis, as indicated at 58 in Fig. 12, or inserts 60 of a suitable bonded abrasive material may be dovetailed or otherwise secured to the drum, as shown in Fig. 11, or inserts 61 of a molded or woven asbestos composition may be riveted to the drum, as shown in Fig. 13. Because of these relative coefficients of friction, after one complete coil layer is formed as shown in Fig. 6 the front portion of the stock will travel at the peripheral speed of the drum 15 and slip along the inner surface of the second layer until all the slack in the first layer has been taken up as shown in Fig. 7. As soon as the first layer is fully tightened, the stock will apply a restraining torque to the drum 15, causing the drum to decrease its speed to conform with the delivery speed of the rolling mill. The electric motor 31 which drives the drum is preferably of a suitable adjustable speed type and provided with one of several well known forms of automatic control adapted to maintain a substantially constant tension in the stock as the drum speed continues to decrease with the increasing diameter of the coil of stock forming thereon.

As soon as the stock is under tension, the guide 51 is preferably withdrawn to avoid interference with the rapidly growing coil of stock. For this purpose I prefer to utilize a power actuated mechanism which is brought into action automatically in response to the initial tensioning of the stock. In the embodiment illustrated the guide 51 is supported by a pair of rods 62 which extend parallel to the axis of the drum 15 and which are slidably supported in the frame 19. A cylinder 63 is mounted on the frame 19, and a piston 64 is slidable in the cylinder, the piston being provided with a piston rod 65 extending parallel to the rods 62 and connected to the guide 51. The front end of the cylinder 63 may be supplied with a suitable pressure fluid under control of a manually operable four-way valve 66, the rear end of the cylinder being connected to an exhaust pipe 67. The piston rod 65 carries a catch 69 adjustably screw-threaded thereto and adapted to cooperate with a latch 70 which is pivotally secured by means of a pin 71 to the frame 19. These parts are so arranged that the latch 70 will engage the catch 69 when the guide 51 is in the proper position for receiving the front end of the stock, the latch preventing rearward movement of the guide under the influence of fluid pressure in the front end of the cylinder 63. A spring 72 is connected to one end of the latch 70 to urge it toward its engaging position, and the plunger 73 of a solenoid 74 is connected to the other end of the latch to effect its release under certain circumstances. As indicated in Fig. 7, the flow of electric current from a source 75 to the solenoid 74 is controlled by a switch 76 which is arranged to be closed automatically upon substantial upward movement of the upper pinch roll 38. This switch is shown connected to the bridge piece 43 by means of a vertical rod 77. The pinch rolls are located slightly out of line with the rolling mill rolls 35 and the guide inlet 52, so that when tension is applied to the stock the upper pinch roll 38 will be lifted as shown in Fig. 7, thus closing the switch 76 and energizing the solenoid 74. This will release the latch 70 and allow the fluid pressure in the front end of the cylinder 63 to withdraw the guide 51 to its rearmost position as shown in Fig. 1.

When the coil of stock has been completed, it is desirable to provide power actuated means for stripping the coil from the drum 15. For this purpose there is provided a stripper 79 in the form of a hollow cylinder surrounding the drum 15 and reciprocal axially relative thereto. In order to ensure proper engagement of the stripper with the innermost layer of a coil, the drum 15 is formed with longitudinal grooves 80 in its peripheral surface, these grooves being engaged by projecting portions or tongues 81 on the inner surface of the stripper. The reciprocal movements of the stripper are controlled by a suitable fluid pressure motor comprising a cylinder 83 having a piston 84 therein provided with a piston rod 85. On the front end of the rod 85 there is mounted a bracket 86 which carries a roller 87 located between spaced flanges 88 projecting from the outer surface of the stripper near the rear end thereof. The stripper 79 is somewhat smaller in diameter than the inside of the guide 51 so that the stripper may extend through the guide when

both these parts are in their rearmost position, as shown in Fig. 1. The cylinder 83 is shown close to and integral with the cylinder 63, the front ends of these cylinders being connected by a port 89. The four-way valve 66 is connected to the front end of the cylinder 83 by means of a pipe 90, and to the rear end of the cylinder 83 by means of a pipe 91. Since the cylinder 63 is of the single-acting type, the double-acting cylinder 83 is utilized to effect forward movement of both the stripper 79 and the wrapping guide 51. For this purpose the forward end of the piston rod 85 is arranged to engage the rear surface of the guide 51.

