July 15, 1947. J. COOK 2,424,021

SPOOLING

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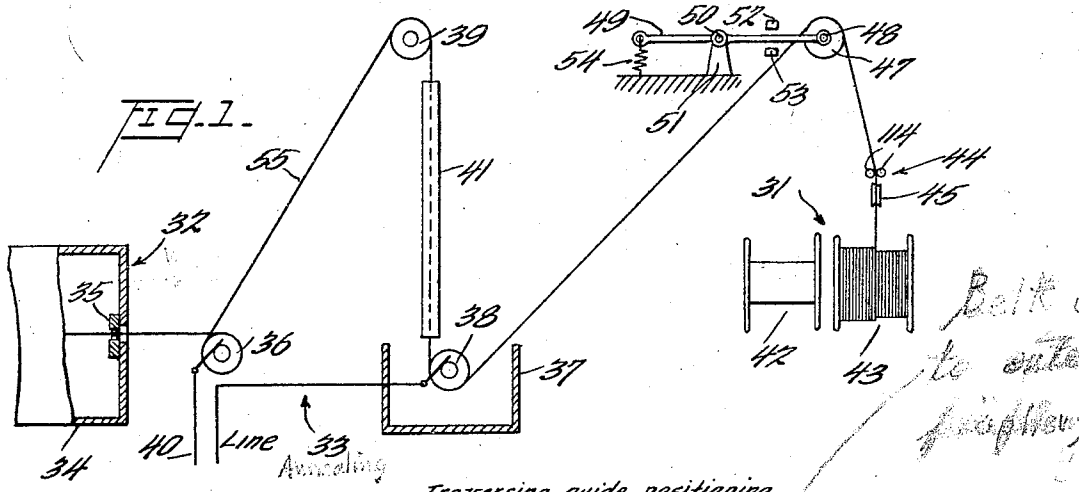
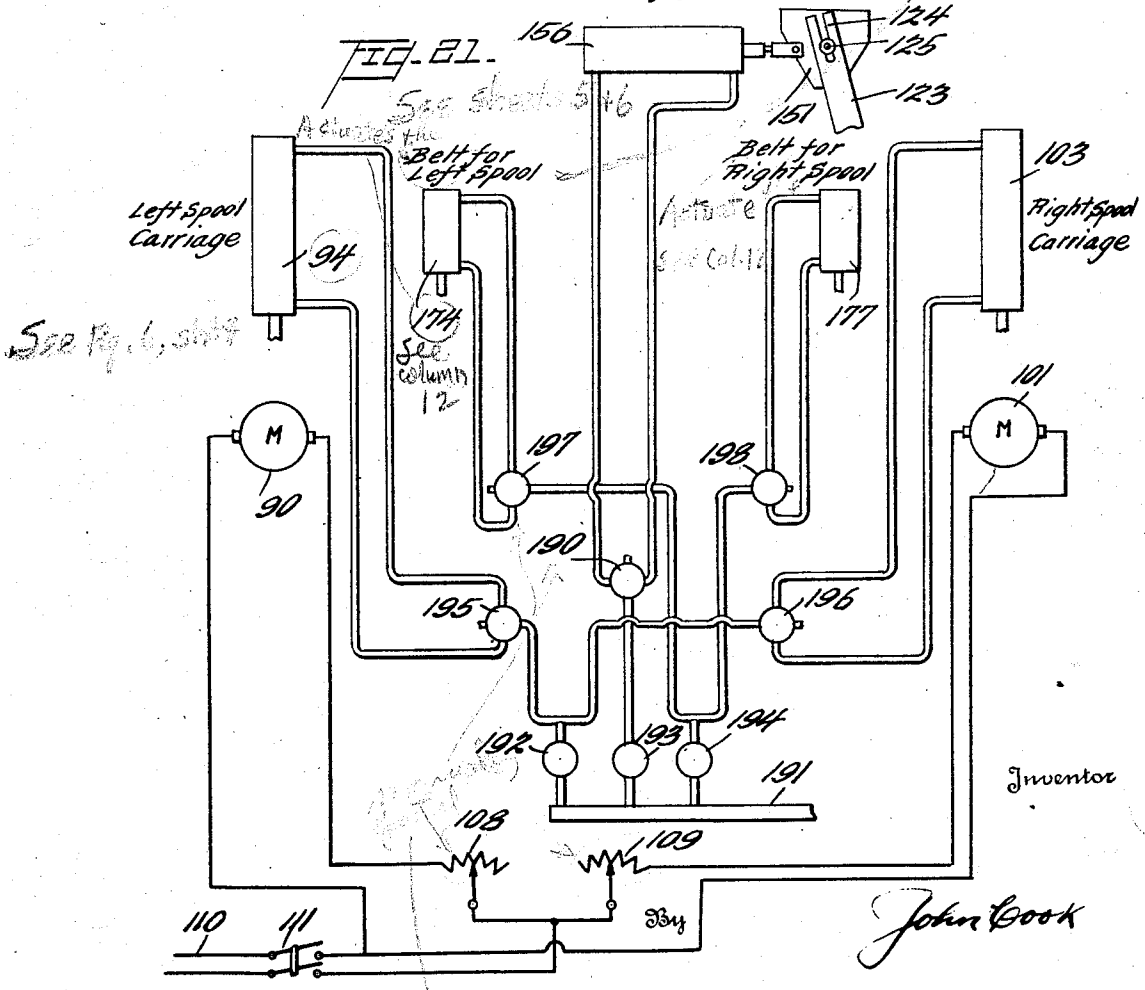
FIG. 1.



Belt ... to auto... tensioner

Traversing guide positioning

FIG. 21.



Inventor

By John Cook

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FIG. 2.

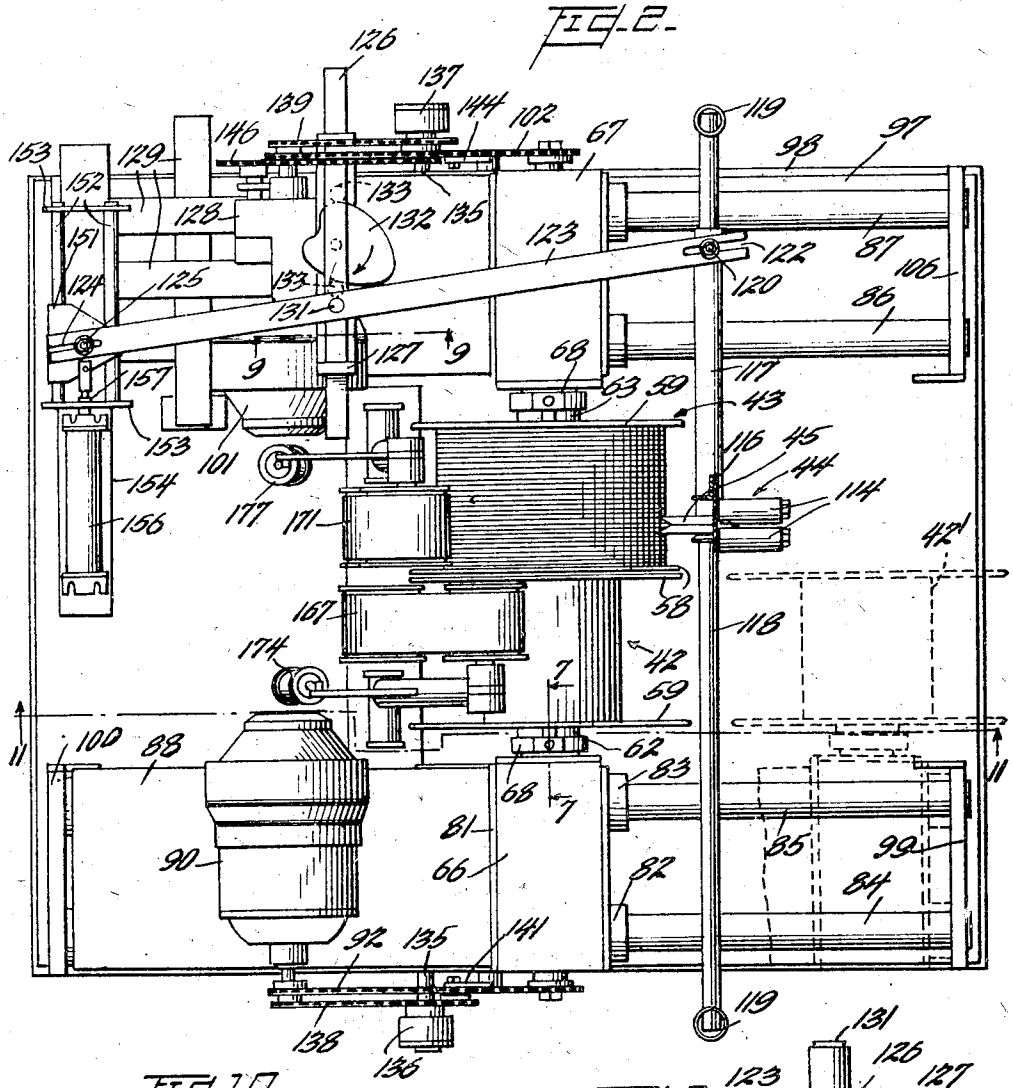

FIG. 10.

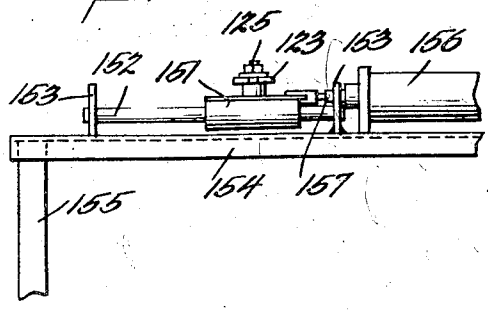

FIG. 9.

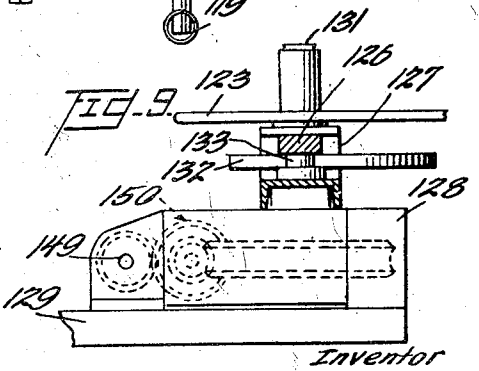

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FIG. 3.

