Aug. 26, 1969 O. A. MINARDI ET AL 3,463,407

AUTOMATIC REEL WINDING CHANGEOVER METHOD AND SYSTEM

Filed April 3, 1968 5 Sheets-Sheet 1

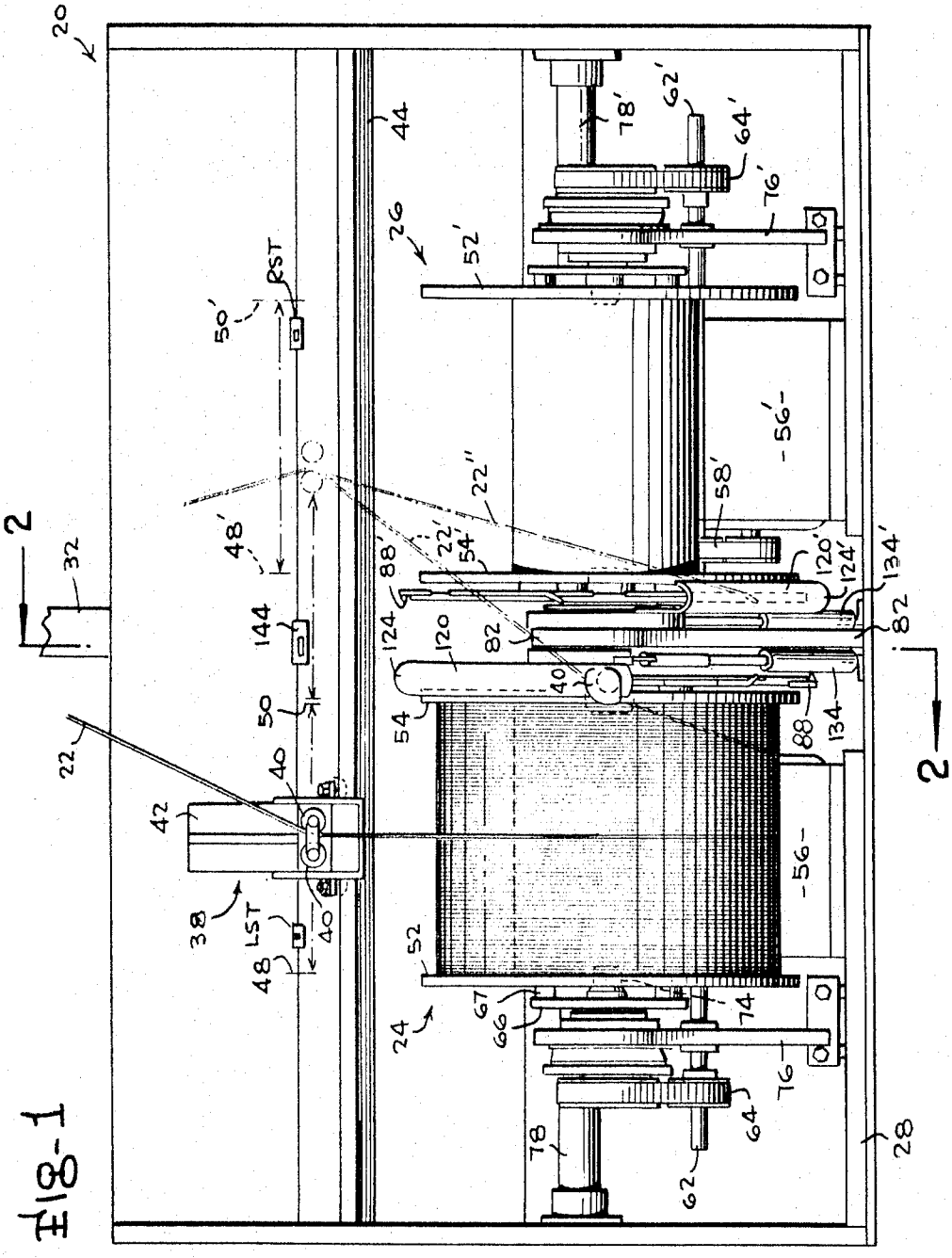


FIG. 1

INVENTORS

ORESTO A. MINARDI &

DICKRAN MANOOGIAN

BY

Mason, Fenwick & Lawrence

