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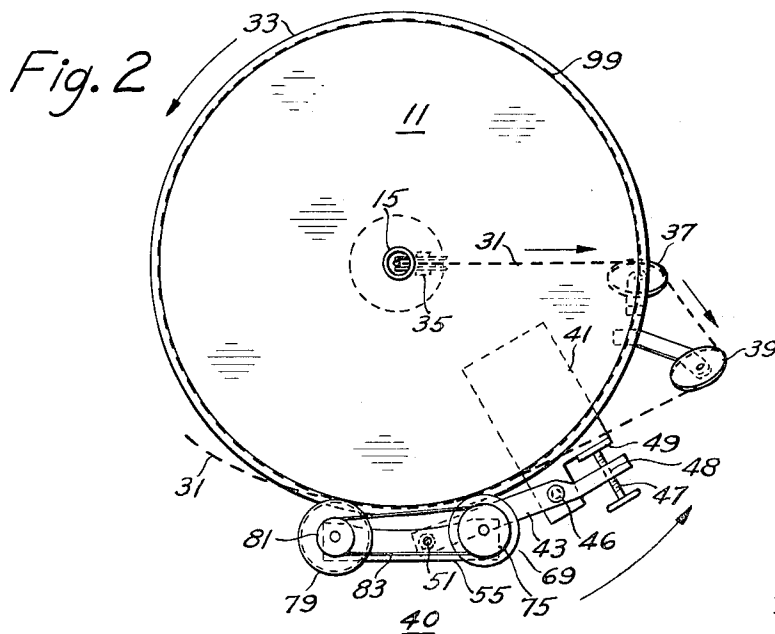
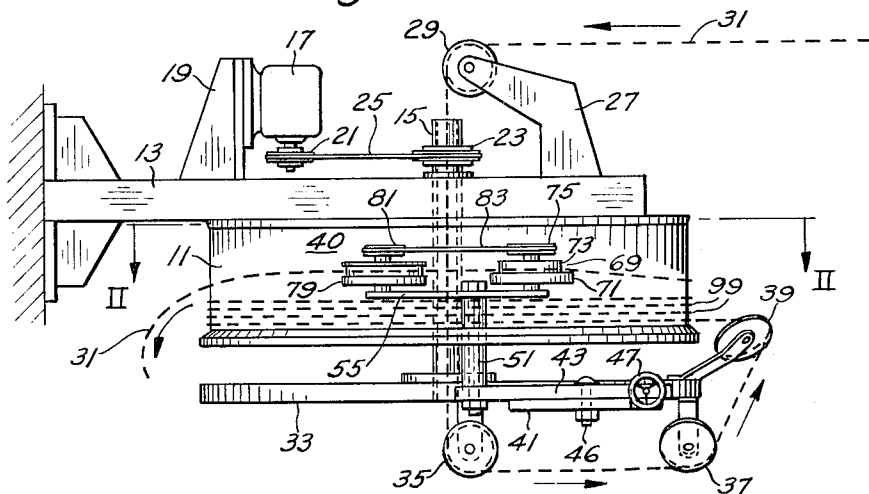
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ROD OR WIRE COILING APPARATUS

