United States Patent [19]

Williams

[11] **3,717,313**

[45] **Feb. 20, 1973**

[54] **COIL UNREELER**

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[22] Filed: **July 9, 1970**

[21] Appl. No.: **53,580**

[52] **U.S. Cl.**.....**292/54 R**, 242/75.4, 242/78.6

[51] **Int. Cl.**.....**B65h 25/32**, B65h 25/04

[58] **Field of Search**.....242/78.6, 75.53, 75.3, 75, 242/75.4, 75.43, 75.2, 67.4, 54 R, 75.5, 75.51

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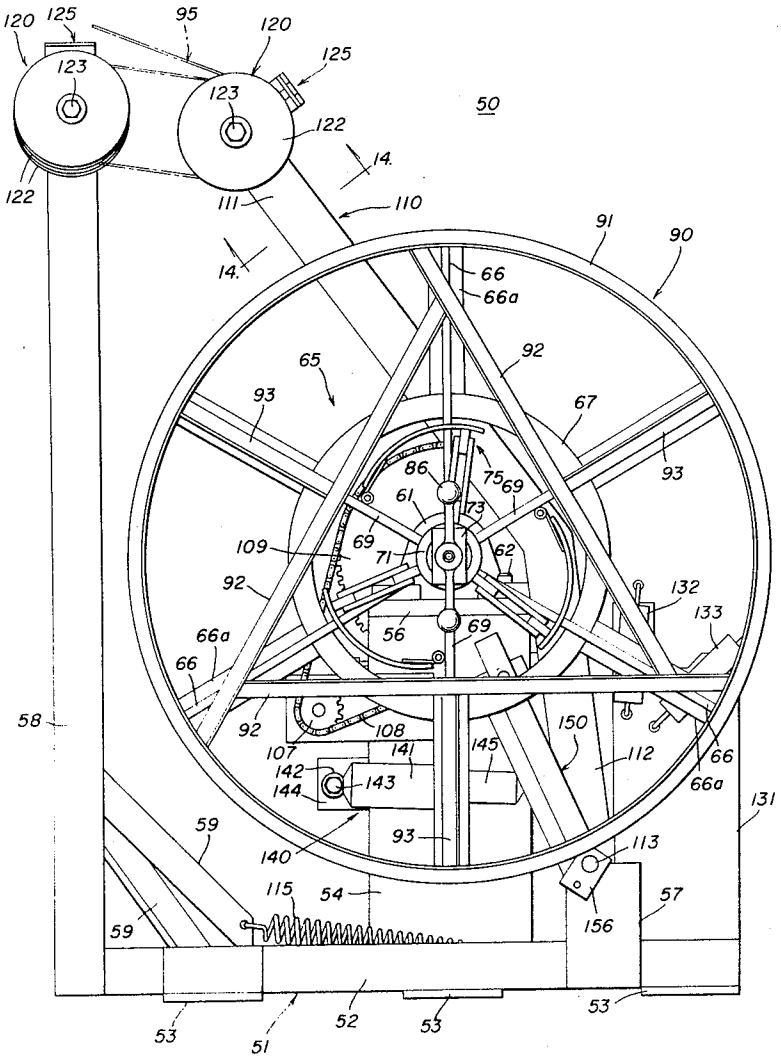
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[57] **ABSTRACT**

An unreeler for coils of a strapping material includes a coil support rotatably driven by a reversible air motor in either an unreeling or a reeling direction, two halves respectively controlling the operation of the air motor in two opposite directions, and a dancer arm having a home position and movable therefrom in opposite directions as the tension in the unreeled position of the strapping material varies above or below a reference range of tension, the dancer arm engaging and actuating the valves for actuating the motor in an unreeling or a reeling direction, respectively, as the arm moves from the home position thereof in response to increased or decreased strap tension; a coil support brake responsive to the movement of the dancer arm is also provided, the brake being applied when the dancer arm is in its home position and being released when the dancer arm moves from its home position.

15 Claims, 15 Drawing Figures



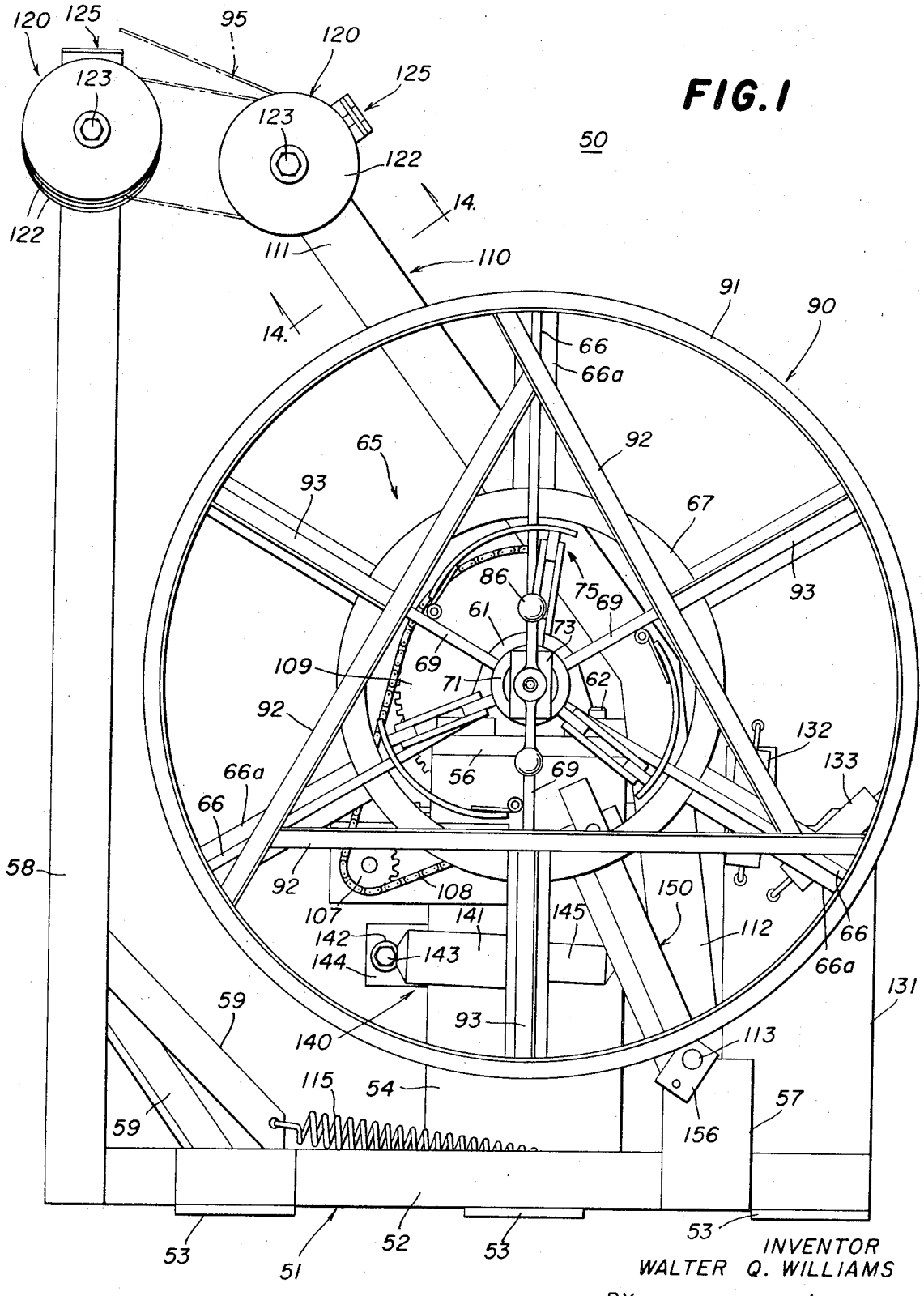


FIG. 1

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ATTYS.