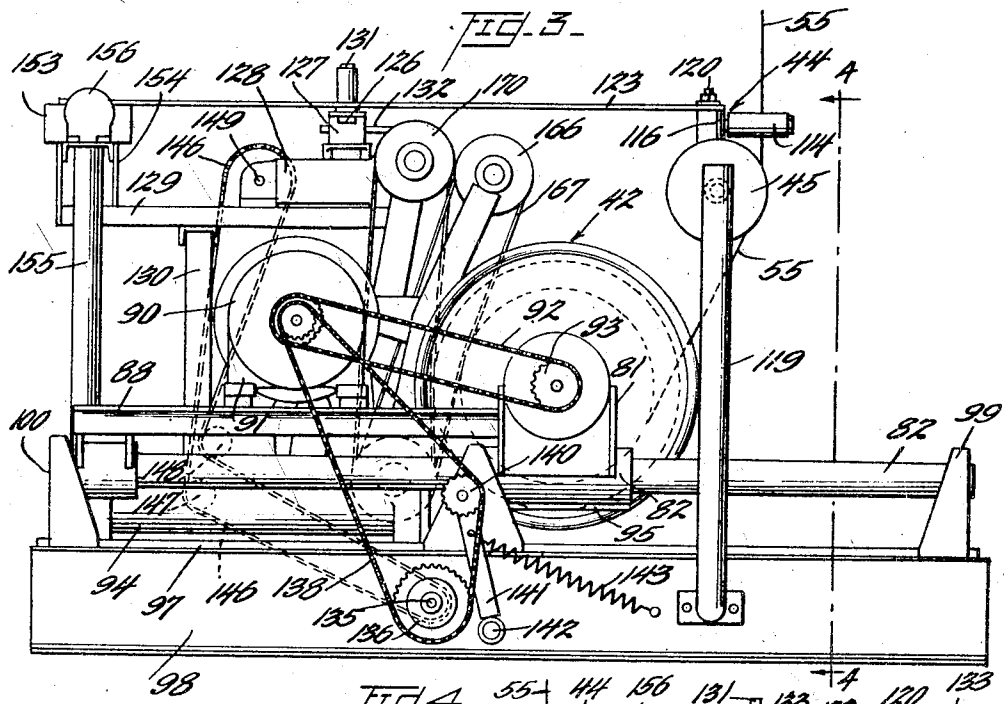

FIG. 4.

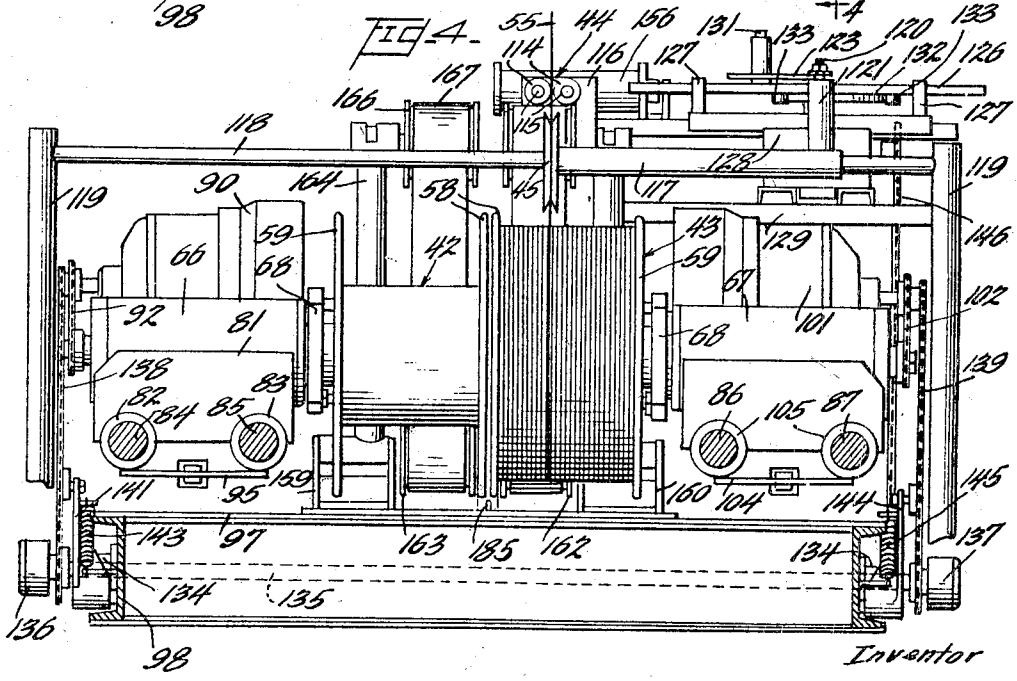

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FIG. 5.

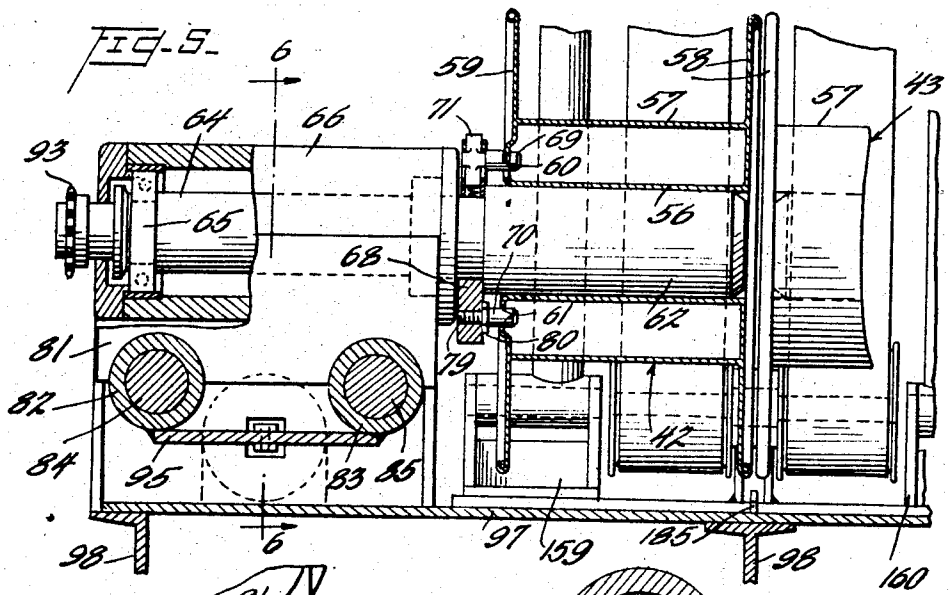

FIG. 6.

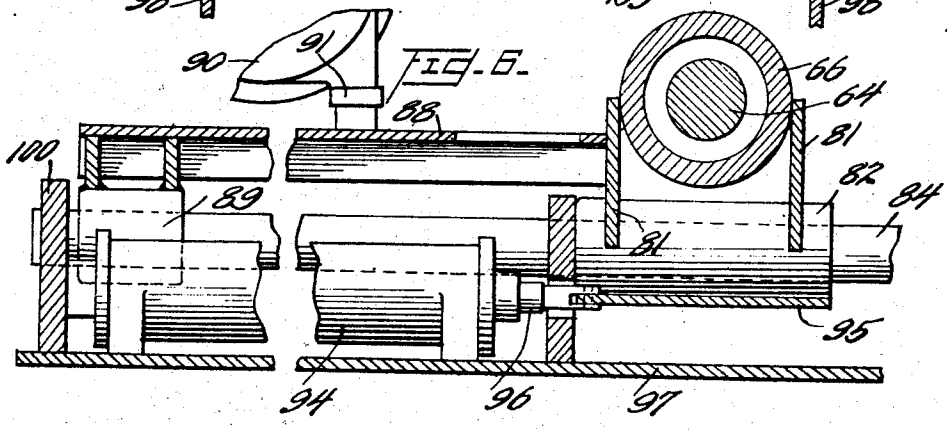

FIG. 8.

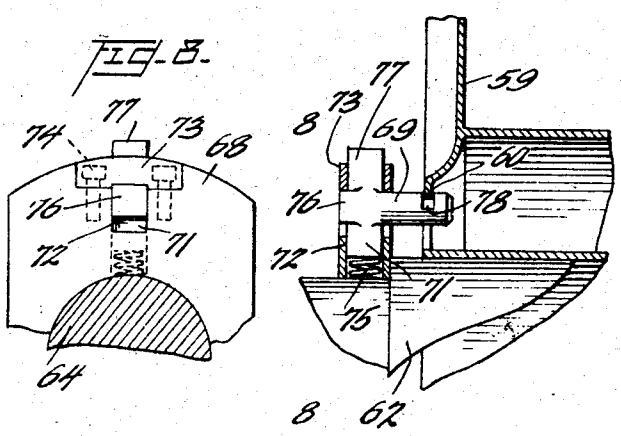

FIG. 7.

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FIG. 11.

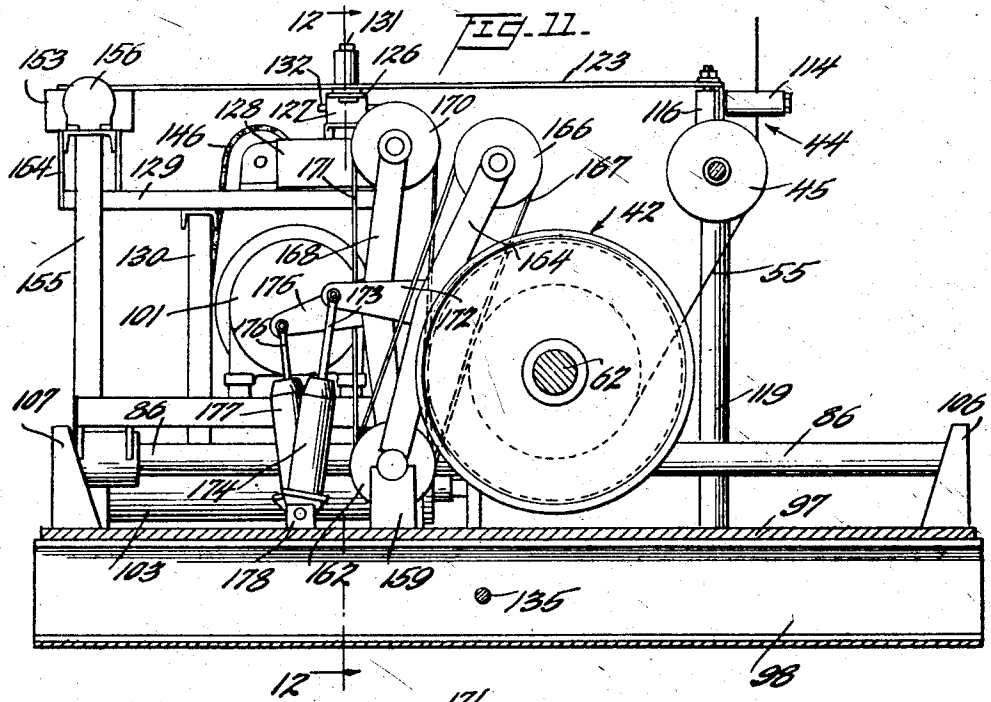

FIG. 12.