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Fig. 1



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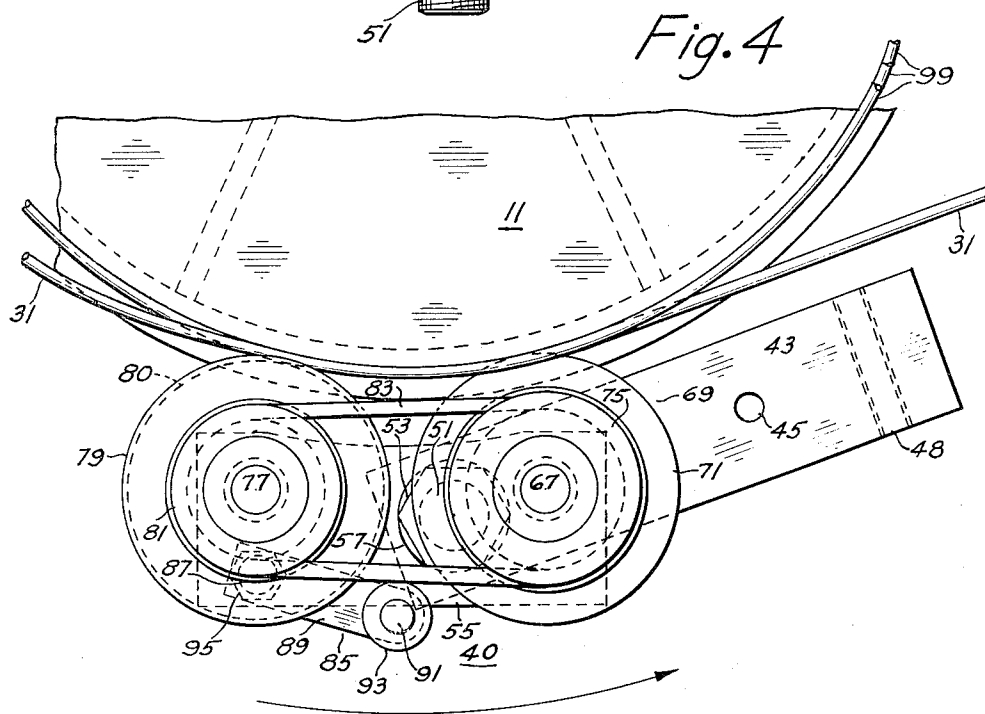
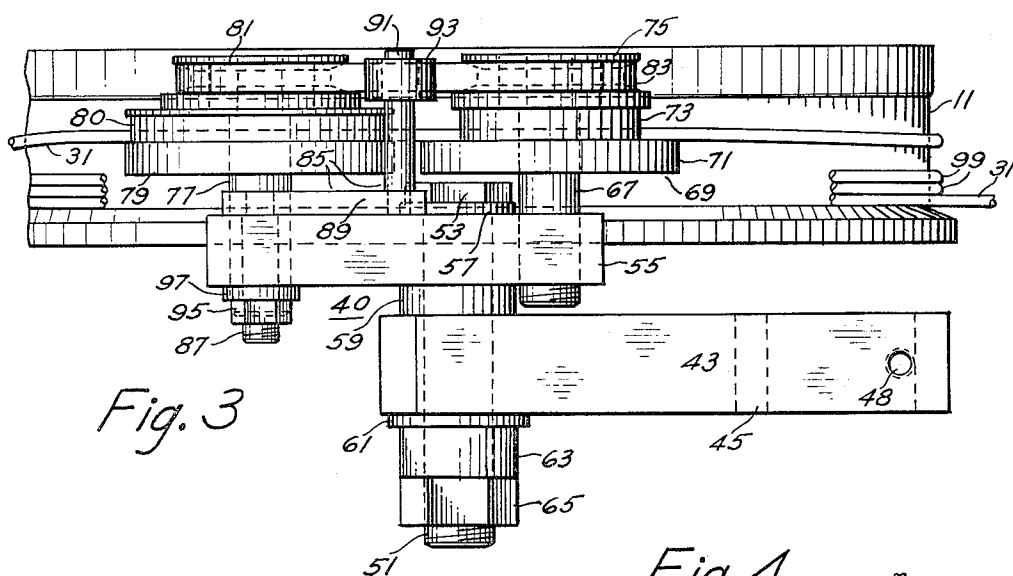
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