FIG. 2

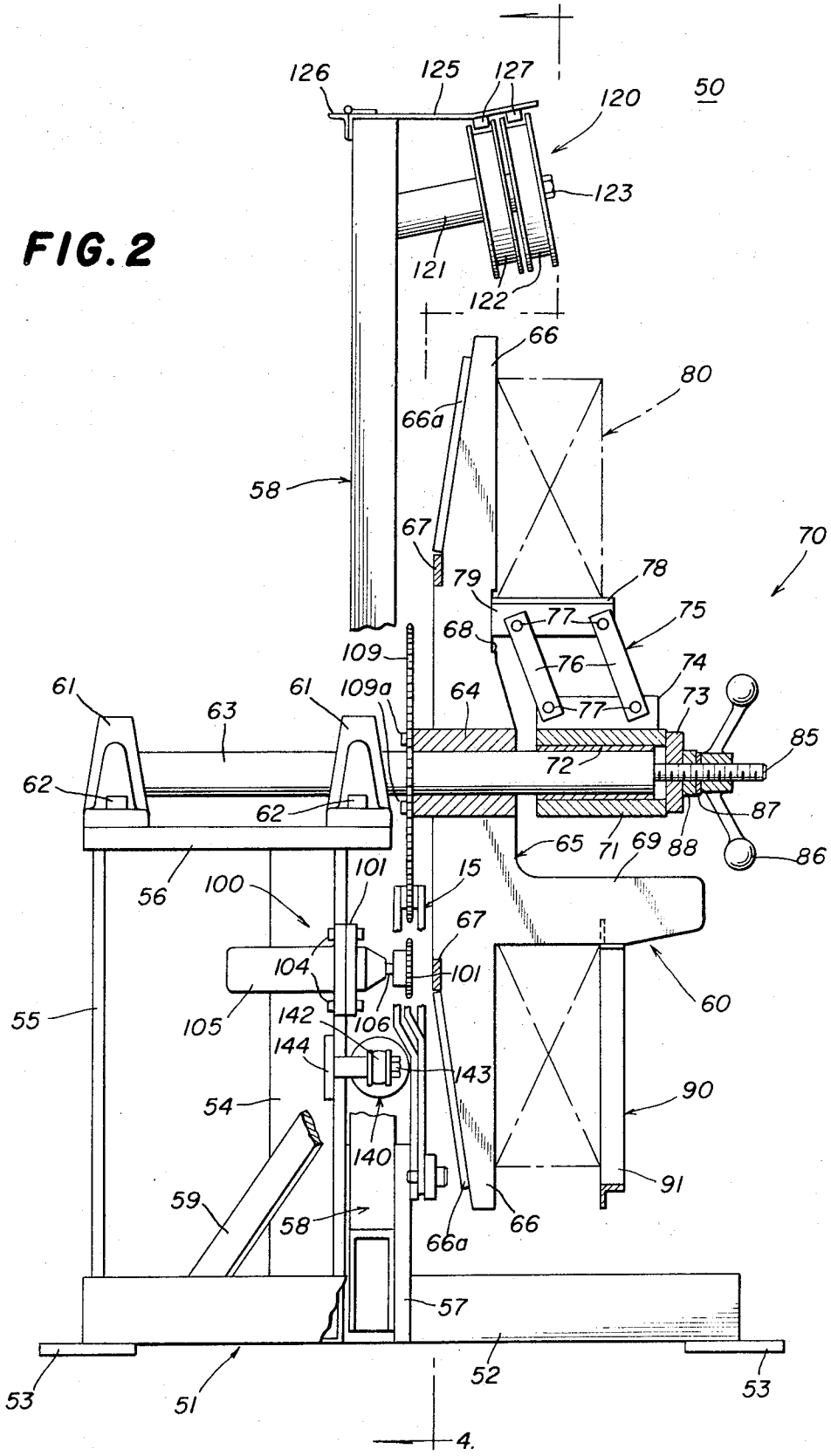

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FIG. 3

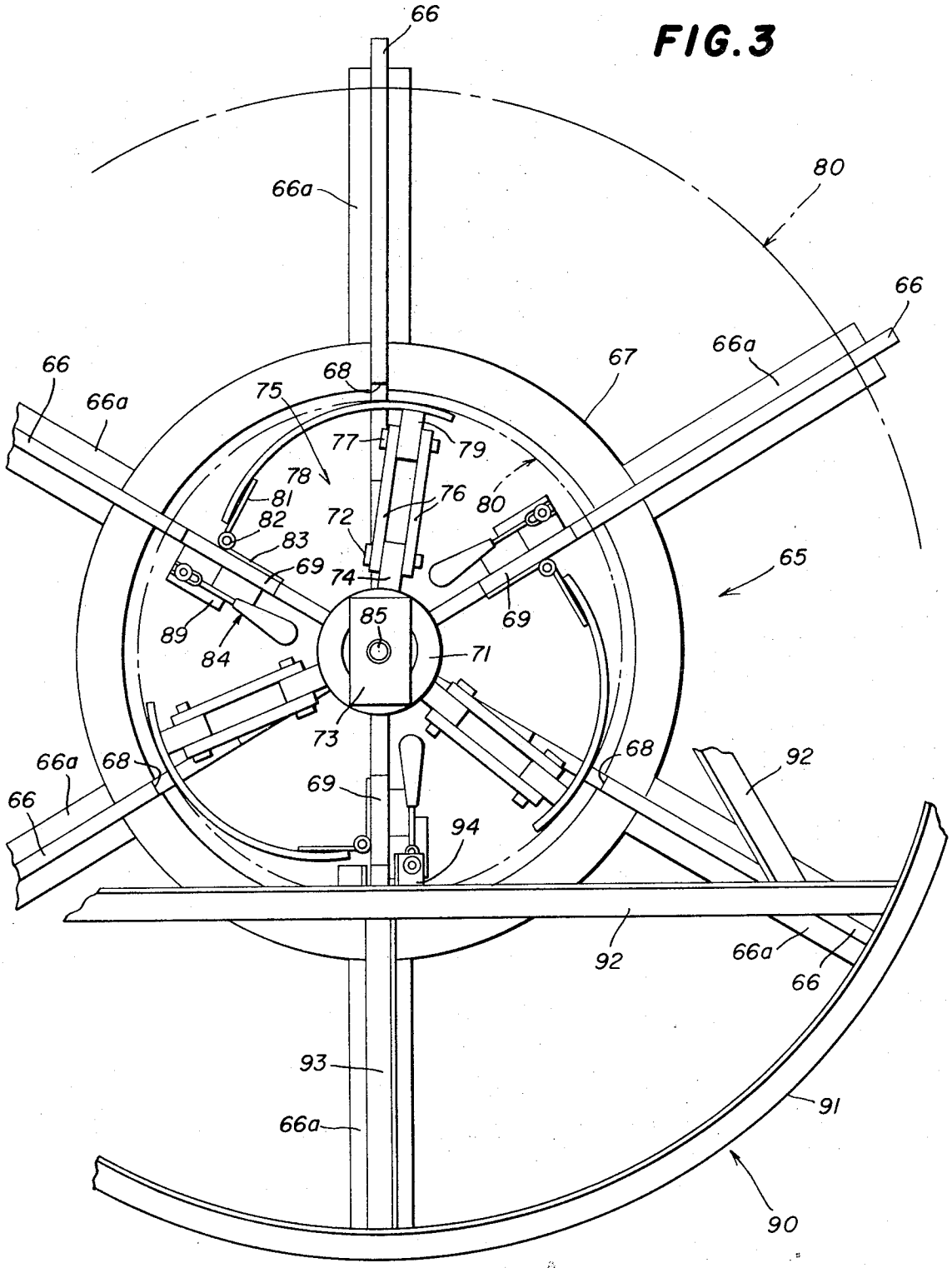

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FIG. 4

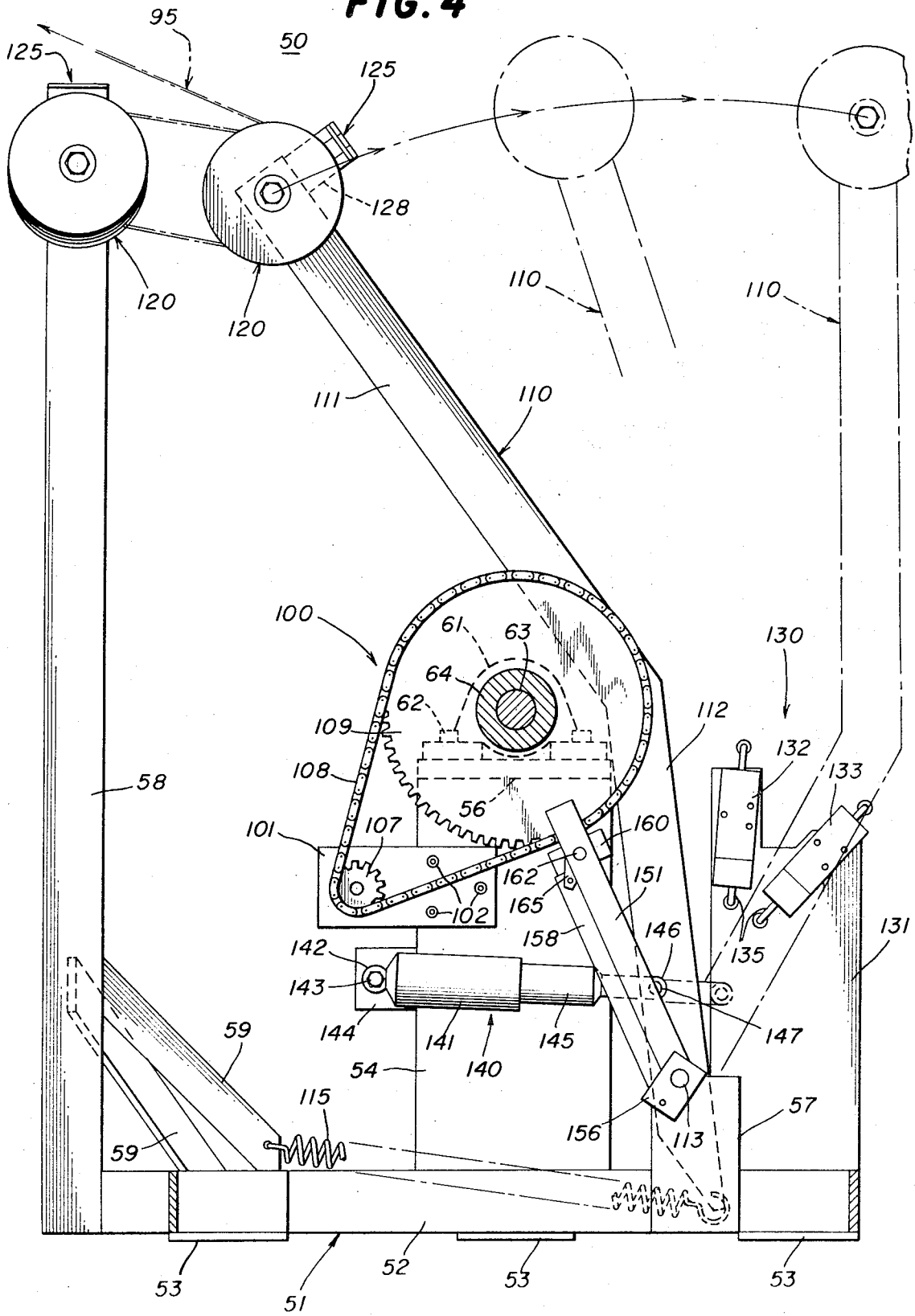

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FIG. 5

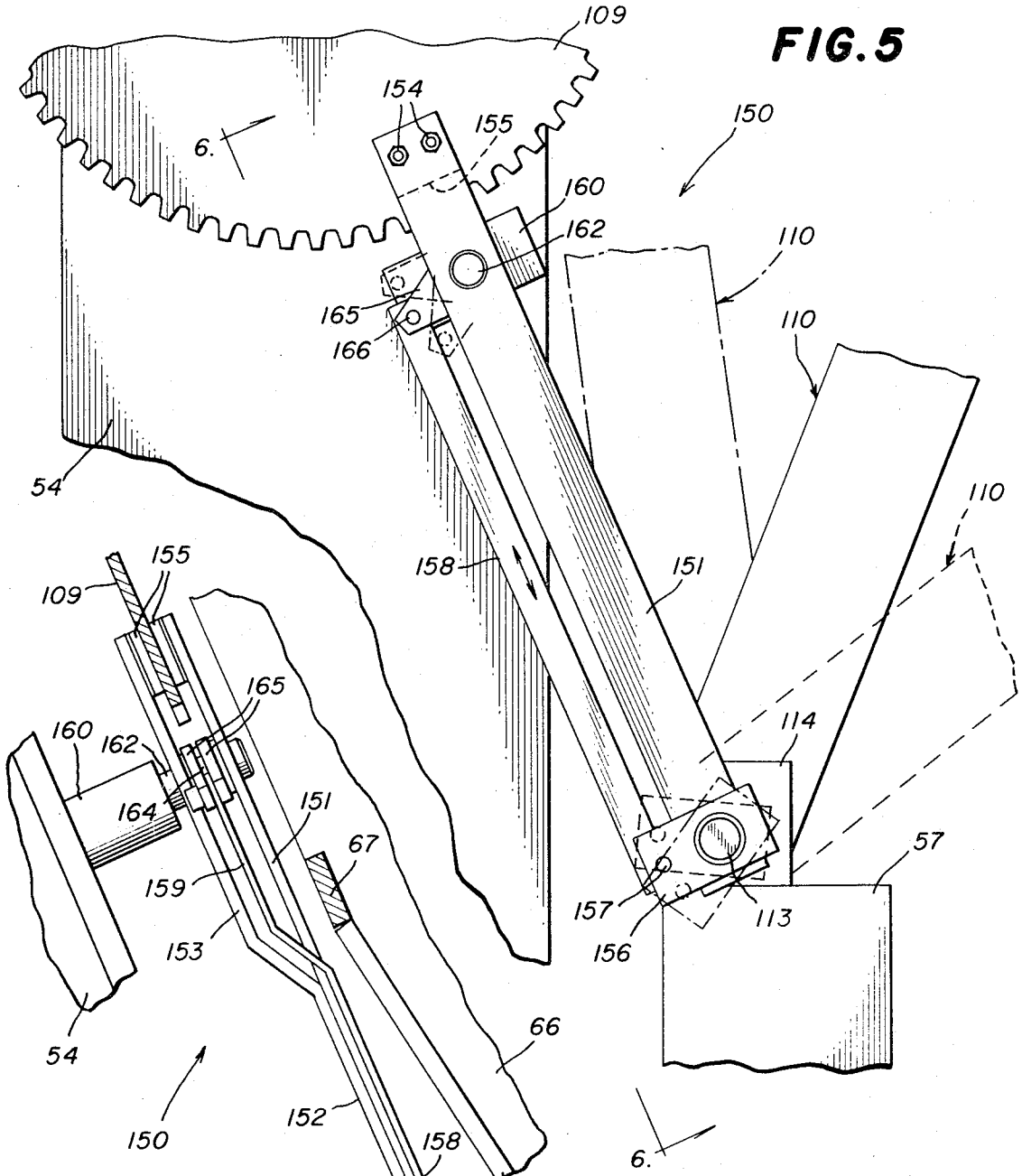

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FIG. 6

FIG. 7

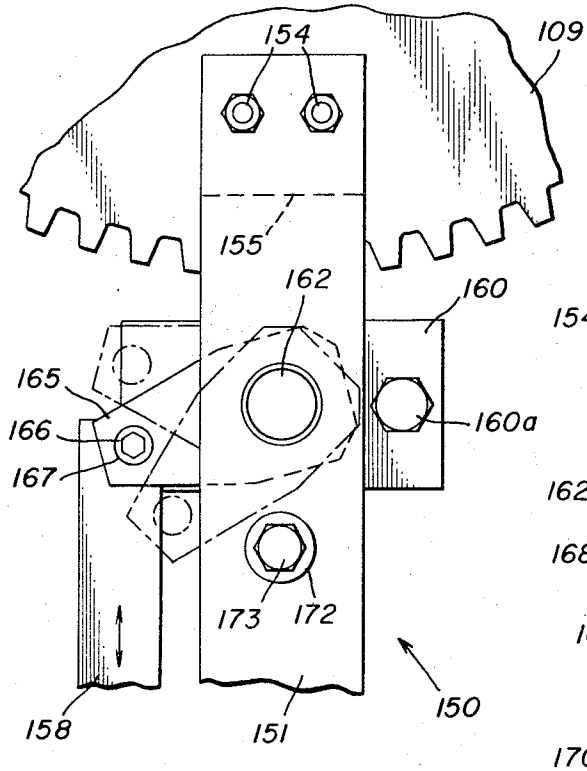


FIG. 8

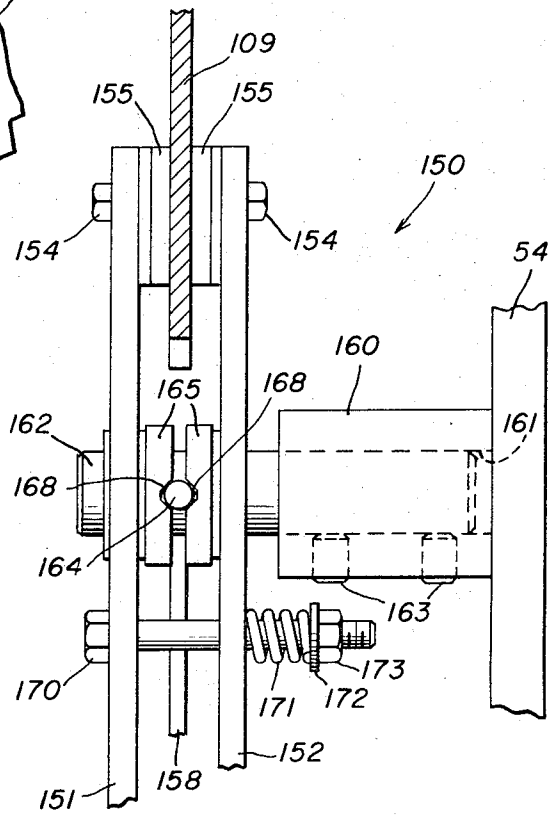


FIG. 9

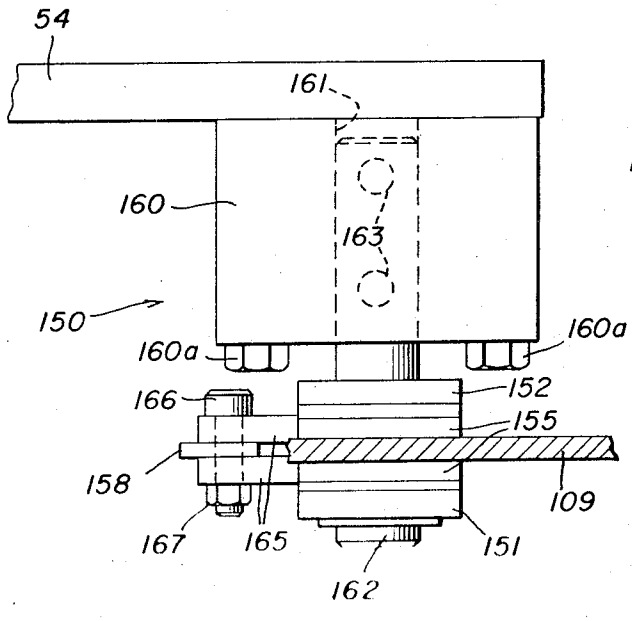


FIG. 10

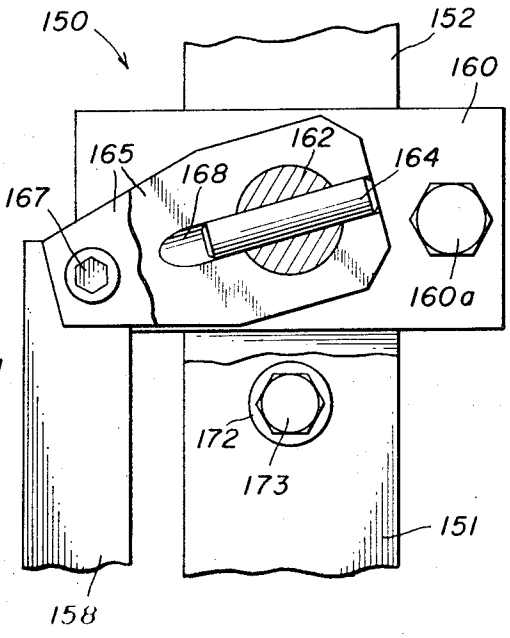


FIG. 11

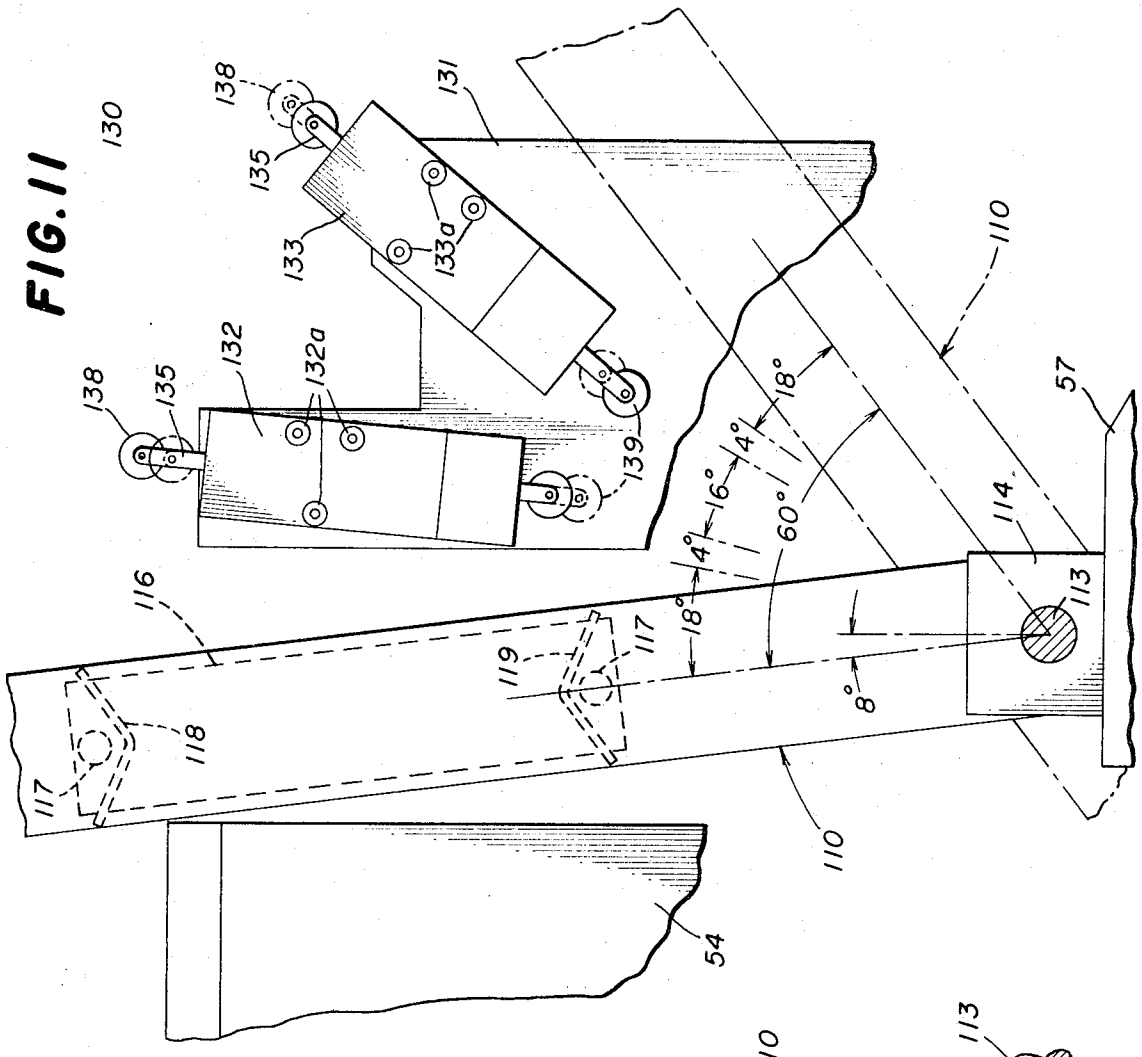

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FIG. 12