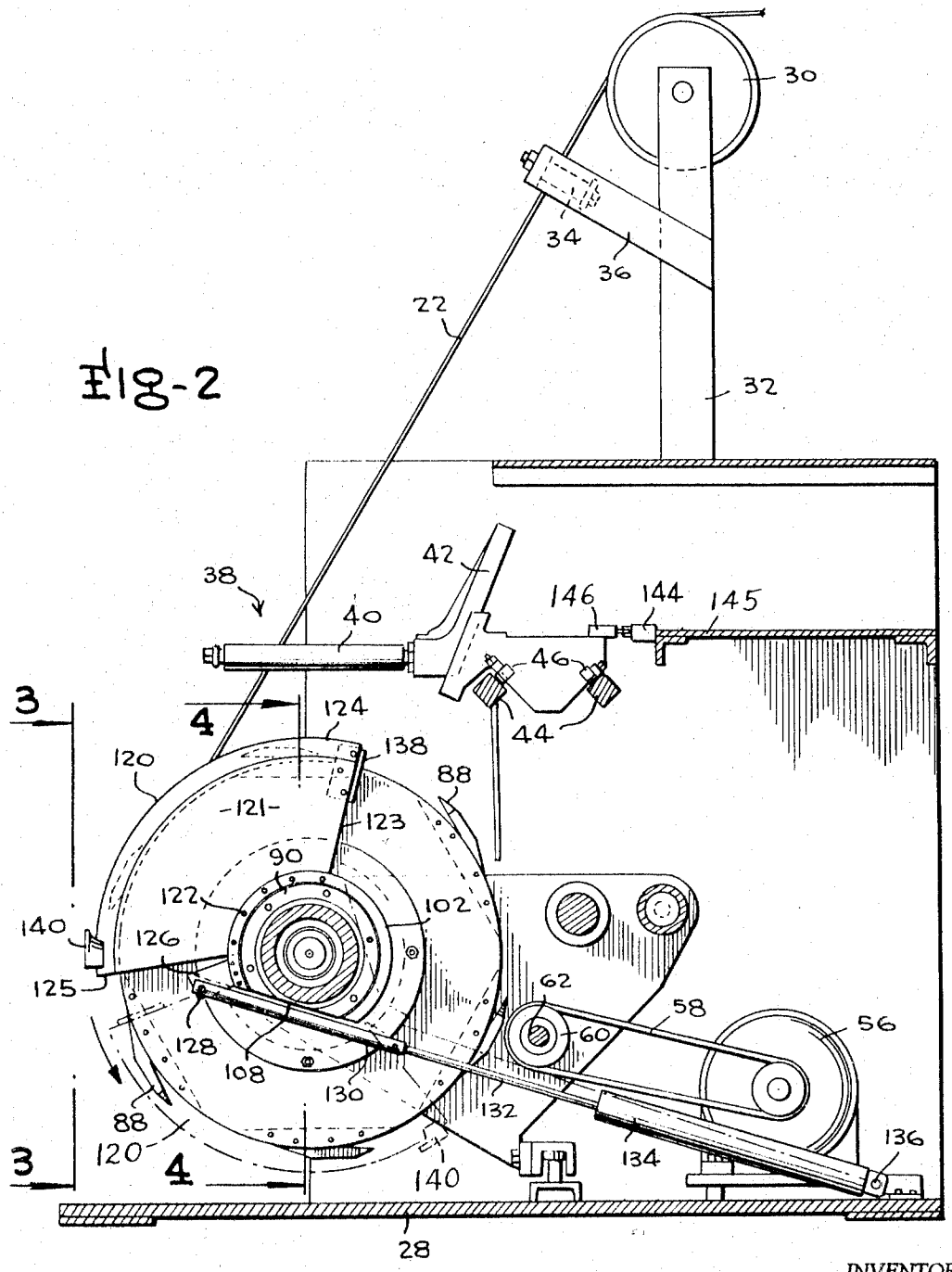
ATTORNEYS

Aug. 26, 1969 O. A. MINARDI ET AL 3,463,407

AUTOMATIC REEL WINDING CHANGEOVER METHOD AND SYSTEM

Filed April 3, 1968 5 Sheets-Sheet 2

Fig-2



INVENTORS
ORESTO A. MINARDI &
DICKRAN MANOOGIAN
BY
Mason, Fenwick & Lawrence
ATTORNEYS