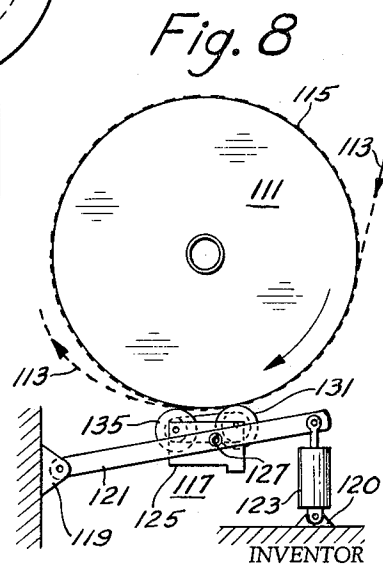
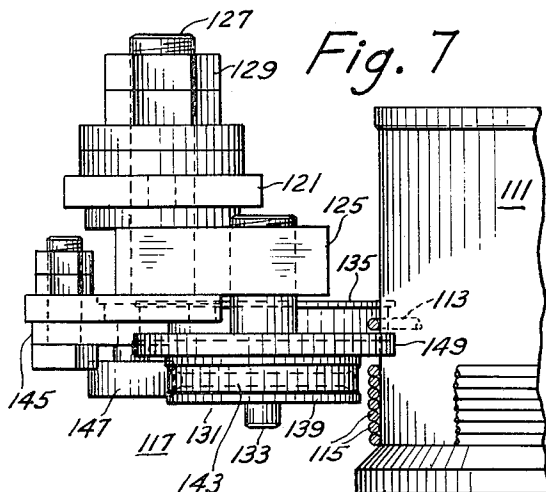
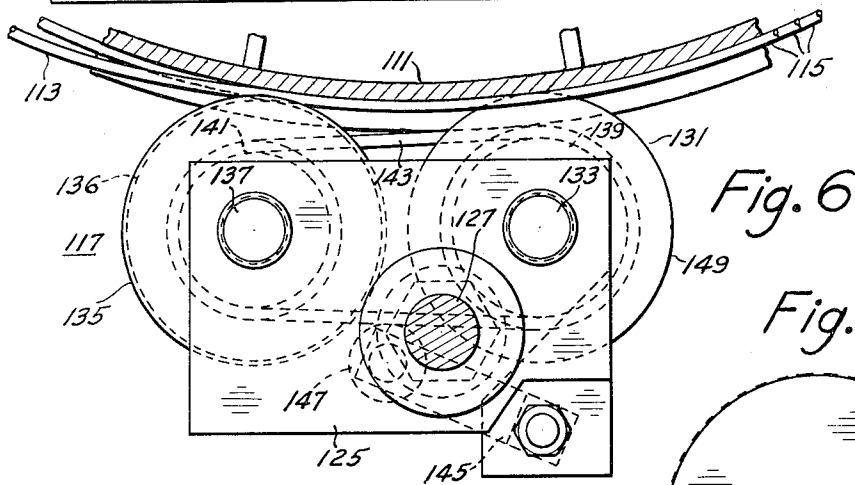
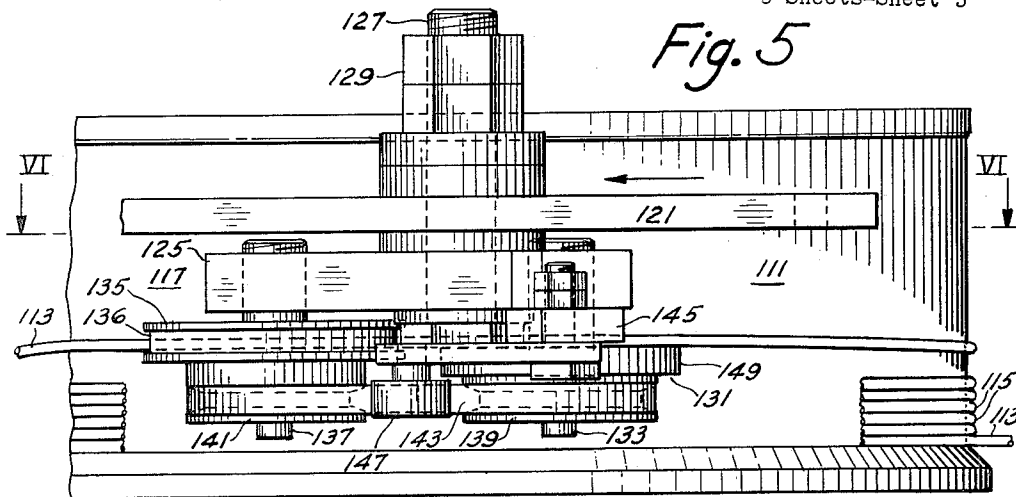
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ROD OR WIRE COILING APPARATUS