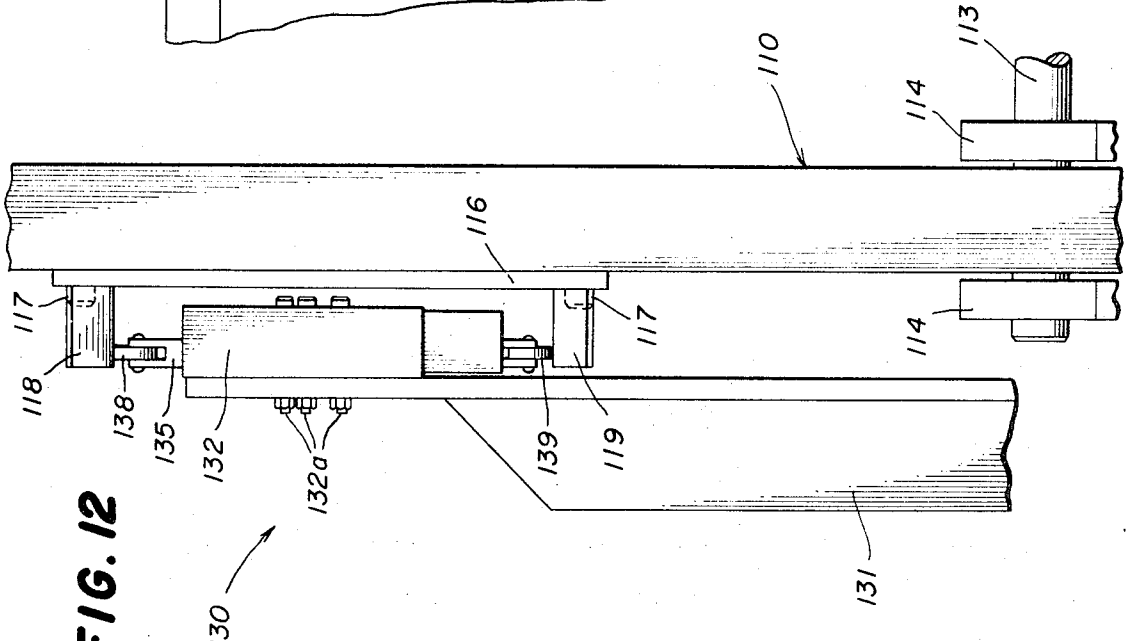

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FIG. 13

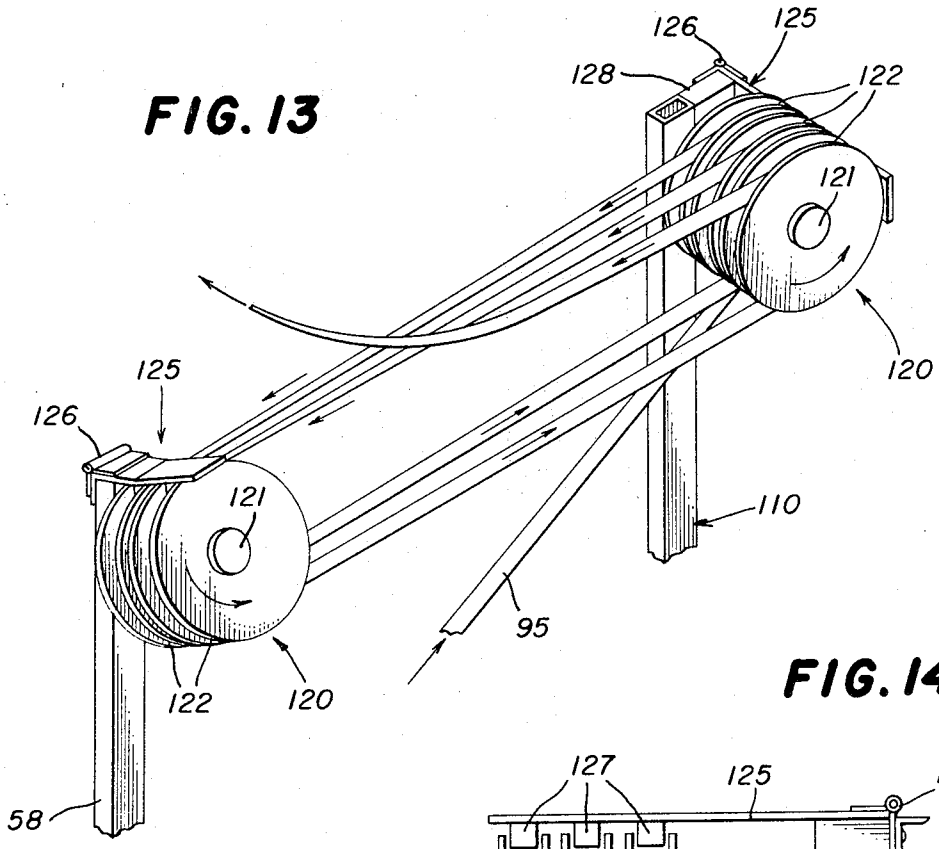
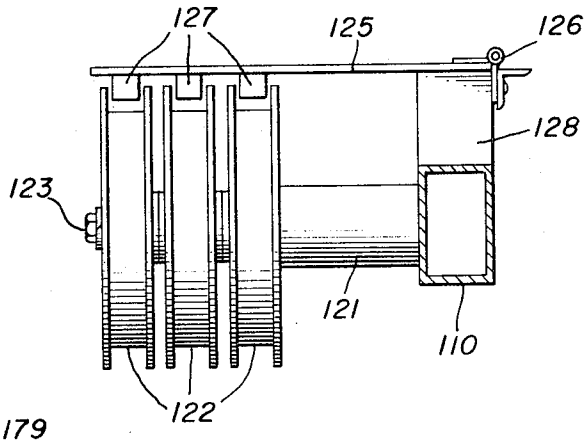


FIG. 14



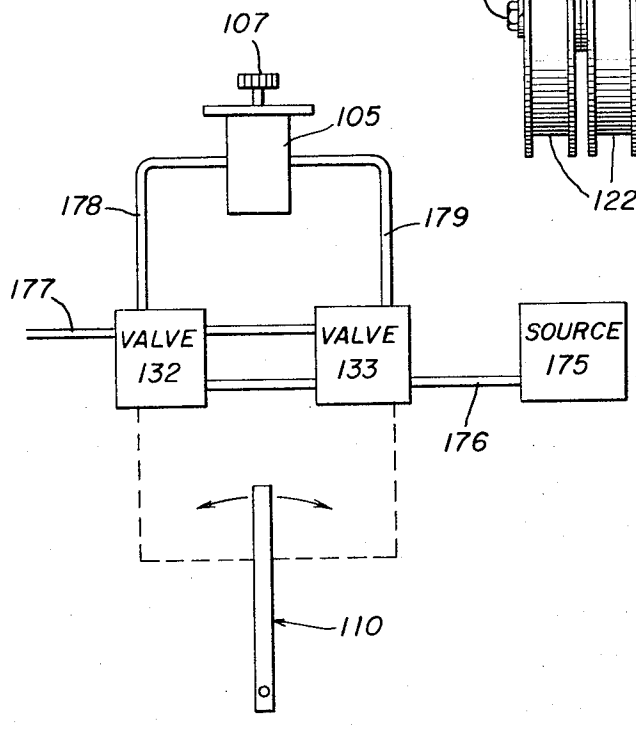


FIG. 15

COIL UNREELER

This invention relates to coil unreelers and, in particular, to unreelers for dispensing flexible strapping material such as steel or plastic strapping and the like.

It is a general object of this invention to provide a coil unreeler which does not rely upon the tensional unreeling force applied to the strapping material by an associated strapping machine for providing the rotational force to rotate the coil.

It is an important object of this invention to provide a coil unreeler for dispensing a continuous strip of strapping material from a coil thereof, the unreeler comprising a coil support for rotatably supporting an associated coil of strapping material having an unreeled portion extending therefrom, a drive motor coupled to the coil support for effecting rotation of the associated coil in an unreeling direction, a tension sensing device for sensing the tension in the unreeled portion of the strapping material, and control apparatus responsive to the sensing by the sensing device of a predetermined tension in the unreeled portion of strapping material for actuating the drive motor to effect rotation of the associated coil in an unreeling direction.