Aug. 26, 1969 O. A. MINARDI ET AL 3,463,407

AUTOMATIC REEL WINDING CHANGEOVER METHOD AND SYSTEM

Filed April 3, 1968 5 Sheets-Sheet 3

FIG-4

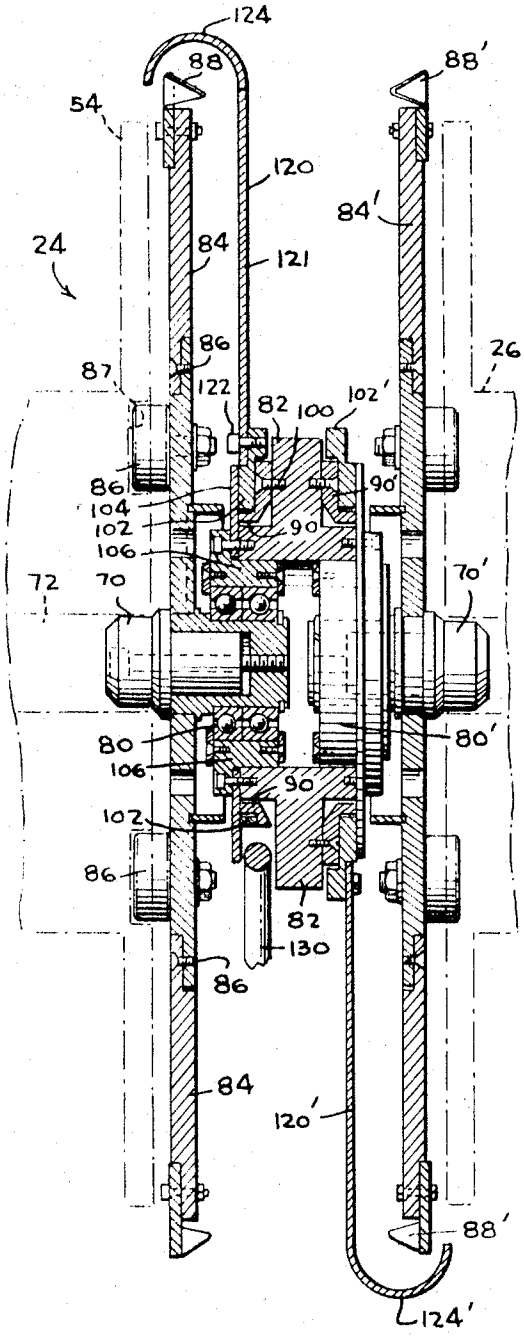
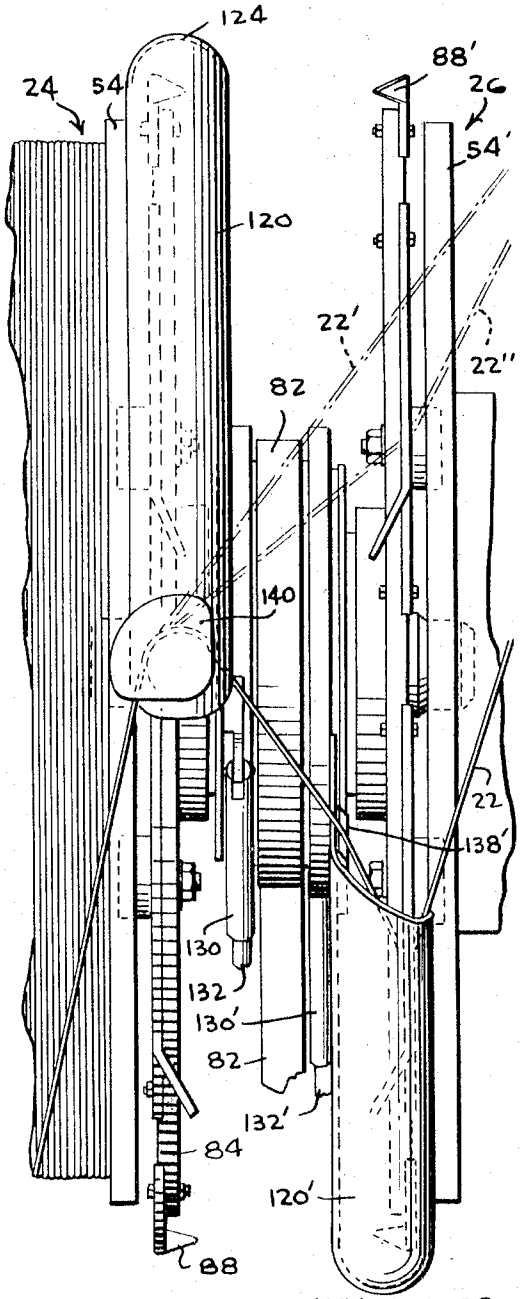