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ROD OR WIRE COILING APPARATUS

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3 Claims. (Cl. 242—82)

The present invention relates to the coiling of rods or wires by means of coiling blocks. More particularly the present invention relates to slack prevention apparatus to maintain rod or wire coils tightly about either rotating coiling blocks or dead blocks.

Throughout the specification, where the term "rods" is used, it is to be understood that the term includes both rods and wire.

A known method of coiling rod consists of wrapping the rod about one portion of a coiling block to form a coil while at the same time discharging the coiled rod in an axial direction from another portion of the coiling block in a series of helically connected coils. In vertical coiling blocks the discharging action is usually implemented by the action of gravity. The coiling block may be of the stationary type or may be a rotating coiling block. In order to prevent premature discharge of the rod from the block the rod is usually held against the block surface by one or more rolling contact members. When the rod then passes beyond the last roller it falls away from the block in the form of a continuous spiral coil.

In spite of the use of rolling contact members or pressure rollers it has been found that the rod has a tendency to loosen upon the coiling block, developing slack and allowing the individual loops to spring away from the coiling block surface as a result of which frictional contact is lost between the surface and the rod and the drawing action of the block is very considerably diminished if not altogether lost.

It is an object of the present invention to provide a constant contact accelerated speed roller type slack preventer.

It is a further object of the present invention to provide a constant contact accelerated speed roller type slack prevention apparatus which can be readily applied to standard coiling blocks without extensive modification.

It is a still further object of the present invention to provide a practical and efficient drive mechanism for a constant contact accelerated speed roller type slack prevention apparatus.

Briefly, the invention consists of a slack preventing roll which can be mounted adjacent the cylindrical surface of a rod coiling block and which is provided with means to bias it toward the block to engage the rod being coiled and press the rod against the block, and is also provided with means to drive the roll in the direction of travel of the rod therepast and at a peripheral speed greater than the speed of travel of the rod therepast. In the specific embodiments illustrated and described, the slack preventing roll is belt-driven by a second roll which engages the cylindrical surface of the coiling block; both rolls are journaled on opposite sides of the pivot of a pivotally mounted arm; means are provided to bias the arm toward the block; and the pivot point of the arm is closer to the axis of the driving roll than to the axis of the slack preventing roll.

Other objects, advantages and aspects of the present invention will be made evident by the following figures and description of the invention wherein like numerals refer to the same structures throughout and

FIGURE 1 shows an elevation of the slack preventer of the present invention associated with a stationary coiling block with some portions distorted for clearer understanding.

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FIGURE 2 shows a cross-sectional plan view of the structure shown in FIGURE 1 taken on the line II—II of FIGURE 1.

FIGURE 3 is an enlarged detail elevation of the slack preventer of the present invention shown in FIGURE 1.

FIGURE 4 is an enlarged detail plan view of the slack preventer of FIGURE 3.

FIGURE 5 shows in elevation a second embodiment of the invention applied to a rotating coiling block.

FIGURE 6 shows a cross-sectional plan view of the second embodiment of the present invention on line VI—VI of FIGURE 5.

FIGURE 7 shows an end elevational view of the second embodiment of the invention shown in FIGURE 5.