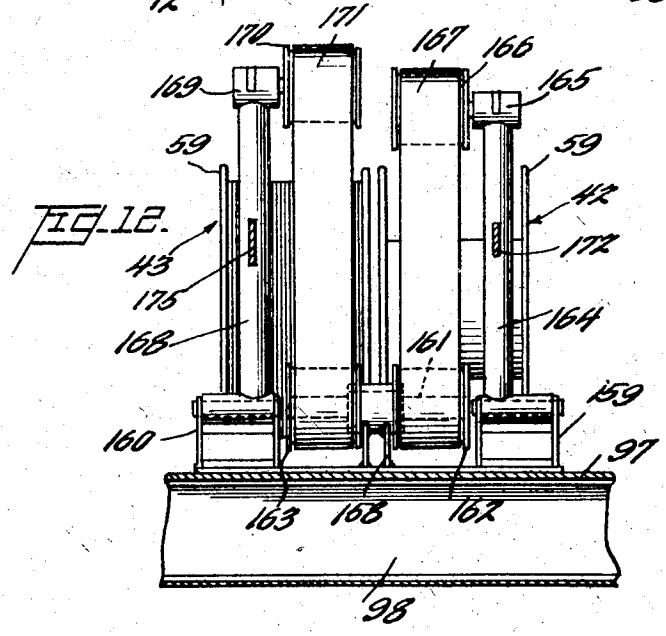

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FIG. 13.

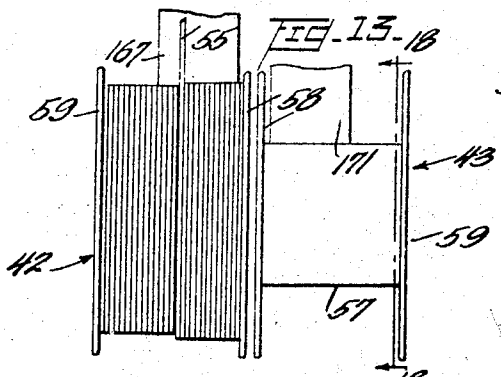


FIG. 18.

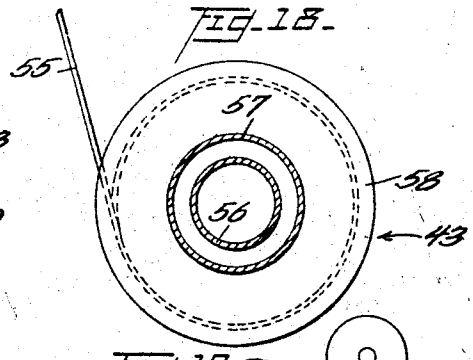


FIG. 14.

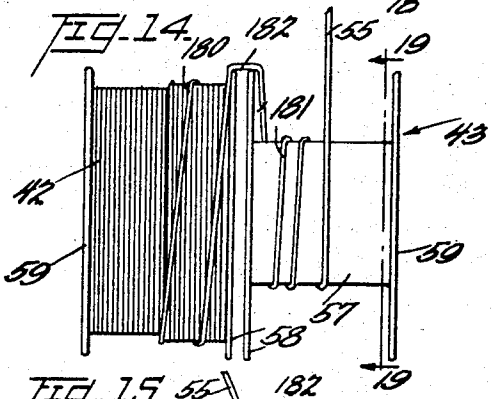


FIG. 19.

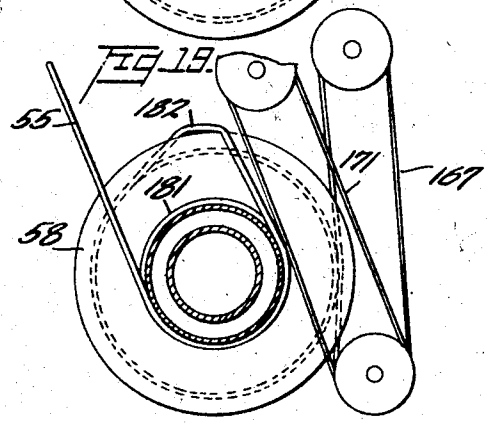


FIG. 15.

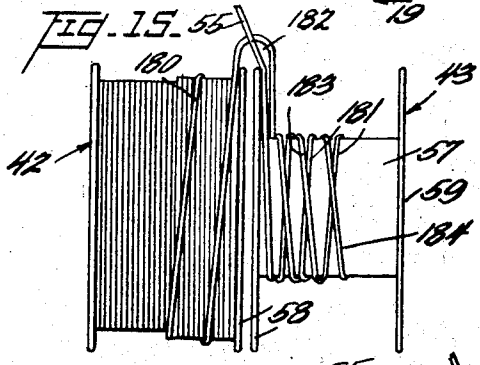


FIG. 16.

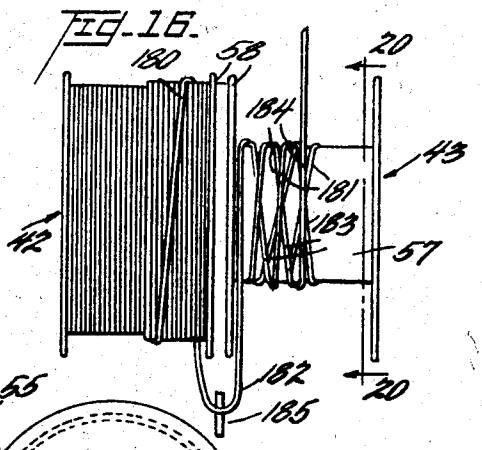
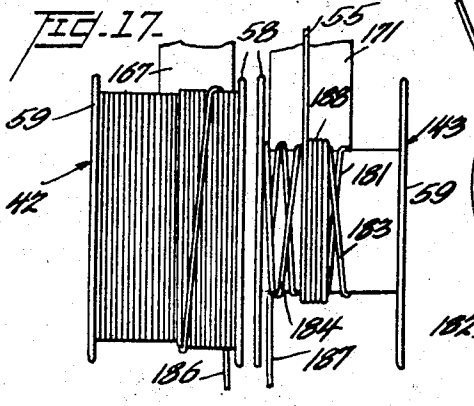


FIG. 17.



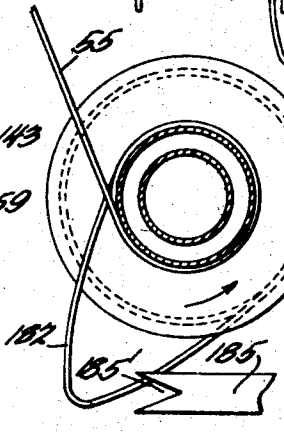


FIG. 20.

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FIG. 22.

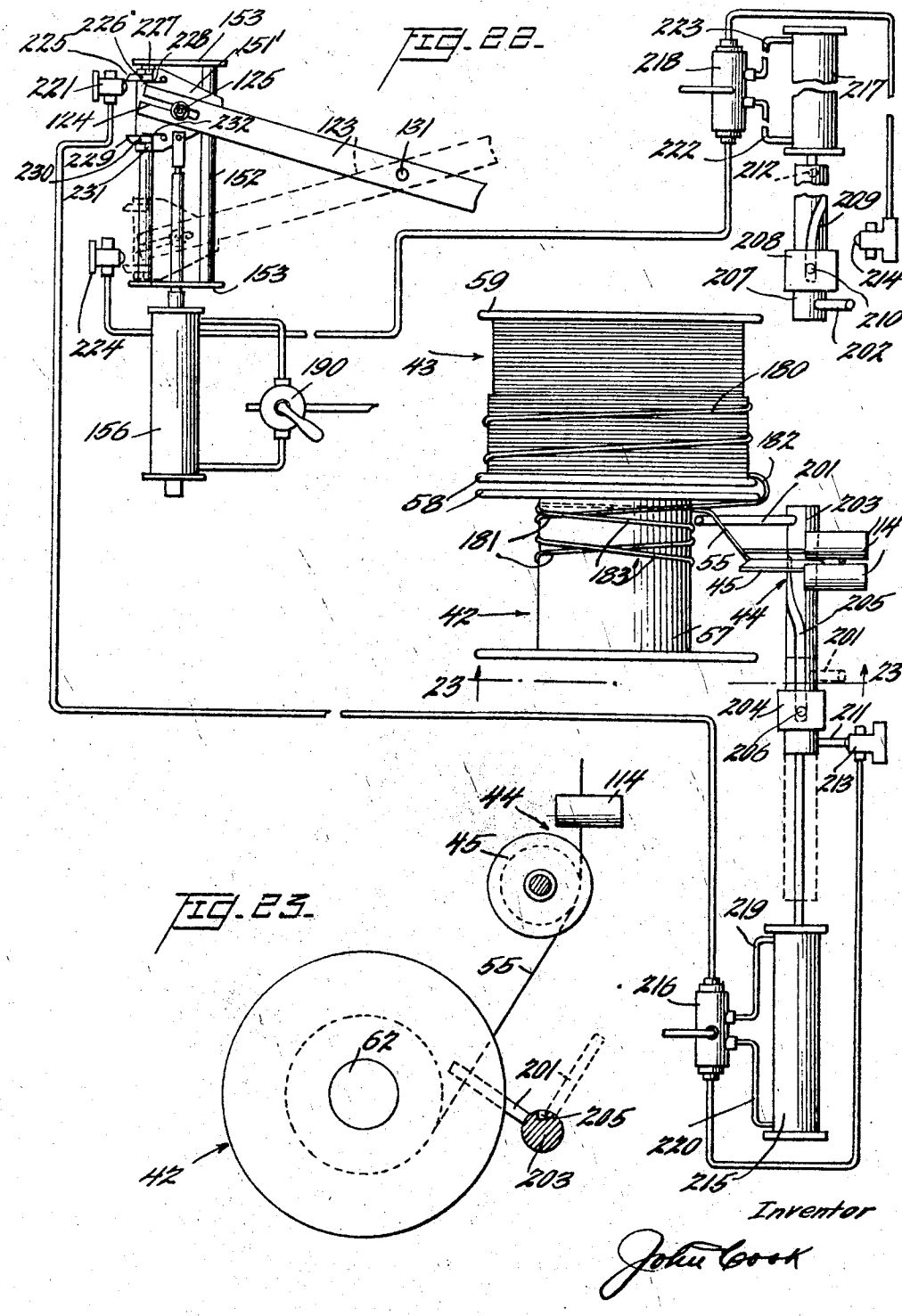

FIG. 23.