FIG-3



INVENTORS
ORESTO A. MINARDI &
DICKRAN MANOOGIAN
BY
Mason, Fenwick & Lawrence
ATTORNEYS

AUTOMATIC REEL WINDING CHANGEOVER METHOD AND SYSTEM

Filed April 3, 1968 5 Sheets-Sheet 4

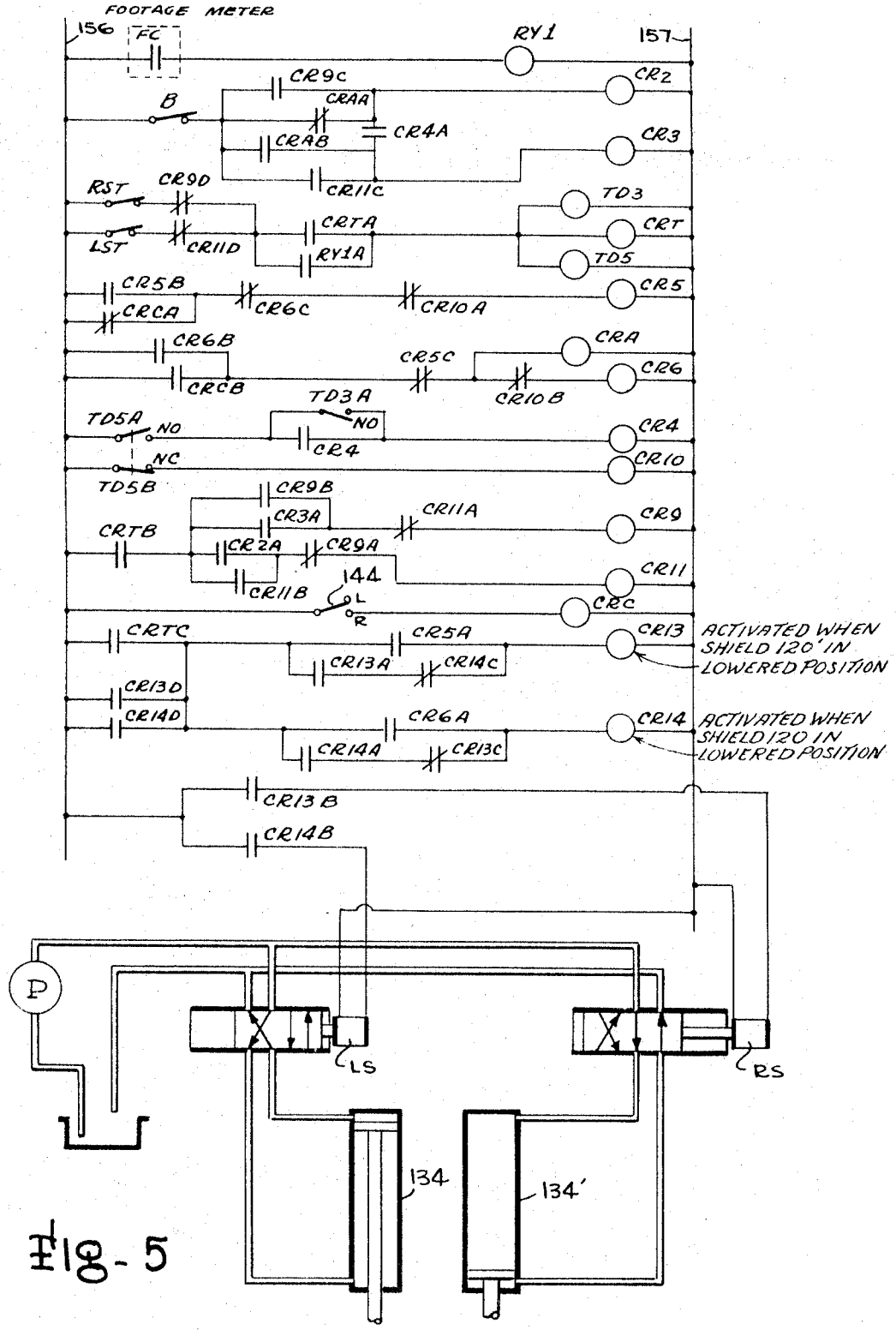
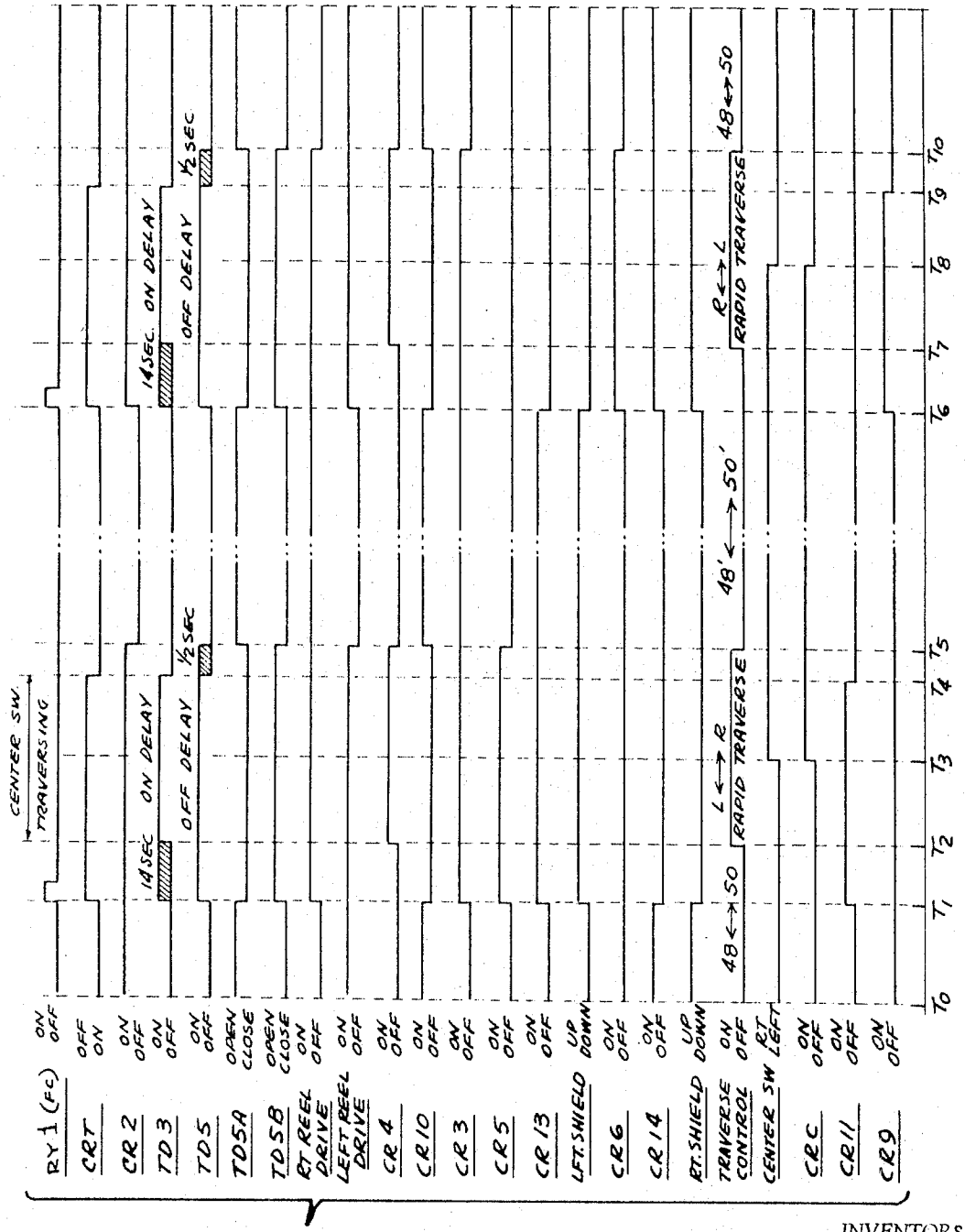