FIGURE 8 shows a diagrammatic plan of the mounting for the slack prevention device shown in FIGURES 5 to 7.

In FIGURES 1 and 2 a stationary vertical coiling block 11 is shown secured to a frame 13. Journaled in frame 13 is a hollow shaft 15 driven by a motor 17 mounted upon a bracket 19 also mounted upon frame 13. Motor 17 drives hollow shaft 15 through the agency of motor drive pulley 21, shaft pulley 23, and drive belt 25. A bracket 27 supports a sheave 29 which directs a length of linear material 31 such as wire or rod, which comes from some previous operation or storage facility, around itself and into hollow shaft 15.

Hollow shaft 15 extends through coiling block 11 and supports a flyer plate 33 at its lower end. Flyer plate 33 rotates with hollow shaft 15. Mounted upon flyer plate 33 are guide sheaves 35 and 37 which direct the linear material 31, after it leaves hollow shaft 15, across the face of flyer plate 33 to a winding sheave 39 also mounted upon flyer plate 33, which winds the linear material about coiling block 11.

Mounted upon flyer plate 33 is a slack prevention device indicated as a whole as 40. A plate 41 is directly secured to flyer plate 33 and supports an arm 43 best shown in FIGURE 2. Arm 43 is pivoted on a fixed drilled axis 45 by bolt 46 passing through plate 41. In one end of arm 43 is mounted an adjusting screw 47 which turns in threaded hole 48 and bears against a bearing plate 49 mounted on plate 41. In the other end of arm 43 is a hole in which a mounting bolt 51 having a head 53 is secured. A second arm 55 is pivoted upon mounting bolt 51 as more clearly shown in enlarged detail in FIGURE 3 with a narrow spacer 57 between head 53 of bolt 51 and arm 55 and with a wider spacer 59 positioned over bolt 51 between arm 43 and arm 55. A washer 61 and spacer 63 are positioned below arm 43 between the arm 43 and nut 65 which secures bolt 51 upon arm 43. At one end of arm 55 is secured a shaft 67 upon which is journaled a drive roll 69. Drive roll 69 comprises a lower section 71 having a relatively large diameter designed to contact the surface of the block and a relatively smaller diameter portion 73. At the top of drive roll 69 is secured a pulley 75.

At the end of the opposite portion of arm 55 is secured a shaft 77 upon which is journaled slack preventing roll 79. In the surface of slack preventing roll 79 is a wide flat bottomed groove or track 80 in which the wire 31 runs. Track 80 has a smooth hard bottom. A pulley 81 is secured to the top of roll 79. Pulley 81 is smaller than pulley 75 so that when the two pulleys are operatively connected together by a drive belt 83 rotation of pulley 75 at one speed will cause pulley 81 to rotate at a faster speed thus rotating slack preventing roll 79, which is substantially the same effective diameter as drive roll 69, at a greater peripheral speed than drive roll 69 and at a greater peripheral speed than the speed of the wire traveling past it. It will be readily understood that the same

effect could be had so far as the surface speeds or peripheral velocities of the respective rolls are concerned if pulleys 75 and 81 were made equal in size while take-up roll 79 was made larger in diameter than drive roll 69. It will be noted in both FIGURE 3 and FIGURE 1 that bolt 51 does not pass through roll arm 55 at the center but is positioned nearer one end than the other.

Mounted upon arm 55 adjacent to shaft 77, but which may be mounted at any convenient location on roll arm 55, is a belt idle roll assembly 85 comprising a mounting bolt 87, a support arm 89, a shaft 91, and a belt idle roll 93 journaled upon a decreased diameter section at the upper end of shaft 91. Support arm 89 may be pivoted by turning bolt 87 in its seating so as to bring belt idle roll 93 against drive belt 83 to the degree necessary to secure sufficient friction between the belt 83 and the pulleys 75 and 81 to provide a positive drive connection between the said pulleys. Idle roll assembly 85 may then be locked in the proper position by tightening a nut 95 below a lock washer 97 on the lower end of bolt 87.