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Patented July 15, 1947

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UNITED STATES PATENT OFFICE

2,424,021

SPOOLING

John Cook, Ridgewood, N. J.

Continuation of application Serial No. 401,389, July 7, 1941. This application November 8, 1945, Serial No. 627,365

20 Claims. (Cl. 242—25)

1

My invention pertains to the art of packaging strand material, and more particularly to the art of spooling wire, this application being a continuation of my application Serial No. 401,389 filed July 7, 1941, and now abandoned.

The invention comprises a machine for winding wire and similar strand material, on spools and the like supporting packages, the wire being wound continuously on successive spools. One characteristic of the spooling machine resides in its capability of winding wire under spooling tension, and at a predetermined uniform linear speed, which speed is determined by the speed of travel of the wire as it is delivered to the machine. With particular reference to the present invention, the speed of travel of the wire to the machine is not disturbed when one spool is wound to fullness and the winding of an empty spool is begun, the operation of winding continuing uninterrupted from the full spool to the next succeeding empty spool.

The spooling machine includes means operable to attach the beginning end of the wire to the spool drum when the wire is fed to an empty spool, the operation of attaching the wire to the spool being performed while the wire continues to be delivered to the spooling machine uninterrupted and without the speed of travel of the wire being diminished. The invention contemplates a novel method of attaching the beginning end of wire to a spool being wound.

The spooling machine of the invention is useful for the spooling of wire, or other strand material, under any circumstances. It is especially useful when wire is delivered to the spooling machine continuously, for example, from a previous manufacturing or wire-treating operation at a speed determined by the speed of travel of the wire through the previous operation. Thus, the spooling machine of the present invention affords novel utility when operated in combination with a wire-drawing machine. There is additional novelty in the combination when there is a wire-treating operation, such for example as a heat-treating operation, performed continuously between the drawing and spooling operations.

Under conventional prior art practice of wire-drawing, the wire is delivered from the drawing machine at a linear speed determined by the speed of the wire drawing operation. Under the prior art practice of spooling wire delivered from a wire-drawing machine, when a given spool has been wound to fullness, the entire mechanism, including the wire-drawing machine and the spooler, is brought to a stop, and adjustments are made to begin the winding of the next spool.

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Under the practice of the present invention, the wire is spooled on successive spools without interrupting operation of the wire-drawing machine. Wire is hardened by the cold working of the drawing operation, and it is usually desirable to heat-treat the drawn wire to give it the desired degree of softness. Attempts have been made to anneal wire as a continuous operation, but usually such continuous drawing, annealing and spooling of wire must be interrupted each time a spool is wound to fullness to make adjustments necessary to begin winding the next spool. Under practice of the present invention, wire can be drawn, heat-treated and spooled as a continuous operation, uninterrupted by the wire being wound on successive spools.

There are various novel details of structure in the spooling machine, which form part of the present invention. These, and the other features of the present invention, will be better understood from the disclosed embodiment. Accordingly, for a complete understanding of the invention, attention is directed to the accompanying drawings, in which:

Figure 1 shows the application of the invention to the art of wire-drawing, annealing and spooling;

Figure 2 is a plan view of the wire-spooling machine;

Figure 3 is a side elevation of the spooling machine, viewed from the front of Figure 2;

Figure 4 is a cross-sectional front elevation of the spooling machine, taken on line 4—4 of Figure 3;

Figure 5 is a detail front elevation, partly in section, of the spool-winding mechanism;

Figure 6 is a cross-section, taken on the line 6—6 of Figure 5;

Figure 7 is a detail cross-section of the spool latch, taken on line 7—7 of Figure 2;

Figure 8 is a detail side elevation of the spool latch viewed from the left in Figure 7;

Figure 9 is a cross-section, taken on line 9—9 of Figure 2, showing the traverse mechanism drive;

Figure 10 is a rear elevation of the machine, with parts broken away, and showing the operating mechanism for shifting the wind from the full to the empty spool;

Figure 11 is a cross sectional elevation taken on line 11—11 of Figure 2;

Figure 12 is a cross-sectional elevation with parts broken away, taken on line 12—12 of Figure 11;

Figures 13 to 17 inclusive, show front elevations of the spools in detail, and severally illustrate the respective successive steps in the process of shifting the winding from a full to an empty spool;

Figure 18 is a cross-sectional elevation taken on line 18—18 of Figure 13, with parts broken away for clearness of illustration;

Figure 19 is a cross-sectional elevation, similar to Figure 18, taken on line 19—19 of Figure 14;

Figure 20 is a cross-sectional elevation, similar to Figures 18 and 19, taken on line 20—20 of Figure 16;

Figure 21 is a diagrammatic view illustrating the control mechanism for the electrically and pneumatically-operated members of the spooling machine;

Figure 22 illustrates a modified form of the invention, which includes automatic mechanism for attaching the beginning end of wire onto an empty spool to be wound; and

Figure 23 is a cross-section taken on line 23—23 of Figure 22, illustrating, in side elevation, the automatic mechanism for beginning winding on an empty spool.

Considering the invention first as comprising a spooling machine in combination with machines which manufacture and treat wire and deliver it to the spooling machine, Figure 1 shows the spooling machine illustrated generally at 31; a wire-drawing machine, illustrated generally at 32; and the annealing means, illustrated generally at 33.

The wire-drawing machine 32 comprises the housing 34, which contains the dies and capstans which draw the wire to successively finer gauges until it passes through the last die 35, which constricts the wire to the desired gauge. The specific structure of the wire drawing machine forms no part of the present invention, and accordingly its details of construction are not shown. The capstan 36 draws the wire 55 through the last die 35 of the machine and out of the wire-drawing machine 32, the wire being fed by the capstan 36 from the drawing machine to the annealing machine 33.

The annealing machine may be of any suitable construction, and in the embodiment shown, it includes the capstan 36, the delivery roller, or sheave 38, and the intermediate sheave 39, which latter is spaced away from and preferably above, the capstan 36 and roller 38 a sufficient distance to provide the required length of wire for the desired amount of heat-treating. The wire 55 is heated by any suitable means, such as electricity from the line 40; opposite sides of the line 40 being respectively connected to the capstan 36 and the delivery roller 38, as shown, to provide a closed circuit through the wire 55. The voltage and amperage of the electrical current are such, relative to the resistance of the wire and its time of travel from capstan 36 to roller 38, that the wire is heated to the desired heat-treating temperature when it reaches roller 38. Any suitable quenching means may be provided, including, for example, the fluid containing tube 41, and the tank 37 in which the wire is cooled to normal temperature after it leaves the delivery roller 38.

The spooling machine comprises the spools 42 and 43, left and right respectively. The wire is wound on one spool—this being spool 43 in Figure 1—until it is wound to fullness. The wire 55 travels to the spool 43 through any suitable traversing guide such as is illustrated generally at 44, and which includes the sheave 45. The traversing guide 45 travels from end to end of the spool 43, being wound, and travels the length of the spool 43, at a speed relative to the rotary speed of the spool, to lay successive convolutions of wire side by side on the spool. When the spool 43 is wound to fullness, the traversing guide 44 is shifted to the left opposite spool 42, which is then wound in like manner. When spooling begins on spool 42, full spool 43 is replaced by an empty one, and when spool 42 is wound to fullness, the traversing guide 44 is again shifted to the right, to the position illustrated in Figure 1, to wind the next empty spool 43. Spools at the right and left are wound in succession, and without interruption of the operation of the spooling machine, wire-drawing machine or annealing machine, and as rapidly as the wire passes through the several machines. In this manner wire is produced at a very rapid speed.

When the wire is delivered from the annealing machine 33 to the spooling machine 31, it preferably passes over the slack take-up sheave 47, from which the wire is delivered to the traversing guide 44. The slack take-up sheave 47 is mounted to rotate on the pivot 48 mounted on the swinging arm 49, which arm pivots at 50 on the fixed bracket 51.

The arm 49 is free to swing between the limiting stops 52, 53, and the arm 49 is held in counterbalance between the stops 52 and 53 by a spring 54 or any other suitable counterbalancing means. The wire is wound at a spooling tension, which is maintained constant, and the counterbalanced sheave 47 operates as a visible gauge to indicate when the spooling tension has been disturbed, for example when adjustments, which will be described more fully hereafter, are made for shifting the winding from one to the other spool 42, 43.

In the disclosed embodiment of the invention, the wire is wound on spools. It is obvious however that the strand material can be formed into packages of any suitable form, and wound on any suitable package support, without departing from the spirit of the invention.

The spools 42 and 43, and successive spools wound, are preferably of uniform construction and are thus interchangeable in the machine. In the embodiment shown, and as most clearly illustrated in Figure 5, each spool comprises a hub 56 and the drum 57 held concentrically in spaced relationship by the spool heads 58, 59, which may be of like construction, or of different construction, as shown. At least one head 59 is equipped with apertures 60, 61 positioned between the hub 56 and drum 57 and spaced apart circumferentially, preferably diametrically opposite each other, as shown.

In the spooling machine of the present invention, the left and right spools 42 and 43, respectively, are mounted on the respective spindles 62 and 63, which fit the spool hubs 56. In the present machine, the spindles 62 and 63 are positioned end to end, as illustrated in Figures 2 and 5, when both are in winding position. The spindle 62 extends from the co-axial shaft 64, which rotates in the bearing 65 mounted in the bearing housing 66. A similar bearing housing 67 at the right, Figure 2, encloses a shaft similar to shaft 64 but oppositely disposed to carry the spindle 63.