In order to facilitate stripping of the coil and avoid scratching of the stock, the drum 15 is preferably made collapsible. For this purpose the drum is made in three segments with tapered inner surfaces, and the adjacent portion of the spindle 16 is formed with a corresponding taper. The rear portions of the drum segments are held in place against centrifugal force by the surrounding stripper 79, and the front portions are similarly held by a garter spring 93 which fits in an annular recess 94 in the ends of the segments.

The drum segments are slidably connected to the spindle 16 by means of longitudinal keys 95, and the sliding movement is limited by means of circumferential keys 96 secured to the spindle and adapted to engage the walls of circumferential recesses 97 formed in the inner surfaces of the segments. The segments are urged rearwardly by means of a coiled compression spring 98 which surrounds a screw 99 mounted in the front end of the spindle 16. One end of this spring engages the head of the screw 99, and the other end engages a washer 100 located at the bottom of a central recess 101 in the front portion of the drum 15.

The operation of the invention will now be apparent from the above disclosure. When no stock is being coiled the drum 15 will be maintained in its expanded position by the action of the spring 98, and the peripheral speed of the drum will be slightly in excess of the delivery speed of the rolling mill 34. The four-way valve 66 will be in the position shown in Fig. 4, so that fluid pressure is supplied to the front ends of the cylinders 83 and 63. The stripper 79 will be withdrawn to its rearmost position, while the wrapping guide 51 will be held in the receiving position by the engagement of the latch 70 with the catch 69. After leaving the reducing rolls 35 the front end of the stock will pass at a substantially constant speed through the delivery guide 36 and between the pinch rolls 37 and 38, which will feed the stock through the opening 52 and between the idler roll 53 and the rotating drum 15. The stock will then engage the inner surface of the guide 51 and be forced to bend around the drum 15 as shown in Fig. 5. As soon as the front end of the stock has passed completely around the drum to form the initial layer or wrap and again contacted with the outer surface of the drum as shown in Fig. 6, the friction between the stock and the drum surface will cause the stock to travel at the speed of the drum (which slightly exceeds the delivery speed of the rolling mill). Hence the slack in the first layer of the coil will be immediately taken up and tension will be applied to the stock. The motor 31 will at once slow down sufficiently to maintain the tension substantially constant. As the tension is applied, the stock will lift the upper pinch roll 38 against the pressure of the springs 44, thus cushioning the shock resulting from the sudden tightening of the stock. As the roll 38 moves upwardly it will close the switch 76 and energize the solenoid 74, lifting the plunger 73 and latch 70 and releasing the catch 69. The fluid pressure in the front end of the cylinder 63 will thereupon force the piston 64 and the wrapping guide 51 rearwardly, and the coil of stock will be free to build up upon the drum 51 without interference. After the automatic withdrawal of the wrapping guide, the operator may turn the valve 66 to the position indicated in Fig. 2, which will have no effect on the position of the pistons but will simply relieve the pressure and prevent possible leakage. As soon as the coil has been completed, the operator will turn the valve 66 to the position shown in Fig. 3, admitting fluid to the rear end of the cylinder 83 and connecting the front ends of both cylinders to the exhaust. The piston 84 will move forwardly, advancing the stripper 79 and the guide 51 and forcing the completed coil axially from the drum. Since the tongues 81 extend into the grooves 80 and below the peripheral surface of the drum, the innermost layer of the stock will be properly stripped no matter how thin it may be. During the stripping operation, friction of the stock against the outer surface of the drum segments will cause them to move forward slightly with the stock against the pressure of the spring 98, this movement causing the drum to collapse or reduce its diameter slightly and thus relieve the pressure against the inner surface of the coil. This facilitates the stripping operation and prevents scratching of the stock. As the ejected coil leaves the drum it may be caught by any suitable mechanism (not shown).

It will be understood that when the rear end of the stock leaves the rolls 35, the upper pinch roll 38 will be moved downwardly by the springs 44, opening the switch 76 and de-energizing the solenoid 74. This will allow the spring 72 to lower the rear end of the latch 70. Consequently, when the coil has been ejected and the operator moves the valve 66 to the position shown in Fig. 4, the stripper 79 will be withdrawn to its rearmost position but the wrapping guide 51 will be stopped by reason of the engagement of the catch 69 with the latch 70, the guide being thus held in the proper position to receive the next length of stock to be delivered. The operation will thereupon be repeated.