In the operation of the first embodiment of the above described invention and referring first to FIGURES 1 and 2, rod 31 passes over sheave 29, through hollow shaft 15 to and around guide sheave 35 to guide sheave 37 and thence to winding sheave 39 which as it is carried about coiling block 11 by the rotation of flyer plate 33 wraps the wire or rod 31 about the surface of block 11 in several coils or wraps 99 as best seen in FIGURE 1.

After having passed around the block 11 several times as wraps 99, the rod 31 is directed upwardly over and supported upon the upper surface of the large diameter portion 71 and behind small diameter portion 73 of drive roll 69 and then between slack preventing roll 79 and the surface of block 11 guided by track 80 of slack preventing roll 79 from where it may then pass downwardly to a coiling surface, not shown, below block 11. Large diameter portion 71 of drive roll 69 not only frictionally contacts the surface of coiling block 11 in order to drive the slack prevention apparatus but also acts as a separator to separate rod 31 from the wraps or coils 99 and direct the rod under the slack preventing roll 79.

Referring to FIGURE 2 adjustment screw 47 is rotated to bias arm 43 and arm 55 pivotally mounted thereon towards block 11 so that portion 71 of drive roll 69 contacts the surface of the block 11 and the slack preventing roll 79 also engages rod 31 on the block surface. Since the distance from pivot 51 to the axis of drive roll 69 is less than the distance from pivot 51 to the axis of slack preventing roll 79, the pressure of the drive roll 69 against the block will be greater than the pressure of the slack preventing roll 79 against the rod, with the result that the drive roll 69 will be rotated by its frictional contact with the block while the slack preventing roll 79 will slip upon the surface of the rod although still maintaining sufficient frictional contact to prevent slack in the rod. A lever arm length ratio of two to one, as approximately illustrated in the figures, has been found satisfactory. Other suitable ratios, however, may be found by experimentation and used for particular applications.

Since plate 41, upon which is mounted the entire slack prevention apparatus 40, is carried around by flyer plate 33, slack prevention apparatus 40 is carried around stationary block 11 with the rolls 69 and 79 frictionally contacting the block surface and rod respectively as above explained. The rotation of drive roll 69 by the surface of block 11 drives slack preventing roll 79 in the same direction and at a greater peripheral speed than the speed of roll 79 past rod 31. The rod 31 is progressively separated from the wraps of rod 99 upon block 11 by the large diameter portion 71 of drive roll 69 as seen in FIGURES 1 and 3, passed behind the small diameter portion 73 of drive roll 69 and then directed under slack preventing roll 79 in track 80 so that the slack prevent-

ing roll, as it rotates at a greater peripheral speed than the speed of roll 79 past rod 31, acts to draw the rod tightly about the surface of stationary block 11, effectively preventing the development of any slack whatever in the rod.

After slack preventing roll 79 passes beyond the rod, that section of the rod drops down from the surface of the block in a continuous helical series of coils onto a coiling surface, not shown, positioned under the coiling block where the coils accumulate until periodically removed for shipping or other purposes. If desired an independent separating finger of carbide or other wear-resistant material may be mounted upon the flyer to rotate about the coiling block surface to separate the linear material from the wraps 99 and direct it under slack preventing roll 79. In this case drive roll 69 would not ordinarily be fabricated with two different diameters and the rod would not contact it. The bottom surface of track 80 in slack preventing roll 79 may be hard, smooth metal or, if desired, may be roughened to provide a greater frictional gripping action. If desired the surface may also be formed from some material having a higher frictional coefficient such as rubber or some of the synthetic plastics. Smooth hard metal is wear-resistant and does not seriously abrade the surface of wire material passing through the coiling apparatus. Either type surface may be used with rod which is ordinarily rough. Likewise the friction drive surface of the drive roll 69 may be formed from any suitable material depending upon the particular circumstances. Smooth metal will very frequently be found to be quite satisfactory but a hard rubber friction surface has also been found to be advantageous. It is also possible to operate the drive belt in a groove cut directly in the surface of the drive roll allowing the belt to contact the coiling block surface and thus provide a rubber friction drive contact with this surface.