Fig. 5

Aug. 26, 1969 O. A. MINARDI ET AL 3,463,407

AUTOMATIC REEL WINDING CHANGEOVER METHOD AND SYSTEM

Filed April 3, 1968 5 Sheets-Sheet 3



INVENTORS

ORESTO A. MINARDI &
DICKRAN MANOOGIAN

BY

Mason, Fenwick & Lawrence
ATTORNEYS

United States Patent Office 3,463,407 Patented Aug. 26, 1969

3,463,407

AUTOMATIC REEL WINDING CHANGEOVER METHOD AND SYSTEM

Oresto A. Minardi, Barrington, and Dickran Manoogian, Cranston, R.I., assignors to The Entwistle Company, Providence, R.I., a corporation of Rhode Island

Filed Apr. 3, 1968, Ser. No. 718,441
Int. Cl. B65h 67/04
U.S. Cl. 242—25 15 Claims

ABSTRACT OF THE DISCLOSURE

A dual-reel wire reel changeover system having first and second pivotable snagger shields respectively associated with snaggers adjacent first and second coaxial reels with a wire guide shiftable from a wire delivery position adjacent a driven full reel to a wire delivery position adjacent a driven empty reel with control means for moving the shield associated with the full reel into shielding relation with the snaggers on the full reel to enable engagement of the wire solely by snaggers mounted adjacent the rim of the empty reel for movement of the wire into contact with a cutting knife on one edge of the shield associated with the empty reel and for subsequent reeling of the wire onto the empty reel.

Background of the invention

This invention relates to an apparatus and method for reeling wire or other strand material and, more particularly, relates to an "on-the-fly" apparatus and method of winding and continuously feeding flexible stock to driven reels without interruption during the changeover from a full reel to an empty reel.

It is a common practice in the wire industry to employ wire reeling apparatus in which two coaxial reels alternately receive predetermined lengths of wire fed at a constant speed to the reels. When one reel has received a predetermined length of wire and has reached its capacity, the moving wire strand is transferred to the adjacent empty reel for subsequent winding. A variety of means have been employed for effecting the transfer from the full reel to the empty reel without interrupting the feed of the wire.

However, the wire industry has, for many years, sought to improve the efficiency of such on-the-fly reel changeover mechanisms in order to meet the ever increasing demands for higher winding speeds and resultant overall efficiency. For example, the Bunch Patent No. 2,971,710 and the Nelson Patent No. 2,932,462 represent examples of devices intended for providing high changeover speeds when shifting from a full reel to an empty reel. The devices disclosed in both of these patents both employ a method of operation in which the wire feeding lay-on or guide member is shifted from the full reel to a position over a driven rotating empty reel so that snagger hooks on the full reel engage the wire initially which is then subsequently engaged by the snagger hooks on the empty reel for movement into contact with a central wire cutting knife located between the two reels. While the devices illustrated in these patents have functioned fairly satisfactorily, the ever increasing needs for higher speed and greater dependability have created the need for apparatus capable of functioning at even higher rates of speed and with greater reliability and freedom from malfunction than has been possible with such devices.