Attached to each shaft, as illustrated generally in Figure 5, and in detail in Figures 7 and 8, is the collar 68, which carries the pins 69 and 70,

which enter the respective apertures 60 and 61 to engage the spool 42 for rotation with the spindle 62. The pin 69 is carried by the block 71, which rides radially of the spool spindle in guideway 72 of the collar 68 provided for it. The guideway 72 is closed at its upper end by the stop 73, which comprises an insert in the collar 68 conforming with its circular contour, as illustrated in Figure 8. Stop 73 is held in position attached to the collar 68 by any suitable means, such as the screws 74. The block 71 is held against rotation by the abutment member 76, and the pin 69 is thus held projected to engage the spool head. The block 71 is backed by compression spring 75 which holds it in engagement with the stop 73. The outer end of the block, distal with respect to the spring 75, constitutes a push button 77.

The notch 78, in the pin 69, is held in latching engagement with the aperture 60 of the spool head 59 by the spring 75 when the spool is positioned on the spindle 62. The spools 42 and 43 are removable from their respective spindles 62 and 63 by depressing the push button against action of the spring 75 to position the notch 78 out of engagement with the aperture 60, and then sliding the spool off of the spindle.

The pin 70 may be constructed similar to pin 69, but preferably it is constructed, as shown, rigidly attached to the collar 68 by being threaded therein, as illustrated at 79, Figure 5. The lock nut 80 holds the pin 70 against accidental release from the collar 68.

The spindle 63 at the right is mounted similarly to the spindle 62, but the mounting is disposed in the opposite direction to the showing in Figure 5. This places the spindles 62 and 63 in end to end relationship, as shown in Figure 5, and the spools 42 and 43 are thus positioned in the machine coaxially side by side, Figure 2, to facilitate the shift of winding from the full to the empty spool. The spool 43 is attached to spindle 63 by a latching structure similar to that shown in Figures 7 and 8, but disposed in the opposite direction. Accordingly, and as indicated in Figures 2 and 5, the spool heads 58 of the left and right spools 42 and 43 are disposed side by side, and the spool heads 59 are positioned away from each other.

The bearing housing 66 is fixedly mounted on the bearing bracket 81, which is fixed to the slide bearings 82, 83, which are slidably mounted on the respective rods 84, 85, see Figure 6. As illustrated in Figures 2 and 4, there are similar rods 86 and 87, which support the spindle mounting of the spool 43 at the right of the machine.

As best illustrated in Figures 3 and 6, there is a support platen 88, fixedly attached at its forward end to the bearing bracket 81, and resting on the rear sliding bearings 89, attached thereto. Bearings 89 also slide on the rods 84, 85, moving in unison with the bearings 82, 83.

The platen 88 supports the electric motor 90, mounted on its base 91. The motor 90 drives the shaft 64 and the spool 42 through the sprocket chain 92 and sprocket 93, Figures 2, 3 and 5.

Thus the motor 90 and the spool 42, mounted on the unitary support comprising the platen 88, the bearing bracket 81, the front slide bearings 82, 83, and rear slide bearings 89, are movable to a forward position in the machine along slide rods 84, 85. The pneumatic cylinder 94, Figure 6, is operable to move the spool 42 from the full line position illustrated in Figure 2, to the dotted line position 42' at the right, and back to the full line position. Connector plate 95 connects slide bearing 82, 83, and attached to the plate 95 is the piston rod 96, Figure 6, which slides into and out of the cylinder 94. The cylinder 94 rests on, and is attached to, the base plate 97, fixed to the base 98 of the machine. When the spool 42 is slid forwardly of the machine, to dotted line position 42' in Figure 2, it is out of the way of spool 43, and can be removed from the spindle 62 to be replaced by an empty spool 42. The rods 82, 83 are supported by front and rear brackets 99, 100, respectively, Figures 2 and 3, which rest on the base plate 97, attached thereto.

The spool 43 is driven independently of the spool 42 by a separate motor 101, through sprocket chain 102, Figures 2 and 4. The motor 101 is mounted similar to the motor 90 on rods 86 and 87. The cylinder 103, with its piston and piston rod connected to the connecting plate 104 attached to the front slide bearing 105, operates to actuate spool 43 forwardly of the machine, into position opposite the dotted line position 42', where the full spool 43 can be removed from spindle 63 and replaced by an empty one. The rods 86, 87, are supported on the machine base 98 by front and rear support brackets 106, 107, respectively, which set on the base plate 97, fixed thereto.

The respective motors 90 and 101 are under control of manually operable rheostat starting switches 108, 109, Figure 21. The motors 90 and 101 are connected in parallel across the line 110, through line switch 111, the starting switches 108 and 109 being connected in circuit with their respective motors, to control operation of the motors independently of each other. So connected, each motor 90 or 101 can be placed in operation at will, to wind its respective spool 42, 43, and the rheostat switches 108, 109 can be adjusted manually to bring their respective motors to desired rotary speed for proper spooling tension.

In addition to the sheave 45 the traversing guide 44 comprises the pair of rollers 114 spaced apart to permit the wire 55 to pass freely between them to the sheave 45. The rollers 114 rotate on the pins 115 carried by the bracket 116, Figures 2, 3, 4 and 11. The bracket 116 is mounted on the sleeve 117, on which the traversing sheave 45 rotates. The sheave 45 is positioned in line with the space between rollers 114 for the wire to pass from the slack take-up sheave 47, Figure 1, between rollers 114 under the guide sheave 45 onto the spool being wound, see Figures 3, 11, 22 and 23.

The sleeve 117, Figures 2, 4 and 11, is mounted to slide on the cross rod 118, longitudinally thereof. The cross rod 118 is mounted to rest in fixed position on the left and right upright supports 119 attached to opposite ends of rod 118, the upright supports 119 being attached to the base 98 of the machine, at the respective opposite sides thereof.

The pivot pin 120 extends from the upper end of the spacer member 121, Figure 4, which projects upwardly from the sleeve 117, the pin 120 being in position to ride in the end slot 122 in the swinging arm 123, and to provide a shifting pivot between sleeve 117 and arm 123. At its opposite end the swinging arm 123 has the slot 124 which receives the pivot pin 125. During the winding of any given spool 42 or 43, the pin 125 comprises a fixed pivot for the swinging arm 123, which oscillates to reciprocate the sleeve 117 longitudinally of the cross rod 118 to actuate the traversing guide 44 opposite the spool 42 or 43 being wound, back and forth between the heads 58, 59 thereof.

Positioned below the swinging arm 123 is the

transverse slide rod 126, Figure 4, mounted to slide in the bearing bracket 127. The bearing bracket 127 is mounted, as seen in Figure 3, and more in detail in Figure 9, to rest on the gear box 128, to be described more fully hereinafter. The gear box 128, in turn, rests on the frame 129, which sets on the upright support pillars 130, the pillars 130 projecting upwardly from the base plate 97 of the machine.

The pin 131 projects upwardly from the slide rod 126 into pivotal engagement with the swinging arm 123. The pin 125, comprising the fixed pivot, slides in slot 124, Figures 2 and 22, to compensate for the varying distance between pivots 125 and 131. The heart-shaped cam 132 is positioned between the cam following rollers 133, which project downwardly from, and spaced apart along, the slide rod 126, Figures 2 and 9.

The heart-shaped cam 132 is the member which operates, by means of mechanism presently to be described, to traverse the guide 44 between the heads 58, 59 of the incident spool 42 or 43 being wound, so timed with reference to the speed of rotation of the spool as to lay successive convolutions of wire 55 side by side throughout the length of the spool drum 57.

Mounted to rotate in bearings 134, Figure 4, at opposite sides of the main base 98 of the machine, is the transverse shaft 135, Figures 2, 3 and 4. Shaft 135 extends throughout the width of the machine and projects beyond on each side thereof. At each end of the shaft 135 is a one-way clutch 136, 137 driven by the sprocket chains 138, 139, respectively, from the respective left and right motors 90 and 101.

The idler sprocket 140, Figure 3, mounted on the swinging arm 141 which pivots at 142, is held by the spring 143 to take up slack in the chain 138. A similar sprocket mounted on arm 144, Figure 4, takes up slack in chain 139, under action of its spring 145.

Positioned at the right of the machine, Figures 2 and 4, and appearing mostly in dotted lines in Figure 3, is the sprocket chain 146, driven by the transverse shaft 135. The sprocket chain is in driving engagement with the idler sprockets 147 and 148, and drives the shaft 149, which drives the heart shaped cam 132 through the reduction gearing 150 contained in gear box 128, Figure 9.

When the motor 90 is in operation and the motor 101 is idle, the shaft 135 is driven by motor 90 through the one-way clutch 136 and overrides the one-way clutch 137. Conversely, when the spool 43 is being wound by operation of motor 101, the shaft 135 is driven by motor 101 through one-way clutch 137. Thus, the shaft 135 is always driven by whichever motor 90, 101 is in operation.

It will be understood that the wire is spooled under predetermined spooling tension at a constant linear speed, commensurate with the speed of delivery to the spooling machine. Because the circumference of the winding surface increases with the growth of wire mass, the speed of rotation of the spool 42, 43 being wound must constantly diminish as the winding progresses. The speed of rotation of the motor 90, 101, in operation is reduced correspondingly for this purpose by adjusting the rheostat switches for varying the speed of the respective motors and which switches, per se, form no part of the present invention, and therefore are not disclosed in detail. However, the shaft 135, being driven by whichever motor 90, 101 is in operation, is driven at a variable speed corresponding to the speed variation of the motor in operation. The speed of travel of the traversing guide 44 is thus varied accordingly as the speed of spool rotation varies, to time the traverse properly with the growth of wire mass.

The shift from the winding of one spool to the winding of the other is made by shifting the traversing guide 44 from position opposite one spool to position opposite the other, and this is accomplished by shifting the fixed pivot 125 from one to the other of the two positions which it occupies. When spool 43 is being wound, fixed pivot 125 occupies the position illustrated in Figure 2. The fixed pivot 125 is shifted to its other position when it is desired to wind spool 42.