The second embodiment of the present invention shown in detail in FIGURES 5 to 7 and diagrammatically in FIGURE 8 is applied to a rotating coiling block. A rotating coiling block 111 rotates in the direction shown by the arrows drawing wire or rod 113 from some external source, not shown, about itself in a series of coils or wraps 115.

Referring first to FIGURE 8 a slack preventing apparatus 117 is mounted upon brackets 119 and 120 secured to the main frame of the apparatus, only partially shown, adjacent the rotating coiling block 111. An arm 121 is pivoted upon bracket 119 at one end and attached at the other end to a pneumatic cylinder 123 pivoted to the bracket 120 at one end as shown in FIGURE 8. A plate 125 is pivoted upon arm 121 in a manner similar to the first embodiment by a bolt 127 and nut 129 as shown in FIGURE 5. A drive roll 131 is journaled upon a shaft 133 mounted in effect in a shorter arm of the plate 125 while a slack preventing roll 135 is journaled upon a shaft 137 mounted in effect in a longer arm of plate 125. A groove or track 136 in the peripheral surface of slack preventing roll 135 provides a guide for the rod. A drive pulley 139 is mounted upon the bottom of drive roll 131 and a smaller pulley 141 is mounted upon the bottom of slack preventing roll 135. The two pulleys are operatively connected together by a belt 143 so that if the drive roll is rotated it will rotate the slack preventing roll 135. A belt idle roll assembly 145 similar to the belt idle roll assembly 85 of the first embodiment described above is also mounted upon the roll plate 125 in a position so that belt idle roll 147 may be biased against belt 143 to any desired degree to provide sufficient tension between pulleys 139 and 141 to provide a positive drive between them. Drive roll 131 has a large diameter section 149 but no small diameter section as shown in the first embodiment.

During operation the rod 113 is passed to rotating coiling block 111 from some other operation or storage fa-

cility not shown. The rotation of block 111 wraps this linear material about the block in a series of wraps or coils 115. The rotation of block 111 in the direction of the arrow directs the rod over the large diameter portion 149 of drive roll 131 so that it is separated from the adjacent coils 115. From here the rod is directed under slack preventing roll 135 in track 136. Slack preventing roll 135 because it is rotating at a peripheral speed in the same direction as but greater than that of the adjacent surface of the rotating coiling block 111 tends to draw the wire more tightly about the coiling block. After it passes take-up roll 135 the rod 113 is allowed to drop downwardly in a series of coils onto a rotating coiling surface, not shown.

The slack preventing roll 135 and drive roll 131 are maintained against the linear material 113 and the coiling block 111 respectively through the action of pneumatic cylinder 123, shown diagrammatically in FIGURE 8, which urges pivot arm 121 towards the rotating coiling block 111. Pivot arm 121 as it moves toward the block carries the freely pivoted plate 125 toward the block and since the drive roll 131 and slack preventing roll 135 are journaled upon the extremities of plate 125 at different distances from the pivot point of the plate, each roll is pressed against the coiling block with an equal force moment but with a force inversely proportional to the ratio of the length of the respective lever arms from the pivot point of the plate to the axis of each roll. Stated in another way the actual pressure exerted by each roll in relation to the pressure exerted by the other roll is inversely proportional to the lever arm of that roll in relation to the lever arm of the other roll. Thus by adjusting the lengths of the lever arms when fabricating the device a constant ratio which determines how much greater the pressure of the drive roll is to be over that of the slack preventing roll may be built into the device. When adjusting the pressure of the pneumatic cylinder therefore the pressure in the cylinder may be increased until the drive roll no longer slips on the capstan surface. If the slack prevention action of the slack preventing roll is insufficient at this pressure because of insufficient friction generating pressure between slack preventing roll 135 and rod 113, the pressure of the cylinder may be increased until the friction generating pressure between the rod and the slack preventing roll becomes sufficient to prevent slack in the rod, at which time the pressure of the drive roll upon the coiling block surface will still remain the same relative amount greater than the slack preventing roll pressure against the rod. No matter how great the pressure may become the drive roll will drive the slack preventing roll faster than itself so long as the belt driving connection between the rolls does not slip.