This invention provides improved results over the prior art systems through the provision of movable shield means associated with each of the reels so that the shield can be moved into the position adjacent the snagger

hooks on the full reel to prevent contact of the traversing wire with the snagger hooks on the full reel. The wire is eventually engaged by the snagger hooks on the empty reel and moved against a cutting edge attached to one edge of the shield associated with the empty reel. The attachment of the knife to the respective shields provides a space-saving result and the fact that the wire is engaged by only a single snagger hook obviously greatly lessens the likelihood of breakage or cutting of the wire. Moreover, it has been found that the mode of operation of this invention also enables the obtainment of higher reeling speeds than has been possible in the past.

Summary of the invention

Therefore, it is the primary object of this invention to provide a new and improved on-the-fly wire reeling apparatus and method.

The primary object of this invention is achieved by the provision of pivotable shield means mounted for pivoting movement about the axis of coaxially adjacent first and second reels alternately receiving wire from a wire guide or traversing means. The reels are driven by separate drive means and measuring means is associated with each reel for determining when each reel has reached its full capacity. Upon reaching its full capacity, the wire guide means shifts from its position above the first full reel to a position above the empty second reel. However, the shield associated with the full reel snaggers is in position above the snaggers of the full reel so that the wire cannot engage the full reel's snaggers and is solely engaged by the empty reel's snaggers. Engagement of the wire by the empty reel's snaggers serves to draw the wire downwardly into engagement with a knife attached to the edge of the empty reel's shield which serves to sever the wire and continued rotation of the empty reel snagger and reel assembly initiates winding onto the empty reel. The full, or first, reel can then be removed while the wire is being wound on the second reel and a new empty reel inserted in place of the full reel. When the second reel reaches its full capacity, the shield members are both actuated to reverse their positions so that the wire can be shifted back to the now empty reel occupying the position of the original full reel. The shifting back from the second reel is achieved in the exact same manner as the wire was initially shifted to that reel with the wire being snagged by the snaggers on the empty reel.

Description of the drawings

FIGURE 1 is a front elevation of a portion of the prefered embodiment for practicing the invention and illustrates the manner in which the wire is shifted from a full reel to an empty reel;

FIGURE 2 is a sectional view taken along lines 2—2 of FIGURE 1;

FIGURE 3 is a front sectional view taken along lines 3—3 of FIGURE 2;

FIGURE 4 is a sectional view taken along lines 4—4 of FIGURE 2;

FIGURE 5 is a schematic representation of the electrical and hydraulic system incorporated in the invention for achieving the required timed operation of the shield members of the invention; and

FIGURE 6 is a timing chart illustrating two complete reel changeover cycles.

Description of the preferred embodiment

The preferred embodiment of the invention, generally designated 20 in FIGURE 1, is shown in the form of a wire reeling machine for winding a rapidly advancing wire 22 onto one or the other of a first reel 24 or a second reel 26. However, it should be understood that the in-

vention may be employed for reeling other strand-like flexible material not necessarily falling within the definition of wire.

Reels 24 and 26 are mounted coaxially with respect to each other for driven rotation upon a base frame member 28 and wire 22 is fed to the respective reels over a conventional infeed pulley 30 (FIG. 2) attached to an upper member 32 of the machine frame. The source of the infeed wire can be any conventional wire source capable of continuously supplying wire at a high speed. Additional guidance of the infeed wire is provided by roller guide 34 attached to an extension frame member 36 as shown in FIGURE 2. Wire 22 passes through roller guide 34 and thence downwardly through a lay-on wire guide 38 which guides the wire to one or the other of the respective reels. Wire guide 38 includes first and second rollers 40 attached to a reciprocable carriage 42 supported by first and second tracks 44 which are engaged by support rollers 46 on carriage 42 as best illustrated in FIGURE 2. The wire guide mean 38 and its associated support structure and the reel mounting and driving means is conventional and is of the type currently employed in a wire reeling machine model DM 18/24 B currently manufactured by the assignee of this application, Entwistle Manufacturing Corporation, Providence, R. I. However, other suitable wire guide means and reel support and drive means such as those shown in the Nelson Patent No. 2,932,462 could be employed, if desired.