It is a further object of this invention to provide a coil unreeler of the type set forth which includes a brake coupled to the coil support for retarding rotation of the associated coil, the brake being released prior to actuation of the drive motor in response to the sensing by the sensing device of the predetermined tension in the unreeled portion of strapping material.

Yet another object of this invention is to provide a coil unreeler of the type set forth wherein the drive motor has a first condition for effecting rotation of the associated coil in an unreeling direction and a second condition for effecting rotation of the associated coil in a reeling direction, the control apparatus being responsive to the sensing by the sensing device of a first relatively high predetermined tension in the unreeled portion of strapping material for actuating the drive motor to the first condition thereof, the control apparatus being responsive to the sensing by the sensing device of a second relatively low predetermined tension in the unreeled portion of strapping material for actuating the drive motor to the second condition thereof.

In connection with the foregoing object, it is another object of this invention to provide a coil unreeler of the type set forth, which further includes a brake coupled to the coil support for retarding rotation of the associated coil, the tension sensing device sensing the tension in the unreeled portion of the strapping material both above and below a predetermined range of tension therein, the brake being released prior to actuation of the drive motor to either of the first and second conditions thereof in response to sensing by the sensing device of tensions in the unreeled portion of strapping material above or below the predetermined range of tension, the control apparatus being responsive to the sensing by the sensing device of a tension in the predetermined range of tension in the unreeled portion of strapping material for deactuating the drive motor and actuating the brake.

It is another object of this invention to provide a coil unreeler of the type set forth wherein the tension sensing device comprises a rocker arm mounted for pivotal movement about a predetermined axis between first and second ranges of movement, and bias means urging the rocker arm toward the first range of movement and into engagement with the unreeled portion of strapping material, application of a predetermined tensional unreeling force to the unreeled portion of strapping material beyond the rocker arm effecting pivotal movement thereof from the first range of movement to the second range of movement, the control apparatus being responsive to movement of the rocker arm from the first range of movement to the second range of movement for actuating the drive motor.

In connection with the foregoing object, it is yet another object of this invention to provide a coil unreeler of the type set forth which further includes a brake plate coupled to the coil support and rotatable therewith, a pair of brake shoes respectively mounted on opposite sides of the brake plate and yieldably urged into engagement therewith for retarding rotation thereof, and releasing mechanism coupled to the brake shoes for moving the brake shoes out of engagement with the brake plate for accommodating free rotation thereof, the control means being responsive to the movement of the rocker arm from the first range of movement to the second range of movement for actuating the releasing mechanism.

Further features of the invention pertain to the particular arrangement of the parts of the coil unreeler whereby the above-outlined and additional operating features thereof are attained.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof will best be understood by reference to the following specification taken in connection with the accompanying drawings, in which:

FIG. 1 is a front elevational view of a coil unreeler made in accordance with and embodying the features of the present invention;

FIG. 2 is a side elevational view of the coil unreeler of FIG. 1 as viewed from the left-hand side thereof, with the fixed strap supporting arm broken away to more clearly show the coil supporting arrangement which is illustrated in partial section;

FIG. 3 is an enlarged fragmentary front elevational view of the coil supporting assembly of the coil unreeler of FIG. 1;

FIG. 4 is a front elevational view of the coil unreeler of FIG. 1 with the coil supporting assembly removed to more clearly illustrate the drive, brake and control assemblies, and illustrating the various positions of the rocker arm;

FIG. 5 is an enlarged fragmentary front elevational view of the brake assembly of the coil unreeler of this invention, illustrating the various positions of the brake assembly and rocker arm;

FIG. 6 is a fragmentary sectional view of the brake assembly of this invention taken along the line 6—6 in FIG. 5;

FIG. 7 is a further enlarged fragmentary front elevational view of a portion of the brake assembly of FIG. 5;

FIG. 8 is a side elevational view of the portion of the brake assembly illustrated in FIG. 7 as viewed from the right-hand side thereof,

FIG. 9 is a top plan view of the portion of the brake assembly illustrated in FIG. 7;

FIG. 10 is a further enlarged fragmentary view of the portion of the brake assembly illustrated in FIG. 7, with

the front brake arm and cam member broken away to more clearly illustrate the internal structure of the cam mechanism;

FIG. 11 is an enlarged fragmentary front elevational view of the control valve apparatus of the present invention;

FIG. 12 is a side elevational view of the control valve apparatus of FIG. 11 as viewed from the left-hand side thereof;

FIG. 13 is an enlarged, fragmentary perspective view of the pulley blocks of the present invention;

FIG. 14 is a sectional view of one of the pulley blocks of this invention taken along the line 14—14 of FIG. 1; and

FIG. 15 is a diagrammatical representation of the pneumatic circuit utilized to power the coil unreeler of the present invention.

Referring now to the drawings and, in particular, to FIGS. 1 to 3 thereof, there is illustrated a coil unreeler constructed in accordance with and embodying the features of the present invention, and generally designated by the numeral 50. The coil unreeler 50 is supported on a framework 51 which includes generally horizontal interconnected frame members 52 provided with foot plates 53 at spaced-apart points therealong for providing a stable base for the coil unreeler 50. Extending upwardly from the horizontal frame members 52 is a front stanchion 54 and a rear stanchion 55 disposed substantially parallel to each other and interconnected at the upper ends thereof by a flat substantially horizontal mounting plate 56. For convenience, the portion of the coil unreeler 50 disposed toward the right in FIG. 2 will hereinafter be referred to as the front thereof, while the portion disposed toward the left-hand side of FIG. 2 will be referred to as the rear thereof. Coupled to the horizontal frame members 52 at the right-hand side thereof, as viewed in FIG. 1, and extending upwardly therefrom is a substantially rectangular anchor plate 57 for a purpose to be described more fully hereinafter. Extending upwardly from the left-hand side of the framework 51 as viewed in FIG. 1 is an upright post or fixed arm 58 braced adjacent to the lower end thereof by a pair of struts 59 anchored to the framework 51.

A coil support assembly, generally designated by the numeral 60, is mounted on the mounting plate 56, the coil support assembly including a pair of pillow blocks 61, respectively disposed adjacent to the front and rear ends of the mounting plate 56 and secured thereto by bolts 62. The pillow blocks 61 are disposed substantially coaxially and respectively provide bearings in which is journaled a shaft 63, the shaft 63 extending a substantial distance forwardly of the front one of the pillow blocks 61, as is best illustrated in FIG. 2. A reel, generally designated by the numeral 65, is mounted on the shaft 63 immediately in front of the front one of the pillow blocks 61, the reel 65 being provided with an annular hub 64 which is fitted over the shaft 63 coaxial therewith and is secured thereto by suitable means such as a roll pin (not shown) so that the reel 65 rotates with the shaft 63. The reel 65 includes a plurality of radially extending arms 66 equiangularly spaced therearound, and each provided adjacent to the outer end thereof with a flange 66a extending laterally from the opposite sides thereof, the arms 66 being interconnected intermediate the ends thereof by a ring 67. The arms 66 are preferably six in number, but other even numbers of arms 66 may be provided if desired. Alternate ones of the radial arms 66 are provided intermediate the ends thereof with a longitudinally extending slot or groove 68 in the front surface thereof, the other ones of the radial arms 66 each being provided intermediate the ends thereof with a coil support arm 69 extending forwardly therefrom substantially parallel to the axis of the reel 65.

A coil clamping assembly, generally designated by the numeral 70, is provided adjacent to the front end of the shaft 63, the coil clamping assembly 70 being provided with a hollow cylindrical hub 71, provided along the inner surface thereof with a hollow cylindrical bushing 72 for being received over the front end of the shaft 63, the hub 71 being provided at the front end thereof with a generally rectangular hub block 73 for limiting the axial movement of the hub 71 rearwardly of the shaft 63. Equiangularly spaced about the hub 71 is a plurality of expanding pad assemblies, generally designated by the numeral 75, preferably equal in number to one half the number of radial arms 66 on the reel 65. The expanding pad assemblies 75 are all identical and, therefore, only one of the expanding pad assemblies 75 will be described in detail. Each of the assemblies 75 includes an attachment flange 74 connected to the hub 71 and extending radially outwardly therefrom. Pivotally connected to each of the attachment flanges 74 adjacent to the front and rear ends thereof by pivot pins 77 is a pair of linkage arms 76. Disposed radially outwardly of the attachment flange 74 is a resilient, arcuate shoe or pad 78, the shoe 78 being provided adjacent to one end thereof with a radially inwardly extending attachment flange 79 pivotally connected by pivot pins 77 to the upper ends of the adjacent pair of linkage arms 76. The linkage arms 76 are arranged substantially parallel to each other so as to form a parallelogram linkage between the hub 71 and the corresponding shoe 78. The shoe 78 is secured at the other end thereof to one plate 81 of a hinge assembly 82, the other plate 83 of the hinge assembly 82 being secured to an adjacent one of the coil support arms 69 (see FIG. 3). The rear edge of the shoe 78 is received in the groove 68 in the adjacent one of the radial arms 66. Thus, the shoe 78 cooperates with the radial arm 66 and the parallelogram linkage to produce a radial movement of the shoe 78 in response to an axial movement of the hub 71, this radial movement of the shoe 78 being limited by the ends of the groove 68. The grooves 68 are so positioned on the radial arms 66 that the outer surfaces of the shoes 78 will be disposed for engagement with the inner cylindrical surface of an associated coil 80, as will be described in greater detail below.

Secured to each of the coil support arms 69 on the opposite side thereof from the hinge assembly 82, is a mounting block 89 carrying a toggle clamp mechanism 84 thereon for a purpose to be described below. Extending axially outwardly of the front end of the shaft 63 is a threaded stud 85 which is received through a complementary opening centrally disposed in the hub block 73 when the coil clamping assembly 70 is inserted over the outer end of the shaft 63. A washer 87 and a thrust washer 88 are provided for cooperation with an internally threaded speed handle 86, for secur-

ing the coil clamping assembly 70 in position on the shaft 63. A reel cap plate, generally designated by the numeral 90, is provided for attachment to the coil support assembly 60 after the coil 80 has been positioned thereon. The cap plate 90 comprises an outer ring 91 braced by an assembly of interconnected chord members 92 and radial members 93 arranged in the pattern illustrated in FIG. 1. Preferably, three of the chord members 92 are provided. Each of the chord members 92 being positioned so that the central portion thereof is disposed generally tangentially with respect to one of the shoes 78. In use, the cap plate 90 is oriented so that the chord members 92 are respectively disposed substantially normal to the coil support arms 69, each of the chord members 92 being provided inter-mediate the ends thereof with an attachment flange 94 for being clampingly engaged by the adjacent one of the toggle clamp mechanisms 84, whereby the cap plate 90 is securely held in position on the reel 65.