It is to be understood that the two embodiments of the apparatus shown in the figures are not limited to operation with the type of coiling block illustrated respectively therewith. Any suitable form of driving connection such as chains, gears and the like can be substituted for the belt connection between the rolls shown in the figures.

The position of the rolls on the pivoting plate or mounting arm can be varied as can the shape of the pivoting mounting arm. As may be seen in the second embodiment shown in FIGURES 5, 6 and 7, the pivot point of the mounting arm need not be located on a direct line between the axes of the two rolls so long as the arm is pivoted eccentrically with respect to the distance to the axes of the rolls.

Although the present invention has been described above in considerable detail it should be understood that the invention is not to be narrowly limited to the exact and specific particulars disclosed and/or described, but such substitutes, modifications or equivalents as are included within the scope and spirit of the invention or pointed out in the appended claims may also be used.

I claim:

1. A slack preventing device for a coiling block having a cylindrical outer surface on which rod is coiled and from which the coiled rod is discharged comprising

- (a) a pivotally supported arm mounted adjacent the outer surface of said block and movable towards and away from said block,
- (b) a first rod-engaging roll journaled on said arm on one side of said pivotal support,
- (c) a second block-engaging roll journaled on said arm on the opposite side of said pivotal support,
- (d) means bearing against said arm to bias said arm with both of said rolls toward said block to engage the rod between the first roll and the block and to engage the second roll against the block to rotate the second roll, and
- (e) a driving connection between the second roll and the first roll whereby rotation of the second roll drives the first roll in the direction of relative movement of the rod therepast and at a peripheral speed greater than the speed of relative movement of the rod and the first roll.

2. A slack preventing device for a coiling block having a cylindrical outer surface on which rod is coiled and from which the coiled rod is discharged comprising

- (a) a pivotally supported arm mounted adjacent the outer surface of said block and movable towards and away from said block,
- (b) a first rod-engaging roll journaled on said arm on one side of said pivotal support,
- (c) a second block-engaging roll journaled on said arm on the opposite side of said pivotal support,
- (d) means bearing against said arm to bias said arm with both of said rolls toward said block to engage the rod between the first roll and the block and to engage the second roll against the block to rotate the second roll,
- (e) a driving connection between the second roll and the first roll whereby rotation of the second roll drives the first roll in the direction of relative movement of the rod therepast and at a peripheral speed greater than the speed of relative movement of the rod and the first roll, and
- (f) the distance from the pivot supporting the arm to the axis of said first roll being greater than the distance from said pivot to the axis of said second roll.

3. A slack preventing device for a coiling block having a cylindrical outer surface on which rod is coiled and from which the coiled rod is discharged comprising:

- (a) a roll movably mounted adjacent the outer surface of said block,
- (b) mounting means arranged to permit movement of the roll to engage the rod on the outer surface of the block,
- (c) means continuously biasing said roll toward said block to continuously engage the rod between the roll and the block and maintain continuous frictional engagement between both the roll and the rod and the block and the rod,
- (d) drive means independent of said roll and positively spaced from the roll, and
- (e) drive connection means connecting the drive means to said roll to drive the roll in the direction of relative movement of the rod therepast and at a peripheral speed greater than the speed of relative movement of the rod therepast.

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