For the purpose of shifting the fixed pivot 125, it is mounted on the carriage 151, which slides on the rods 152, Figures 2, 3, 10 and 11, to a position near one or the other support brackets 153 which rest on the frame 154, fixed thereto. The frame 154 rests on the frame 129, supported thereby, and is additionally supported by the upright posts 155, which set on the base plate 97. Also resting on the frame 154 is the pneumatic cylinder 156, containing a piston which actuates the piston rod 157, connected by any suitable means to the carriage 151. When the carriage 151 is moved, by operation of the cylinder 156, from its position near one bracket 153 to a position near the other, arm 123 swings on pivot 131, to shift the traversing guide 44 from its position opposite one spool 42 or 43 to a corresponding position opposite the other.

It will be noted that the traversing guide 44 will continue under action of the heart-shaped cam 132 while the shift from one spool to the other is being made, and it will occupy nearly the same position relative to the empty spool that it did relative to the full spool. This is because the speed of rotation of the heart-shaped cam 132 is relatively slow, and its amount of rotation is slight during the time of the shift.

Means, comprising an interdrive, adapted to be operatively connected between the spools 42 and 43, is employed to insure rotation of an empty spool at a rate commensurate with the linear speed of the wire at the time when the winding is shifted from a spool being wound to an empty spool. The interdrive is shown in Figures 2, 3, and 4, and in detail in Figures 11 and 12.

Mounted on the base plate 97 of the machine are central bearing brackets 158 and the side bearing brackets 159 and 160, respectively incident to the spools 42 and 43. The shaft 161 rotates in the bearing 158, and keyed to the shaft 161 at the opposite ends thereof are the pulleys 162 and 163, respectively incident to the spools 42 and 43. The bracket 159 carries the swinging arm 164 pivoted thereon, and at the end of the arm 164 there is mounted a bearing housing 165 containing a stub shaft for rotation of idler pulley 166. The belt 167 is carried by the pulleys 162 and 166. Mounted similarly, to pivot in the bracket 160, is the swinging arm 168 with the bearing housing 169 enclosing a stub shaft for rotation of the pulley 170. The belt 171 is carried by the pulleys 163 and 170.

Attached to the swinging arm 164, Figure 11, is the pivot bracket 172, to which the piston rod 173 is pivotally attached. The piston rod 173 is actuated by the piston contained in pneumatic cylinder 174 to swing the belt 167 forward and backward into and out of contact with the surface of spool 42. A similar construction, com-

prises the pivot bracket 175 and piston rod 176 pivotally connected thereto, the piston rod 176 being actuated by the piston enclosed in the cylinder 177, and this mechanism operates to move the belt 171 into and out of contact with the surface of the spool 43. From the foregoing, it will be apparent that when one of the belts is shifted into engagement with wire being wound on one of the spools and the other belt shifted into engagement with the drum of an empty spool, rotation of the empty spool will be effected at a greater speed than that of the spool on which the wire is being wound. The cylinders 174 and 177 are mounted to pivot on brackets 178 attached to the base plate 97 of the machine.

As will be seen in Figures 2, 4 and 12, the belts 167 and 171 are not centrally located with reference to the respective spools 42 and 43. Instead, their nearest edges are positioned just inside the adjacent spool heads 58 of the two spools 42 and 43, and the belts 167 and 171 extend in directions away from each other with their most distant edges positioned somewhat beyond the centers of the respective spools 42 and 43. For a reason which will be explained hereinafter, the belt 167 of spool 42 is disposed near the head 58 at the right of the spool, in Figure 2, whereas belt 171 is disposed nearer the head 58 at the left of the spool 43.

It will be readily appreciated that to begin winding wire on a given spool some means must be provided to attach the beginning end of the wire to the spool drum. The present invention comprises a novel method of attaching the beginning end of the wire onto the drum of the empty spool when its winding is begun, and the steps of this method are illustrated in Figures 13 to 20. For the purpose of illustrating the method of shifting from a full to an empty spool more clearly, the wire 55 is shown enlarged in Figures 13 to 20. To make the shift in accordance with the practice of the present invention, a time is preferably selected when the traversing guide 44 is near the center of the full spool 42, and moving in a direction toward the outermost spool head 59 of the full spool.

Assuming, in accordance with the example illustrated in Figures 13 to 20, that the spool 42 has been wound to fullness, the transfer will preferably be made when the winding situation is as illustrated in Figures 13 and 18 with the traverse of wire 55 positioned about midway between the heads 58, 59 of spool 42, and moving to the left. At this time the wire 55 is being wound on the spool 42 under the belt 167, and side by side convolutions will be forming towards the edge of the belt remote from the head 58. In the case of spool 42 being wound the fixed pivot 125 is in the position opposite to that shown in Figure 2.

The traversing guide 44 is now shifted opposite the spool 43 by moving the fixed pivot 125 in the manner hereinafter described, by means of the pneumatic cylinder 156, to the position shown in Figure 2.

At the completion of this movement, the wire 55 is in position to be wound on spool 43 at a point along its length which nearly corresponds with the position of winding on spool 42 at the beginning of the movement. This stage in the process of shifting from one spool to the other is illustrated in Figure 14. The shift from the position of Figure 13 to that of Figure 14 produces a traverse on both spools 42 and 43, which lays a number of spaced apart convolutions 180 wound on spool 42, and an additional number of similar

convolutions 181 spaced apart on spool 43. There are generally about three or four convolutions 181 wound on empty spool 43, and, due to the greater circumference of the winding surface of the full spool 42, a lesser number of convolutions 180 are formed thereon. Between spools 42 and 43, there is a bite 182 of wire formed tight over the edges of adjacent spool heads 58.

For the purpose of binding the beginning end of wire being wound on the empty spool to the drum 57 thereof, the traversing guide 44 is rapidly shifted from the full to the empty spool, back to the full spool, and again in the original direction to the empty spool. In the example illustrated in Figures 13 to 20, the fixed pivot 125 is shifted from its position at the end of the slide rod 152 opposite that shown in Figure 2, to the shown position, back to the original position, and again to the shown position. From the foregoing, it will be apparent that when one of the belts is shifted into engagement with wire being wound on one of the spools and the other belt shifted into engagement with the drum of an empty spool, rotation of the empty spool will be effected at a speed proportional to the linear speed of the wire and thus initiate winding of the wire about the drum of the empty spool without tensioning the wire thereby precluding breaking of or damage to the wire.

Of the three movements, the first as hereinbefore described, changes position of the elements from that illustrated in Figures 13 and 18, to that illustrated in Figures 14 and 19. In the second movement, the elements occupy the position illustrated in Figure 15. In the third movement the elements occupy the position illustrated in Figure 16.

During the second movement of fixed pivot 125, when the traversing guide 44 moves back to a position opposite the full spool 42, spaced apart convolutions 183, Figure 15, are formed on the drum 57 of empty spool 43, and those overlie the previously formed convolutions 181. Because of the difference in circumference on the winding surface of full and empty spools 42 and 43, respectively, the two surfaces being driven at the same linear speed through the interdrive of belts 167 and 171, spool 43 rotates more rapidly than spool 42. Inasmuch as the linear speed of the drum 57 of spool 43 is equal to the speed of wire travel to spool 43 during formation of convolutions 181, no strain or tension is imparted to the wire during formation of the convolutions 181. As soon as convolutions 183, which overlie convolutions 181 and between the latter and the belt 171, are formed, they grip the previously formed convolutions 181, and together with the belt 171 hold them in engagement with the drum surface to bind the beginning end of wire being wound to the empty spool 43.

When the traversing guide 44 again moves to the empty spool 43 in the third movement of the fixed pivot 125, the elements occupy the position illustrated in Figure 16. This movement causes a third set of spaced apart convolutions 184 to form on empty spool 43. Convolutions 184 overlie previously formed convolutions 183 and 181 and are disposed between the latter convolutions and the belt 171 to help bind the beginning or leading end of wire being wound to the surface of the drum of empty spool 43.

It will be noted that, upon completion of the second movement of the fixed pivot 125, when the elements assume the position illustrated in Figure 15, the traversing guide 44 will be oppo-

site the full spool 42, but no convolutions will be formed thereon by this movement. This is because the three movements of the fixed pivot 125 are so rapid that the convolution forming wire 55 can not climb from the surface 57 of the empty drum over the edges of the spool heads 58.

It will also be noted that, while convolutions 181 are being formed, the bite 182 forms tightly over the rims of adjacent spool heads 58. As soon as convolutions 183 begin to form to overlie and bind the convolutions 181, the bite 182 begins to grow, as illustrated in Figure 15, due to the first-formed convolutions 181 which did not get caught under convolutions 183 becoming unwound. The growing bite 182 whips around with rotation of the spools 42 and 43. Positioned attached to the machine base plate 97, below the spools 42 and 43 and in a plane which lies between the heads 58 thereof, is the cutter 185, with the notched cutting edge 185'. As the bite 182 grows it whips into notch 185', as illustrated in Figures 16 and 20, and is cut thereby. This forms the free or trailing end 186 of wire extending from the full spool 42, and the free or leading end 187 extending from spool 43, Figure 17.

It will be noted that at all stages illustrated in Figures 13 to 20, the convolutions 181, 183 and 184 formed on spool 43 are wound between the edges of the belt 171, and the spaced apart convolutions 180 formed on spool 42 are wound between the edges of belt 167. The belts 167 and 171 thus operate to help lay the respective free ends 186 and 187 of wire on the full spool 42 and empty spool 43, respectively.

When the stage illustrated in Figure 16 is reached, the shift is completed, and the wire begins to form successive convolutions 188, Figure 17, laid side by side by the traversing guide 44, under action of the heart-shaped cam 132. Traversing begins on spool 43 under action of the heart-shaped cam approximately at that position which corresponds with the position of spool 42 where traversing discontinued under action of the heart-shaped cam at the beginning of the shift. As a result of the method of shifting described, the first side by side convolutions 188 on the empty spool are laid from approximately midway between the heads 58 and 59 towards the head 58, and are thus laid between the edges of the belt 171.

The first side by side convolutions 188 laid under action of the heart-shaped cam 132 onto the empty spool 43, as illustrated in Figure 17, operate to overlie the convolutions 181, 183 and 184, and winding of the convolutions 188 continues towards the head 58 of spool 43 until the free end 187 is wrapped onto the drum 57 of the spool.

It will be understood that, in actual practice, the action of shifting from the full spool to the empty spool is very rapid. The movement from the full spool to the empty spool to form convolutions 181, back from the empty spool towards the full one to form convolutions 183, and in the original direction to form convolutions 184, is accomplished manually as rapidly as it is possible to swing the handle of master valve 190, Figure 21, which controls cylinder 156.