Referring now to FIGS. 2 and 4 of the drawings, there is illustrated a drive assembly, generally designated by the numeral 100, for the reel 65. The drive assembly 100 includes a generally rectangular mounting plate 101 secured by means of suitable fasteners 102 to the front stanchion 54 and extending outwardly beyond the left-hand edge thereof, as viewed in FIG. 4. Secured to the mounting plate 101 adjacent to the outer end thereof by means of fasteners 104 is a reversible air motor 105, the air motor 105 extending through a complementary opening in mounting plate 101 substantially normal thereto and being provided at the front end thereof with an output drive shaft 106. Secured to the output shaft 106 is a relatively small sprocket wheel 107 which is coupled by means of a riveted chain 108 to a large sprocket wheel 109 disposed coaxially with the shaft 63 and secured to the rear end of the hub 65 by means of a plurality of circumferentially spaced bolts 109*a*. Thus, it will be seen that the rotation of the sprocket plate 109 effected by the drive motor 105 serves to rotate the reel 65 and the shaft 63.

The coil unreeler 50 is also provided with a dancer arm, generally designated by the numeral 110, and comprising upper and lower straight portions 111 and 112, respectively, disposed at an obtuse angle to each other. The lower portion 112 of the dancer arm 110 is fixedly secured to a shaft 113 which is journaled at the opposite ends thereof in complementary openings in a pair of bearing plates 114, respectively disposed on the upper ends of the anchor plates 57 (see FIG. 5), for accommodating pivotal movement of the dancer arm 110. The dancer arm 110 is of such a length that the upper end of the upper portion 111 thereof is disposed generally in horizontal alignment with the upper end of the fixed arm 58. The lower end of the lower portion 112 of the dancer arm 110 extends downwardly below the shaft 113 to a point adjacent to the frame members 52 and has connected thereto one end of a tension spring 115, the other end of the tension spring 115 being connected to one of the struts 59 for biasing the dancer arm 110 in a clockwise direction about the shaft 113, as viewed in FIG. 4. Referring to FIGS. 11 and 12 of the drawings, an actuator plate 116 is attached by means of suitable fasteners 117 to the rear surface of the lower portion 112 of the dancer arm 110, the actuator plate being provided adjacent to the upper and lower ends thereof, respectively, with two generally V-shaped actuator members 118 and 119 extending rearwardly therefrom substantially normal thereto, with the apexes of the V-shaped members 118 and 119 being disposed toward each other. The function of the actuator members 118 and 119 will be described more fully below.

The fixed arm 58 and the dancer arm 110 are each provided adjacent to the upper end thereof with a pulley block, generally designated by the numeral 120. Each of the pulley blocks 120 comprises a plurality of pulleys 122 arranged coaxially on a shaft 121 which is secured by a bolt 123 to the upper end of the associated arm 58 or 110. Preferably, each of the pulley blocks 120 comprises three pulleys, the axis of the shaft 121 for the pulley block 120 on the dancer arm 110 being disposed substantially normal thereto, while the axis of the shaft 121 for the pulley block 120 on the fixed arm 58 is inclined upwardly at a slight angle thereto, as illustrated in FIG. 2. This angled arrangement of the pulley blocks 120 is to accommodate the camber in the strap web 95 to be dispensed from the coil 80. Each of the pulley blocks 120 is provided with a retainer 125 mounted at one end thereof by a hinge assembly 126 to the adjacent end of the associated arm and provided at the other end thereof with a plurality of retaining lugs 127, respectively received in the channels of the pulleys 122 for retaining the strap web 95 therein. The hinge assembly 126 for the retainer 125 on the fixed arm 58 is attached directly to the upper end thereof, while the hinge 126 for the retainer 125 on the dancer arm 110 is attached to the upper end thereof by means of a mounting block 128.

In use, the leading end of the strap web 95 fed from the coil 80 is threaded through the pulley blocks 120 in the manner illustrated in FIG. 13 and is then fed to associated equipment, such as a strap straightener and a strapping machine for securing the strap web 95 about an associated bundle or package in a well-known manner. Such strapping machines are provided with strap drive apparatus which serves to pull the strap web 95 from the supply coil 80 thereof. It will be appreciated from FIG. 4 that under the urging of the tension spring 115, the dancer arm 110 is normally biased toward the right-hand positions thereof illustrated in phantom in FIGS. 4, 5 and 11, in which positions a substantial length of strap web 95 is accommodated between the pulley blocks 120. As the leading end of the strap web 95 is pulled by the associated strapping machine, the length of strap web 95 extending between the pulley blocks 120 will be taken up by the strapping machine, thereby urging the dancer arm 110 toward the fixed arm 58, i.e., toward the left as viewed in FIG. 4, all in a well-known manner.

A valve assembly, generally designated by the numeral 130, is also provided for controlling the operation of the air motor 105. A mounting plate 131 extends upwardly from the right-hand side of the framework 151, as viewed in FIG. 4, two valves 132 and 133 being secured to the front surface of the mounting plate 131 adjacent to the upper end thereof by means of bolts 132*a* and 133*a*, respectively. Referring to FIGS. 11 and 12, the valves 132 and 133 are identical in construction, each of the valves 132 and

133 being provided with a plunger or actuator rod 135 extending longitudinally therethrough and outwardly beyond the opposite ends thereof, each plunger 135 being provided at the upper end thereof with a roller 138 and being provided at the lower end thereof with a roller 139. The valves 132 and 133 are spaced apart on the mounting plate 131 and are so positioned with respect to the dancer arm 110 that the rollers 138 and 139 are engaged by the actuator members 118 and 119, respectively, on the actuator plate 116 as the dancer arm 110 moves between the extreme left-hand and right-hand positions thereof illustrated in FIGS. 4, 5 and 11. More particularly, the valves 132 and 133 are so oriented with respect to the dancer arm 110 that, as the dancer arm 110 moves in a counterclockwise direction as viewed in FIG. 11, with the plungers 135 in their downward positions, illustrated in solid line in FIG. 11, the upper actuator member 118 will move past and clear the upper roller 138 on each valve, after which the lower actuator member 119 will engage the lower roller 139 on that valve for urging the plunger 135 to the upward position thereof illustrated in phantom in FIG. 11. Similarly, with the plungers 135 in their upward positions, as the dancer arm moves in a clockwise direction, as viewed in FIG. 11, the lower actuator member 119 will move past and clear the lower roller 139 on each valve, after which the upper actuator member 118 will engage the upper roller 138 on that valve for moving the plunger 135 to its downward position. Preferably, the valves 132 and 133 are so connected to a suitable source of pressurized air that, when the plungers 135 are in their downward positions, the valves 132 and 133 are closed while, when the plungers 135 are in their upward positions, the valves 132 and 133 are open to permit the passage of air therethrough from the associated source to the air motor 105, as will be described in greater detail below.

Referring now to FIGS. 1, 2 and 4 of the drawings, the coil unreeler 50 is also provided with a shock absorber, generally designated by the numeral 140, for cushioning the clockwise movement of the dancer arm 110. The shock absorber 140 includes a cylinder 141 having a pivot coupling 142 at one end thereof pivotally connected by means of a bolt 143 to a mounting plate 144 secured to the front stanchion 54. The shock absorber is also provided with a piston 145 slidably received within the cylinder 141 and provided at the free end thereof with a pivot coupling 146 pivotally connected by means of a pivot pin 147 to the lower portion 112 of the dancer arm 110. In use, shock absorber 140 will serve to cushion the sudden clockwise movement of the dancer arm 110, as viewed in FIG. 4, when the supply coil 80 is exhausted or in the event that the strap web 95 breaks.

Referring now to FIGS. 4 to 10 of the drawings, the coil unreeler 50 is provided with a brake assembly, generally designated by the numeral 150, for retarding the rotation of the reel 65 and the coil 80 carried thereon. The brake assembly 150 includes a pair of substantially parallel brake arms 151 and 152, the front brake arm 151 being substantially straight, while the rear brake arm 152 has an offset portion 153 at the upper end thereof, whereby the brake arms 151 and 152 are arranged back-to-back in engagement with each other at the lower ends thereof, while the offset portion 153 at the upper end of the brake arm 152 is spaced a predetermined distance from the adjacent upper end of the brake arm 151. The brake arms 151 and 152 are pivotally mounted adjacent to the lower ends thereof on the shaft 113 forwardly of the bearing plates 114. Respectively attached to the brake arms 151 and 152 at the upper ends thereof by means of bolts 154 are two brake pads or shoes 155 respectively disposed on the inner surfaces of the brake arms 151 and 152 in facing relationship. The brake arms 151 and 152 are disposed substantially along a radial line extending between the axes of the shafts 63 and 113, with the brake shoes 155 being respectively disposed on opposite sides of the sprocket plate 109 a very slight distance radially inwardly from the outer edge thereof. Fixedly secured to the shaft 113 forwardly of the brake arm 151, as by welding, is a substantially rectangular pivot plate 156 having a pivot pin 157 adjacent to the outer end thereof for pivotally connecting the pivot plate 156 to a brake actuator arm 158. The actuator arm 158 is shaped complementary to the brake arm 153 and is disposed substantially parallel thereto, the actuator arm 158 having an offset upper portion 159 which is disposed between the upper ends of the brake arms 151 and 152.