The improved strip reel is comparatively simple and inexpensive to manufacture, and thoroughly reliable in operation. A tight and compact coil will be produced, since the stock is under tension throughout substantially the entire coiling cycle. The rolling mill rolls 35 as well as the reel drum 15 may remain in continuous rotation.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A strip reel comprising a rotatable drum, means to deliver stock to the drum at a substantially constant speed, driving means for the drum arranged to rotate the drum at a peripheral speed slightly higher than the delivery speed of the stock when no stock is being coiled thereon, and means to guide the front end portion of the stock around the drum in spaced relation therewith and then into contact with the peripheral surface thereof, the frictional engagement of the drum

with the front end portion serving to take up the slack in the initial layer of the stock and apply tension to the stock, the driving means for the drum being arranged to reduce the speed of rotation of the drum, as soon as tension is applied to the stock, and maintain a substantially constant tension in the stock during the coiling operation.

2. A strip reel comprising a rotatable drum, means to rotate the drum, a pair of pinch rolls to deliver stock to the drum, means including a guide to direct the front end portion of the stock around the drum and cause the drum to apply tension to the stock, one of the pinch rolls being yieldably supported against the stock and arranged to move away from the other roll upon application of tension to the stock, and means responsive to movement of the yieldably supported roll and arranged to withdraw the guide and prevent the guide from interfering with the further coiling of the stock.

3. A strip reel comprising a rotatable drum, means to rotate the drum, means to deliver stock to the drum, guide means to direct the front end portion of the stock around the drum, and means to withdraw the guide means from the path of the stock in a direction parallel to the axis of the drum.

4. A strip reel comprising a rotatable drum, means to rotate the drum, annular guide means surrounding the drum and having a tangentially located opening therein, means to deliver stock through the opening in the guide means, and means to withdraw the guide means from the path of the stock in a direction parallel to the axis of the drum.

5. A strip reel comprising a rotatable drum, means to rotate the drum, annular guide means surrounding the drum in spaced relation therewith and having a tangentially located opening therein, means to deliver stock through the opening in the guide means, an idler roller mounted adjacent the opening and arranged to hold the entering stock in frictional contact with the drum, and means to withdraw the guide means and the roller from the path of the stock in a direction parallel to the axis of the drum.

6. A strip reel comprising a rotatable drum, means to rotate the drum, means to deliver stock to the drum, guide means to direct the front end portion of the stock around the drum, the guide means being movable to an inoperative position in a direction parallel to the axis of the drum, means yieldably urging the guide means toward its inoperative position, and a releasable latch to retain the guide means in its operative position.

7. A strip reel comprising a rotatable drum, means to rotate the drum, means to deliver stock to the drum, guide means to direct the front end portion of the stock around the drum, the guide means being movable to an inoperative position in a direction parallel to the axis of the drum, a fluid pressure motor yieldably urging the guide means toward its inoperative position, and a releasable latch to retain the guide means in its operative position.

8. A strip reel comprising a rotatable drum, means to rotate the drum, means to deliver stock to the drum, guide means to direct the front end portion of the stock around the drum, the guide means being movable to an inoperative position in a direction parallel to the axis of the drum, a stripper movable in a direction parallel to the axis of the drum to remove a completed coil of stock therefrom, a fluid pressure motor connected to the guide means, a fluid pressure motor connected to the stripper, and a single valve to control the supply of fluid to both of said motors.

9. A strip reel comprising a rotatable drum, means to rotate the drum, means to deliver stock to the drum, guide means to direct the front end portion of the stock around the drum, the guide means being movable to an inoperative position in a direction parallel to the axis of the drum, a stripper movable in a direction parallel to the axis of the drum to remove a completed coil of stock therefrom, a single-acting fluid pressure motor connected to the guide means to move the guide means to its inoperative position, a releasable latch to retain the guide means in its operative position, a double-acting fluid pressure motor connected to the stripper to move the stripper in both directions and arranged to move the guide means away from its inoperative position, and a single valve to control the supply of fluid to both of said motors.

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