The described method of shifting from spool 42 as the full spool to empty spool 43 is repeated when spool 43 is the full one, except that the several movements are made respectively in opposite directions. The time of shifting in any case is preferably selected when traversing guide 44 is approximately in the center of the full spool and is moving in the direction away from the empty spool. This results in a situation in which all the convolutions formed in making the shift, convolutions 180 on the full spool and convolutions 181, 183, and 184 on the empty spool, are positioned on the spools to be under action of the belts 167 and 171. Furthermore, when the traversing guide begins to travel under action of the heart-shaped cam 132, and begins winding side by side convolutions 188 on the empty spool, these convolutions are formed under action of the belts 167 or 171, of the empty spool.

Figure 21 illustrates schematically one practical lay-out of the motor controls, and the controls for the various pneumatically operated mechanisms used for shifting from the full to the empty spool. In the embodiment shown, compressed air is fed from the main line 191 to the several reducing valves 192, 193 and 194, which furnish air at the different pressure required for the several cylinders.

The cylinders 94 and 103, which respectively actuate the carriages of spools 42 and 43 from winding positions to their forward positions for spool replacement, and back to winding positions, received compressed air from reducing valve 192 at their required pressure, respectively through the master control valves 195 and 196. The cylinder 156, which actuates the fixed pivot 125 for making the shift, receives air at its required pressure from the reducing valve 193, through master control valve 190. The cylinders 174 and 177, which actuate the respective belts 167 and 171 into engagement with their respective spools 42 and 43, receive compressed air at the pressure they require from reducing valve 194, through their respective master control valves 197 and 198. The master valves 190, 195, 196, 197 and 198 are each manually operable to feed compressed air to both ends of their respective cylinders 156, 94, 103, 174 and 177, to cause the respective cylinders to operate in both directions as required.

The steps to be taken in making the shift will now be described, with reference to the example illustrated in Figures 13 to 20. Spool 42 is being wound, and the rheostat switch 108 for motor 90 is therefore closed. When spool 42 approaches fullness, rheostat switch 109 is closed to energize motor 101, and is adjusted to bring the drum 57 of the empty spool 43 approximately to the same surface speed as the winding speed of spool 42. Motor 101 is now being driven under no load.

The operator now selects a time when traversing guide 44 is moving away from the head 58 of the full spool 42, and opens valve 197 to actuate belt 167 into engagement with the full spool 42. Next the valve 198 is operated to actuate belt 171 into engagement with the drum 57 of empty spool 43. Now the condition of the machine is such that spool 42 drives spool 43 at the same surface speed through the interdrive comprising belts 167 and 171. At this stage the counterbalanced sheave 47, Figure 1, may indicate that the driving speed of spool 42, and accordingly the spooling tension, has been disturbed by the load adjustment on motor 90. Accordingly, appropriate manual adjustments of the rheostats 108 and 109 are made to return the machine to proper spooling tension, which is indicated when the sheave 47 is counterbalanced.

The operator now selects a time when the traversing guide 44 is at about midway of the length of the spool 42 being wound, continuing to move in the direction away from the head 58 or away from the empty spool 43, and at this

time he makes the shift from the full to the empty spool. He moves the handle of the valve 190 rapidly, first in the direction to make the shift, then back in to direction towards the full spool, and again in the original direction to complete the shift. This operation causes the beginning end of wire being wound on the empty spool 43 to attach itself to the spool drum 57, in the manner disclosed in detail in Figures 13 to 20. When the shift is completed the bite 182 of wire between spools is cut by the cutter 185, and the first side by side convolutions 188 begin to form on the empty spool 43.

Winding having begun on the empty spool 43, the valve 198 is operated to actuate belt 171 out of engagement with the spool 43 now being wound. Motor 90 is stopped by opening the switch 108, and valve 197 is operated to actuate belt 167 out of engagement with the full spool 42. When motor 90 comes to a stop, valve 195 is operated to move the carriage of spool 42 forward into dotted line position 42' in Figure 2. The latch mechanism of Figures 7 and 8 is operated to remove the full spool 42 from the spindle 62 and replace it with an empty one. Valve 195 is now operated to return the carriage of spool 42 back into coaxial alignment with spindle 63, and the machine is ready to shift the winding back to spool 42 when spool 43 becomes wound to fullness.

It will be understood that when the shift is made from spool 43 as the full one to empty spool 42, valve 196 is the one operated to move the carriage of spool 43 forward and back to replace an empty spool on spindle 63.

The shift from the full to the empty spool can be made manually by operation of the handle of valve 190, in the manner described. Mechanism can be employed, however, to automatically bind the beginning end of wire being wound onto drum 57 of the empty spool, and one embodiment of such mechanism is illustrated in Figures 22 and 23.

As illustrated in Figures 22 and 23, the automatic mechanism comprises the wire actuating pins 201 and 202, respectively, disposed in positions adjacent spools 42 and 43. Pin 201 projects laterally from the slide arm 203, which travels longitudinally in the guideway 204, from the dotted line position illustrated in Figure 22, to the full line positions. The slide arm 203 includes the cam slot 205, engaged by the cam follower pin 206 which projects inwardly from the guideway 204 into the slot 205 to rotate the arm 203 on its axis during its longitudinal movement. By means of the cam 205, the pin 201 is rotated from dotted line position in Figure 23, where it is out of the way of the spool head 59, to the full line position, where it lies close to the spool drum 57 and normal to the path of travel of the wire 55 from the traversing sheave 45 to the spool 42. By means of the cam 205 the pin 201 is positioned to engage the wire 55 at a point close to the winding surface of empty spool 42.

The pin 202, for spool 43, is similarly projected laterally of slide arm 207 which slides in guideway 208. Slide arm 207 includes cam slot 209 engaged by the cam follower pin 210, in a manner similar to the cam slot 205 of arm 203.

The rear ends of the arms 203 and 207 have radially projected valve actuating pins 211 and 212, respectively, in position to engage and operate respective bleeder valves 213, 214, when the respective pins 201 and 202 arrive at their extremely extended positions, indicated by the full line showing of arm 203 in Figure 22.

The arm 203 is actuated by the pneumatic cylinder 215, under control of the master valve 216, and a similar cylinder 217, under control of master valve 218, actuates arm 207. The bleeder valve 213 operates control valve 216 to energize line 219 to retract the arm 203 from full line to dotted line position, and this takes place when the pin 211 operates bleeder valve 213 at the time when wire actuating pin 201 has attained its extremely extended position. Line 220 is energized to project arm 203 to full line position when the control valve 216 is operated by the bleeder valve 221. In the case of a shift to spool 43 as the empty spool, line 222 is energized to retract arm 207, when control valve 218 is operated by bleeder valve 214, and line 223 is energized when bleeder valve 224 operates the control valve 218.

Bleeder valves 221 and 224 are respectively operated when the carriage 151' of the fixed pivot 125 is moved into full and dotted line positions, respectively, of Figure 22. The valve 221 is operated by actuating finger 225 which pivots at 226, but which is held against pivoting by the stop 227, when the carriage 151' moves from dotted to full line position. Finger 225 is held in engagement with the stop 227 by the spring 228, but is able to pivot against the action of spring 228, to pass valve 221 ineffectually, when the carriage 151' moves from full to dotted line position. Similar construction, comprising the finger 229, pivoted at 230, and held in engagement with stop 231 by spring 232, operates valve 224 when carriage 151' is moved from full to dotted line position, but does not operate valve 224 when carriage 151' is moved from dotted to full line position.

With the automatic mechanism illustrated in Figures 22 and 23, the control valve 190 for the cylinder 156 which actuates the carriage 151' and the fixed pivot 125 carried thereby, is given one movement only to make the shift from the full to the empty spool.

When spool 43 is the full one, as shown in Figure 22, the carriage 151' is in dotted line position during winding of spool 43. Valve 190 is operated to energize cylinder 156 to move carriage 151' to full line position, and this movement traverses guide 44 to the illustrated position opposite spool 42. In this movement the spaced apart convolutions 180 are formed on the empty spool 43, convolutions 181 are formed on the empty spool 42, and the bite 182 is formed between the spools.

In the movement of carriage 151' to full line position, the finger 229 passes over bleeder valve 224 without operating it, but finger 225, being held by stop 227, operates bleeder valve 221. This, in turn, operates control valve 216 to energize line 220 to cylinder 215, whereby the arm 203 is projected from dotted line to full line position, shown. In the movement of arm 203, the pin 201 moves circumferentially from dotted to full line positions in Figure 23, into position between the spool heads 58 and 59 of spool 42 close to the surface of the drum 57 thereof. The pin 201 thus attains a position across the path of wire 55 and normal thereto, engages the length of wire 55 between the traversing guide 44 and the spool drum 57, and forms the spaced apart convolutions 183' seen in Figure 22, which overlie the convolutions 181, and bind the beginning end of wire being wound onto the drum of the empty spool 42.

As in the case of the manual method of binding the beginning end of wire 55 to the surface of the drum 57, the master valve 190 is operated when

the traversing guide 44 is at about midpoint between spool heads of the full spool 43, moving in the direction away from the empty spool 42, and during the shift the traversing guide moves to about the midpoint between heads of the empty spool 42. This forms the convolutions 181, seen in Figure 22, which are like the convolutions 181 in Figure 14. The single movement of the valve 190 sets the automatic mechanism of Figures 22 and 23 in operation to form the convolutions 183' which are similar to convolutions 183 in Figure 15, and which operate to bind the convolutions to the drum surface in a like manner. Actuation of the arm 203 to form convolutions 183' places the valve actuating pin 211 into operating engagement with the bleeder valve 213, which operates master control valve 216 to energize line 219 and retract arm 203 to its dotted line position. This forms convolutions, not shown, which are similar to convolutions 184, and the traversing guide 44 now continues to traverse in its normal manner under action of the heart-shaped cam 132, to form side by side convolutions, such as 188 in Figure 17, and begin the winding of spool 42.

When arm 203 retracts to dotted line position in Figure 22, pin 202 rotates to dotted line position in Figure 23, where it is out of the way of the spool head 59.

When spool 42 is wound to fullness, and the shift is made to spool 43, valve 190 is operated in the opposite direction to move the carriage 151' of fixed pivot 125 from full line to dotted line position. This operates bleeder valve 224 which operates master valve 218, to energize cylinder 217 to project arm 207 to form convolutions, such as 183', which overlie and bind previously formed convolutions 181. When arm 207 reaches the limit of its stroke, pin 212 operates bleeder valve 214 to operate master valve 218, to retract the arm 207.