A mounting block 160 is secured by means of bolts 160a to the front stanchion 54 adjacent to the periphery of the sprocket plate 109, the mounting block 160 having a cylindrical bore 161 extending therethrough substantially normal to the front stanchion 54. Received in the bore 161 is a cylindrical shaft 162 secured to the block 160 by means of set screws 163, the front end of the shaft 162 being received through complementary openings in the upper ends of the brake arms 151 and 152. Extending diametrically through the shaft 162 and fixedly secured thereto between the brake arms 151 and 152 is a generally cylindrical dowel or pin 164, with the opposite ends thereof extending a slight distance beyond the periphery of the shaft 162. Respectively secured to the inner surfaces of the brake arms 151 and 152 are a pair of cam plates 165, each of the cam plates 165 receiving the shaft 162 through a complementary opening therein, whereby the cam plates 165 are pivotally movable with respect to the shaft 162. The cam plates 165 are each pivotally connected at one end thereof to the upper end of the actuator arm 158 by means of a bolt 166 and nut 167. Each of the cam plates 165 has formed in the inner surface thereof an elongated channel or groove 168 shaped complementary to the pin 164 and normally receiving the pin 164 therein.

Extending through complementary openings in the brake arms 151 and 152 a slight distance below the shaft 162 is a bolt 170, the rear end of the bolt 170 having a compression spring 171 disposed therearound and held in place by a backing washer 172 and a nut 173. The nut 173 is adjusted to compress the spring 171 so as to urge the brake arms 151 and 152 toward each other, the compression in the spring 170 being preferably set so that the brake shoes 155 are normally held in engagement with the opposite surfaces of the sprocket plate 109 for braking or retarding the rotation of both the sprocket plate 109 and the reel 65 connected thereto. When the brake assembly 150 is in this normally applied or braking condition, the pin 164 is

disposed in the grooves 168 and in firm engagement therewith. It will be appreciated that, when the actuator arm 158 is moved either upwardly or downwardly, it will effect a corresponding pivotal movement of the cam plates 165, whereby the grooves 168 will be moved out of alignment with the pin 164. Thus, the camming action between the cam plates 165 and the pin 164 will move the cam plates 165 and the brake arms 151 and 152 apart from each other in an obvious manner, for releasing the brake assembly 150 by disengaging the brake shoes 155 from the sprocket plate 109 to permit free rotation thereof.

The operation of the coil unreeler 50 will now be described in detail. When it is desired to mount a coil 80 of strapping material on the coil unreeler 50, the cap plate 90 is first removed from the coil support assembly 60 by means of releasing the toggle clamps 94. The speed handle 86 is then rotated so that it moves axially outwardly of the stud 85. This will accommodate a corresponding axial outward movement of the hub 71 of the coil clamping assembly 70 whereby, through the action of the parallelogram linkage, the ends of the shoes 78 connected thereto will move radially inwardly along the slots 68 to the inner ends thereof. This will assure sufficient clearance between the shoes 78 and the cylindrical inner surface of the coil 80. The coil 80 is then mounted on the reel 65 with the coil support arms 69 extending through the central opening in the coil 80, and with the rear surface of the coil 80 flush against the front edges of the radial arms 66. The speed handle 86 is then rotated so that it moves axially inwardly of the stud 85, thereby moving the hub 71 axially inwardly and expanding the shoes 78 radially outwardly through the action of the parallelogram linkage until the shoes 78 are firmly in engagement with the inner cylindrical surface of the coil 80. In this manner the coil 80 is securely locked in position on the reel 65 for rotation therewith. The cap plate 90 is then replaced on the reel 65 flush against the outer side surface of the coil 80, whereby the cap plate 90 cooperates with the radial arms 66 for preventing any axial movement of the coil 80 with respect to the coil support assembly 60.

The leading end of the strap web 95 is then fed from the coil 80 upwardly through the pulley blocks 120 in the manner illustrated in FIG. 13, and is then fed to the associated strap tightening apparatus and strapping machine in a standard fashion. A sufficient length of the strap web 95 will be unreeled from the coil 80 to permit the dancer arm 110 to rest in a home or reference position midway between the valves 132 and 133, the dancer arm 110 being balanced in this home position by the cooperating action of the tension spring 115 and the holding force exerted on the free end of the strap 95 by the strapping machine. It will be noted that the valves 132 and 133 are so coupled to the air motor 105 that, when the valve 132 is opened, the air motor 105 will be driven in a first direction so as to rotate the shaft 63 in a clockwise or unreeling direction, as viewed in FIG. 4, and when the valve 133 is open the air motor 105 will be driven in a second direction so as to effect rotation of the shaft 63 in a counterclockwise or reeling direction, as viewed in FIG. 4.

When the associated strapping machine is operated, it will exert a tensional force on the free end of the strapping web 95 in the direction of the arrow in FIG. 4, thereby pulling the dancer arm 110 toward the left as viewed in FIG. 4 and simultaneously drawing strapping material from the length of the strap web 95 extending between the pulley blocks 120. As noted above, when the dancer arm 110 is in its home position between the valves 132 and 133, the brake assembly 150 will be in its braking condition, i.e., with the pin 164 recessed in the grooves 168 in the cam plates 165 and with the brake shoes 155 in braking engagement with the sprocket plate 109. As the dancer arm 110 moves in a counterclockwise direction from its home position, the pivot plate 156 is also rotated counterclockwise, thereby pulling the actuator arm 158 downwardly and pivoting the cam plates 165 in a counterclockwise direction for separating the brake shoes 155 and releasing them from engagement with the sprocket plate 109 for accommodating free rotation of coil 80. As the dancer arm 110 moves further toward the left under the action of the pulling force exerted by the strapping machine on the strap web 95, actuator member 119 will engage the lower roller 139 on the valve 132 for moving the plunger 135 to its upward position, thereby opening the valve 132. The opening of the valve 132 admits air under pressure to the air motor 105 for driving the motor 105 and the coil 80 in an unreeling direction, as described above, for dispensing strapping material from the coil 80. The motor 105 will continue rotating the coil 80 in an unreeling direction and dispensing the strapping material therefrom at a fixed predetermined rate which is preferably greater than the rate at which the strapping material is consumed by the strapping machine. Accordingly, the length of material accommodated between the pulley blocks 120 will be permitted to increase, thereby allowing the dancer arm 110 to move back to the right in a clockwise direction, as viewed in FIG. 4, under the urging of the tension spring 115. This clockwise movement of the dancer arm 110 will continue until it passes back over the valve 132, whereupon the actuator member 118 will engage the roller 138 for moving the plunger 135 to its downward position and closing the valve 132, thereby deactuating the air motor 105. As the dancer arm 110 continues its clockwise movement into its home position, the pivot plate 156 is rotated in a clockwise direction, thereby rotating the cam plates 165 clockwise under the action of the actuator arm 158 until the grooves 168 are again in alignment with the pin 164, whereupon the compression spring 171 will urge the brake shoes 155 back into engagement with the sprocket 109 for exerting a braking force thereon. The rotation of the coil 80 will, thus, be gradually slowed by the brake assembly 150 until it has completely stopped.

In the operation of the standard strapping machine, after the strap has been wrapped around the object to be bound, the supply end of the strap is pulled to a tensioned condition therearound, thereby creating a certain amount of slack in the strap web 95 extending between the strapping machine and the coil unreeler 50. This slack will permit the dancer arm 110 to move further in a clockwise direction under the urging of the tension spring 115, thereby creating an excessive length of strap web 95 to be stored between the pulley blocks 120. For this reason the valve 133 is provided to

control the air motor **105** for restoring the dancer arm **110** to its equilibrium or home position.

More particularly, as the dancer arm **110** moves from its home position in a clockwise direction, the pivot plate **156** will also be rotated in a clockwise direction, thereby moving the actuator arm **158** upwardly and pivoting the cam plates **165** in a clockwise direction, so that the grooves **168** therein are moved out of alignment with the pins **164**. Thus, the pin **164** and the cam plates **165** coact to separate the brake shoes **155** and move them out of engagement with the sprocket plate **109**, thereby releasing the brake assembly **150**. As the dancer arm **110** continues its clockwise movement past the valve **133**, the actuator member **119** will engage the roller **139**, for moving the plunger **135** to its upward position and opening the valve **133**. Thus, a supply of air under pressure will be provided to air motor **105** for effecting operation thereof in a reeling direction for taking up the excess slack in the strap web **95** onto the coil **80**. As this excess slack is taken up on the coil **80**, the dancer arm **110** will be pulled back in a counterclockwise direction toward its home position. As the dancer arm **110** passes back over the valve **133**, the actuator member **118** will engage the roller **138** for moving the plunger **135** to its downward position and closing the valve **133**, thereby deactuating the air motor **105**. As the dancer arm **110** moves into its home position, the pivot plate **156** and the cam plates **165** will be moved in a counterclockwise direction back into their braking configuration wherein the grooves **168** are again in alignment with the pin **164**. Thus, the brake shoes **155** will again be urged into engagement with the sprocket plate **109** for braking the rotation of the coil **80**, as described above.

It will be seen that the action of the air motor **105** and the control valves **133** and **134** therefor will serve to maintain the dancer arm **110** in its home position, and thereby serve to maintain a predetermined range of tension in the unreeled portion of strap web **95** and to maintain a predetermined length of strap web **95** between the pulley blocks **120**. Thus, it will be appreciated that the dancer arm **110** serves as a sensing device for sensing the tension in the unreeled portion of the strap web **95** stored between the pulley blocks **120**. When the length of this portion of the strap web **95** drops below a predetermined amount as a result of the tension increasing above a reference range of tension, the drive motor **105** is actuated for rotating the coil **80** in an unreeling direction and dispensing additional strap web therefrom to relieve the tension in the strap web **95** and increase the length thereof between the pulley blocks **120**. The air motor **105** is deactuated and the rotation of the coil **80** is braked when the tension in the strap web **95** is again in the reference range and the dancer arm **110** has returned to its home position. Similarly, if the length of strap web **95** between the pulley blocks **120** becomes too great as a result of the strap tension dropping below the reference range, the dancer arm **110** cooperates with the valve **133** to actuate the air motor **105** for rotating the coil **80** in a reeling direction and taking up slack thereonto to increase the tension in the strap web **95** and decrease the length thereof between the pulley blocks **120**. The air motor **105** is deactuated and the rotation of the coil **80** is braked when the tension in the strap web **95** is again in the predetermined range and the dancer arm **110** has returned to its home position.