With the spooling machine of the present invention, wire can be continuously wound on successive spools at a constant uniform speed and without interruption for spool replenishing. Such a spooling machine has various uses, for example, to spool wire directly from a wire-drawing machine without interrupting operation of the latter machine. It is especially useful when the wire is annealed continuously between the drawing and spooling operations, because time is an important factor in the proper annealing of metal, and the annealing operation is best performed with the wire traveling at a constant uniform speed, it being understood that any slackening of wire travel often results in burning or discoloring the wire, while any acceleration of the wire travel, by an increase in tension, often results in a breaking of the wire, especially in instances where the wire is of a relatively fine gauge.

Without further elaboration the foregoing will so fully explain the invention that others may, by applying current knowledge, readily adapt the same for use under various conditions of service. Moreover, it is not indispensable that all the features of the invention be used conjointly since they may be employed advantageously in various combinations and subcombinations.

It is obvious that the invention is not confined to the herein described use therefore as it may be utilized for any purpose to which it is adaptable. It is therefore to be understood that the invention is not limited to the specific construction as illustrated and described as the same is only illustrative of the principles of operation, which are capable of extended application in various forms, and that the invention comprehends all construction within the scope of the appended claims.

What I claim is:

1. In the art of spooling wire continuously on successive spools, the process of attaching the beginning end of wire being wound to the drum of an empty spool which comprises winding the wire on a given spool to fullness, directing the wire to the succeeding spool and winding a plurality of convolutions with a greater lead on the second spool in one direction longitudinally thereof, then winding a plurality of convolutions of a greater lead on the said second spool in the other direction longitudinally thereof to overlap the first set of convolutions, and retain said wire on the spool and thereafter helically winding the wire on the second spool in juxtaposed convolutions over the overlapping convolutions.

2. A wire spooling machine comprising a plurality of spools, means to drive the several spools to wind wire thereon successively, means to deliver wire to the spooling machine continuously at a predetermined linear speed, means to drive the several spools at independently varying rotary speeds, an interdrive operable between the winding surface of a spool being wound and the winding surface of a successive empty spool and driven by the full spool to drive the empty spool at a winding speed commensurate with the linear speed of wire delivery to the spooling machine when winding is transferred from a full spool to the next succeeding empty spool.

3. A wire spooling machine comprising a plurality of adjacent coaxial spools, means to drive the spools to wind wire, a traversing guide comprising means to lay wire on the spool being wound in side by side convolutions, means to transfer the traversing guide from one to the other spool for winding successive spools, the transfer means comprising means to reciprocate the traversing guide to produce a plurality of spaced overlapping convolutions of increased lead to bind the beginning end of wire wound on the empty spool.

4. A wire spooling machine comprising means to drive the spools to wind wire, a traversing guide to lay wire on the spool being wound in side by side convolutions, means to transfer the traversing guide from one to the other spool for winding successive spools, means operated by operation of the transfer means to produce a plurality of overlapping convolutions of increased lead to bind the beginning end of wire wound on the empty spool.

5. A wire spooling machine comprising a plurality of spools, means to drive the several spools to wind wire thereon successively, means to deliver wire to the spooling machine continuously at a predetermined linear speed, means to drive the several spools at indpendently varying rotary speeds, an interdrive operable between the surface of a full spool and the surface of the succeeding empty spool to drive the several spools at a winding speed commensurate with the linear speed of wire delivery to the spooling machine when winding is transferred from a full spool to the next succeeding empty spool.

6. A wire spooling machine comprising a plurality of spools, means to rotate the spools independently of each other to wind wire, a movable guide to direct the wire to be wound to the spools, shifting means to transfer the guide to different spools to wind them in succession, means

to continuously deliver moving wire to the guide at a preestablished linear speed, means to independently control the speed of rotation of the respective spools to maintain a winding speed commensurate with said linear speed, and means operable by the wire on a spool being wound to insure rotation of an empty spool at said winding speed and to institute winding of said wire on said empty spool upon operation of said shifting means.

7. In a spooling machine, the combination of means for independently rotating a plurality of spools successively effective for continuously winding thereon a strand at a rate proportional to a preestablished definite delivery speed of the strand to the spools, and speed correlating means operably associated with a pair of said spools and rendered effective by engagement with the strand on a spool being wound for rotating an empty spool at said rate to receive said strand and institute winding thereon when shifted thereto.

8. In a spooling machine, the combination of means for independently rotating a plurality of spools successively effective for continuously winding thereon a mass from a strand at a winding rate proportional to a preestablished definite delivery speed of the strand to the spools, a friction interdrive operable between a pair of said spools and actuated by engagement with the mass on a spool being wound for insuring rotation of an empty spool at said rate to receive said strand and institute winding thereon when shifted thereto.

9. In a spooling machine, the combination of means for independently rotating a plurality of spools successively effective for continuously winding thereon a mass from a strand at a winding rate proportional to a preestablished definite delivery speed of the strand to the spools, transfer means for shifting said strand from one spool to another, and a friction interdrive operable between a pair of said spools and actuated by engagement with the mass on a spool being wound for insuring rotation of an empty spool at said rate to receive said strand and to institute winding said strand thereon when said transfer means is rendered effective.

10. In a spooling machine, the combination of means for independently rotating a pair of spools successively effective for continuously winding thereon a strand at a rate proportional to a preestablished definite delivery speed of the strand to the spools, and interdrive means including a pair of uniformly actuated elements for engaging the strand on a spool being wound and the winding surface of an empty spool respectively to insure rotation of said surface at a rate for receiving said strand and for instituting winding of the strand thereon when transferred thereto.

11. In a spooling machine, the combination of means for independently rotating a pair of spools successively effective for continuously winding thereon a mass from a strand at a winding rate proportional to a preestablished definite delivery speed of the strand to the spools, transfer means effective for shifting said strand from a spool being wound to an empty spool, a friction interdrive operable between said spools and actuated by engagement with the mass of the spool being wound for insuring rotation of the empty spool at said rate to receive said strand and institute winding of the strand thereon when shifted thereto by said transfer means, and fluid operated means for rendering transfer means effective.

12. In a spooling machine, the combination of means for independently rotating a pair of spools successively effective for continuously winding thereon a mass from a strand at a winding rate proportional to a preestablished definite delivery speed of the strand to the spools, transfer means effective for shifting said strand from a spool being wound to an empty spool, a friction interdrive operable between said spools and actuated by engagement with the mass of the spool being wound for insuring rotation of the empty spool at said rate to receive said strand and institute winding of the strand thereon when shifted thereto by said transfer means, and fluid operated means for rendering said interdrive effective.

13. In a spooling machine, the combination of means for independently rotating a pair of spools successively effective for continuously winding thereon a mass from a strand and at a rate proportional to a preestablished definite delivery speed of the strand to the spools, and a pair of relatively shiftable and uniformly operated belts rendered effective by engagement of one of said belts with the mass on a spool being wound for rotating the winding surface of an empty spool at said rate to receive said strand and institute winding of said strand when transferred thereto from the spool being wound, and means for urging said belts into engagement with said last mentioned mass and said empty spool respectively, to render said belts effective.

14. In a spooling machine, the combination of means for independently rotating a pair of spools successively effective for continuously winding thereon a strand at a rate proportional to a preestablished definite delivery speed of the strand to the spools, and means rendered effective by the strand on a spool being wound for rotating an empty spool at said rate to receive said strand and institute winding thereon when shifted thereto, and means effective for severing said strand between said spools after institution of the winding.

15. In combination, means for independently rotating a plurality of spools successively effective for continuously winding thereon a mass from a strand at a winding rate proportional to a preestablished definite delivery speed of the strand to the spools, a friction interdrive operable between a pair of said spools and actuated by engagement with the mass on a spool being wound for insuring rotation of an empty spool at said rate to receive said strand and institute winding thereon when shifted thereto, and strand operated means for denoting variation of said rate.

16. In combination, means for independently rotating a plurality of spools successively effective for continuously winding thereon a mass from a strand at a winding rate proportional to a preestablished definite delivery speed of the strand to the spools, guide means for guiding the strand to the respective spool, and means for shifting the guide means to transfer the strand from one spool to another, and a friction interdrive operable between a pair of said spools and actuated by engagement with the mass on a spool being wound for insuring rotation of an empty spool at said rate to receive said strand and institute winding thereon when transferred thereto.

17. In a spooling machine, the combination of means for independently rotating a pair of spools successively effective for continuously winding

thereon a mass from a strand and at a rate proportional to a preestablished definite delivery speed of the strand to the spools, and a pair of relatively shiftable and uniformly operated belts rendered effective by engagement of one of said belts with the mass on a spool being wound for rotating the winding surface of an empty spool at said rate to receive said strand and institute winding of said strand when transferred thereto from the spool being wound, and means for urging said belts into engagement with said last mentioned mass and said empty spool to render said belts effective, and cutter mechanism for severing said strand between said spools when said belts are rendered ineffective.

18. In combination, a pair of independently rotatable spools successively effective for continuously winding thereon a strand at a rate proportional to a preestablished definite delivery speed of the strand to the spools, and means rendered effective by the strand wound on one of said spools for rotating the other spool at said rate to condition said other spool for receiving said strand at said speed when said strand is transferred from said one spool to said other spool.

19. The combination of wire treating means of the type necessitating a continuous uniform speed of travel of the wire from said treating means

to preclude damage to the wire; and a wire spooling machine comprising means for independently rotating a pair of replaceable spools successively effective for continuously winding thereon the wire at a rate proportional to said speed, and means rendered effective by the wire on a spool being wound for insuring rotation of an empty spool at said rate to receive said wire and institute winding thereon when shifted thereto and thus maintain said uniform speed of said wire from said wire treating means.

20. The combination of wire treating means of the type necessitating a continuous uniform speed of travel of the wire from said treating means to preclude damage to the wire; a pair of independently rotatable spools successively effective for continuously winding thereon the wire at a rate proportional to said speed; and speed synchronizing means operably associated with said spools and rendered effective by engagement with the wire on a spool being wound for rotating an empty spool at said rate to receive the wire at said speed during transferring of the wire from the spool being wound to the empty spool and thus maintain said uniform speed of travel of the wire from the wire treating means.

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