Thus, it will be noted that the tensional unreeling force applied to the strap web **95** by the associated strapping machine serves only to move the dancer arm **110**, this movement being greatly facilitated by the mechanical advantage afforded by the pulley blocks **120**. Accordingly, very little tension is built up in the strap web **95** in moving the dancer arm **110**. More importantly, the driving force for rotating the coil **80** is supplied solely by the air motor **105**, no portion of this drive force being supplied by the pulling action of the associated strapping machine on the strap web **95**. This is extremely important when certain types of plastic strap, such as polypropylene strap, are utilized, since these plastic straps generally lack the tensile strength of steel strapping and would be likely to deform or break if the normally extremely heavy supply coil **80** were driven directly by the pulling force exerted on the strap web **95** by the strapping machine.

It will be noted that in the preferred embodiment, two pulleys **122** have been provided on the fixed arm **58** and three pulleys **122** have been provided on the dancer arm **110**. However, it will be appreciated that any desired number of pulleys **122** may be provided depending upon the length of strap web **95** to be accommodated between the pulley blocks **120**. Ideally, the length of strap web **95** accommodated between the pulley blocks **120** will be substantially equal to the length of strap web **95** consumed during each strapping operation of the associated strapping machine. Thus, only one unreeling operation of the coil unreeler **50** would be required for each strapping operation, thereby minimizing wear on the coil unreeler **50**. While this ideal situation may be difficult or impossible to achieve where objects of widely differing sizes are being strapped by the strapping machine, the automatic tension-sensing action of the coil unreeler **50** will nevertheless always provide smooth dispensing of the strap web **95** while preventing the buildup of harmfully excessive tension therein.

From the foregoing, it will be observed that there has been provided an improved coil unreeler which is particularly suitable for use in dispensing plastic strapping material or other strapping material having relatively low tensile strength, as well as in dispensing steel strapping from unusually heavy coils thereof. More particularly, there has been provided a coil unreeler wherein the coil is rotated by a drive motor completely independently of the force exerted on the strap web by the associated strapping machine.

There has also been provided a motor-driven coil unreeler wherein the drive motor is an air motor controlled by air valves, whereby the control system for the coil unreeler is completely pneumatic.

In addition, there has been provided a motor-driven coil unreeler provided with a reversible drive motor for driving the coil in either an unreeling or a reeling direction for either dispensing strapping material from the coil or taking up slack strapping material onto the coil.

Finally, there has been provided an improved brake assembly for a motor-driven coil unreeler for retarding the rotation of the coil when the drive motor is deactuated.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A coil unreeler for dispensing a continuous strip of strapping material from a coil thereof, said unreeler comprising a coil support for rotatably supporting an associated coil of strapping material having an unreeled portion extending therefrom, a drive motor coupled to said coil support for effecting rotation of the associated coil in an unreeling direction, a brake coupled to said coil support for retarding rotation of the associated coil, a tension sensing device for sensing the tension in the unreeled portion of the strapping material, and control apparatus responsive to the sensing by said sensing device of a predetermined tension in the unreeled portion of strapping material for releasing said brake and thereafter actuating said drive motor to effect rotation of the associated coil in an unreeling direction.

2. The coil unreeler set forth in claim 1, wherein said control apparatus is responsive to the sensing by said sensing device of a tension less than said predetermined tension in the unreeled portion of strapping material for deactuating said drive motor and applying said brake to retard the rotation of the associated coil.

3. The coil unreeler set forth in claim 1, wherein said drive motor comprises an air motor, and wherein said control apparatus includes a valve for controlling the flow of air to said air motor, and a mechanical linkage coupling said tension sensing device to said brake.

4. The coil unreeler set forth in claim 1, and further including means coupling said drive motor to said coil support and rotatable therewith, said brake being engageable with said coupling means for retarding rotation thereof.

5. A coil unreeler for dispensing a continuous strip of strapping material from a coil thereof, said unreeler comprising a coil support for rotatably supporting an associated coil of strapping material having an unreeled portion extending therefrom, an air motor coupled to said coil support and having a first condition for effecting rotation of the associated coil in an unreeling direction and a second condition for effecting rotation of the associated coil in a reeling direction, a brake coupled to said coil support for retarding rotation of the associated coil, a tension sensing device for sensing the tension in the unreeled portion of the strapping material both above and below a predetermined range of tension therein, and control apparatus including a first valve for controlling the flow of air to said air motor in the first condition thereof and a second valve for controlling the flow of air to said air motor in the second condition thereof and being responsive to said sensing device for controlling said air motor and said brake, said control apparatus being responsive to the sensing by said sensing device of a tension above said predetermined range of tension in the unreeled portion of strapping material for releasing said brake and thereafter actuating said air motor to the first condition thereof to effect rotation of the associated coil in an unreeling direction, said control apparatus being responsive to the sensing by said sensing device of a tension in said predetermined range of tension in the unreeled portion of strapping material for deactuating said air motor and applying said brake to retard rotation of the associated coil, said control apparatus being responsive to the sensing by said sensing device of a tension below said predetermined range of tension in the unreeled portion of strapping material for releasing said brake and actuating said air motor to the second condition thereof for effecting rotation of the associated coil in a reeling direction.

6. The coil unreeler set forth in claim 5, and further including means coupling said air motor to said coil support and rotatable therewith, said brake being engageable with said coupling means for retarding rotation thereof.

7. The coil unreeler set forth in claim 5, and further including a sprocket plate coupled to said air motor and fixedly secured to said coil support for rotation therewith, said brake including a pair of brake shoes receiving said sprocket plate therebetween for clamping engagement with said sprocket plate to retard the rotation thereof.

8. A coil unreeler for dispensing a continuous strip of strapping material from a coil thereof, said unreeler comprising a coil support for rotatably supporting an associated coil of strapping material having an unreeled portion extending therefrom, an air motor coupled to said coil support for effecting rotation of the associated coil in an unreeling direction, a rocker arm mounted for pivotal movement about a predetermined axis between first and second ranges of movement, bias means urging said rocker arm toward said first range of movement and into engagement with the unreeled portion of strapping material, application of a predetermined tensional unreeling force to the unreeled portion of strapping material beyond said rocker arm effecting pivotal movement thereof from said first range of movement to said second range of movement, and control apparatus including a valve having an actuator member for controlling the flow of air to said air motor and being responsive to the movement of said rocker arm from said first range of movement to said second range of movement thereby to engage said actuator member to actuate said air motor to effect rotation of the associated coil in an unreeling direction.

9. The coil unreeler set forth in claim 8, wherein said control apparatus is responsive to the movement of said rocker arm from said second range of movement to said first range of movement for deactuating said drive motor.

10. The coil unreeler set forth in claim 8, and further including a fixed arm mounted for engagement with the unreeled portion of strapping material and cooperating with said rocker arm to support a reach of strapping material therebetween, the length of said reach varying with the movement of said rocker arm.

11. The coil unreeler set forth in claim 8, and further including a fixed arm, pulley assembles respectively mounted on said fixed arm and said rocker arm for engagement with the unreeled portion of strapping material and cooperating to support a reach of strapping material therebetween, the length of said reach varying with the movement of said rocker arm.

12. A coil unreeler for dispensing a continuous strip of strapping material from a coil thereof, said unreeler

comprising a coil support for rotatably supporting an associated coil of strapping material having an unreeled portion extending therefrom, a drive motor coupled to said coil in an unreeling direction, a rocker arm mounted for pivotal movement about a predetermined axis between first and second ranges of movement, bias means urging said rocker arm toward said first range of movement and into engagement with the unreeled portion of strapping material, application of a predetermined tensional unreeling force to the unreeled portion of strapping material beyond said rocker arm effecting pivotal movement thereof from said first range of movement to said second range of movement, a brake plate coupled to said coil support and rotatable therewith, a pair of brake shoes respectively mounted on opposite sides of said brake plate and yieldably urged into engagement therewith for retarding rotation thereof, releasing mechanism coupled to said brake shoes for moving said brake shoes out of engagement with said brake plate for accommodating free rotation thereof, and control means responsive to the movement of said rocker arm from said first range of movement to said second range of movement for actuating said releasing mechanism and actuating said drive motor to effect rotation of the associated coil in an unreeling direction.

13. The coil unreeler set forth in claim 12, wherein said releasing mechanism comprises a fixed cam member mounted between said brake shoes, a pair of movable cam members respectively coupled to said brake shoes and disposed on opposite sides of said fixed cam member for camming engagement therewith, and means coupling said movable cam members to said rocker arm for moving said movable cam members in response to movement of said rocker arm, said movable cam members being responsive to movement of said rocker arm from said first range of movement to said second range of movement for urging said brake shoe out of engagement with said brake plate.

14. A coil unreeler for dispensing a continuous strip of strapping material from a coil thereof, said unreeler comprising a coil support for rotatably supporting an associated coil of strapping material having an unreeled portion extending therefrom, a drive motor coupled to said coil support for effecting rotation of the associated coil in an unreeling direction, a sprocket plate coupled to said drive motor and fixedly secured to said coil support for rotation therewith, a brake coupled to said coil support for retarding rotation of the associated coil, said brake including a pair of brake shoes receiving said sprocket plates therebetween for clamping engagement with said sprocket plate to retard the rotation thereof, a tension sensing device for sensing the tension in the unreeled portion of the strapping material, and control apparatus responsive to the sensing by said sensing device of a predetermined tension in the unreeled portion of strapping material for releasing said brake and thereafter actuating said drive motor to effect rotation of the associated coil in an unreeling direction.

15. A coil unreeler for dispensing a continuous strip of strapping material from a coil thereof, said unreeler comprising a coil support for rotatably supporting an associated coil of strapping material having an unreeled portion extending therefrom, an air motor coupled to said coil support and having a first condition for effecting rotation of the associated coil in an unreeling direction and a second condition for effecting rotation of the associated coil in a reeling direction, a tension sensing device for sensing the tension in the unreeled portion of the strapping material, and control apparatus including a first valve for controlling the flow of air to said air motor in the first condition thereof, a second valve for controlling the flow of air to said air motor in the second condition thereof responsive to the sensing by said sensing device of a first relatively high predetermined tension in the unreeled portion of strapping material for actuating said air motor to the first condition thereof to effect rotation of the associated coil in an unreeling direction, said control apparatus being responsive to the sensing by said sensing device of a second relatively low predetermined tension in the unreeled portion of strapping material for actuating said air motor to the second condition thereof to effect rotation of the associated coil in a reeling direction.

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