Wire guide 38 is alternately positioned above either of the reels and is shown positioned above the leftmost reel 24 in FIGURE 1. When feeding wire to reel 24, the carriage 42 is reciprocated so that the wire is evenly fed to the reel between the reel flanges. The carriage is reciprocated so that the wire is fed between a left limit position 48 and a right limit position 50 as designated in FIGURE 1. Similarly, when the wire is being fed to the right reel 26, the carriage 42 is reciprocated so that the infeed wire passing between rollers 40 is reciprocated between a left limit position 48' and a right limit position 50' as shown in FIGURE 1. When one reel is substantially full, it is necessary to shift the wire guide carriage to a position above the other (empty) reel in order to initiate a reeling operation on the empty reel. Means for such shifting and for reciprocating the carriage between the right and left limits above the respective reels is conventional and well known.

Reel 24, as illustrated in FIGURE 1, is provided with a left, or exterior, flange 52 and a right, or interior, flange 54 for retaining the wire on the reel. The left end of reel 24 is drivingly connected to an electric motor 56 (FIG. 2) which drives the reel through a belt 58 connected to a pulley 60 keyed to a shaft 62 which, in turn, is connected by a final output drive belt 64 which drives a reel engaging drive plate 66. The entire drive assembly 66, etc. can be moved to the left as illustrated in FIGURE 1 for enabling removal of a full reel and replacement with an empty reel. The right end of the left reel 24 receives a supporting pintle 70 (FIG. 4) within an axial recess 72 formed in the reel. Similarly, the left end of reel 24 receives a supporting pintle 74 (FIG. 1) within an axial recess 72 for supporting the reel for rotation. The leftmost supporting pintle 72 and the associated drive plate 66 are reciprocable to the left as shown in FIGURE 1 to enable removal of reel 24 when it has reached its capacity. The entire leftmost drive assembly and support means is supported by a frame plate 76 and support rod 78 for this purpose.

The leftmost supporting pintle 74 is provided with suitable rotatable support bearings (not shown) and the right supporting pintle 70 is provided with rotatable support bearings 80 as illustrated in FIGURE 4. Bearings 80 are supported by a center plate bracket 82 which, in turn, is connected to frame 28.

A snagger disc or plate 84 (FIG. 4) is connected to the right support pintle 70 for rotation therewith. The snagger disc is actually formed of outer and inner coaxial portions suitably connected by screws 86 or the like; however, for the purposes of this invention, the snagger plate can be considered to be a unitary member and a cylindrical drive lug 86 extends from the left face of the disc 84 as shown in the drawings, and is received within a driving recess 87 provided on the end of reel 24. Several such recesses are provided so that the reel can be easily connected in driving relation with the snagger discs 84. Similar driving recesses are provided on each end of the reel with the recesses in the left end of the reel being engaged by the drive lugs 67 extending from drive plate 66. Therefore, driving rotation of reel 24 through drive plate 66 and drive lugs 67 serves to also drivingly rotate the snagger disc 84. A plurality of snaggers 88 are connected to the periphery of snagger discs 84 for the purpose of engaging the wire 22 during crossover from a full reel to an empty reel.

An annular bearing member 90 (FIG. 4) having its center of curvature coaxial with the axis of pintles 70 and 74 is attached to the left surface of center plate bracket 82 by means of screws 100. The annular bearing member 90 provides a rotatable support for a snagger shield supporting ring plate 102 which encompasses bearing 90 in concentric relationship so that the ring plate 102 can revolve about the axis of pintles 70 and 74. The axis of pintles 70 and 74 is also the axis of rotation of reels 24 and 26 as will be evidenced from inspection of the drawings. A flat retaining plate 104 of annular shape is clamped against the leftmost side of center plate bracket 82 by an outer bearing member 106 which has screws passing through bores about its periphery and threaded into the center plate bracket 82 as shown in FIGURE 4. The retaining plate 104 maintains the snagger shield supporting ring 102 in position on the annular bearing member 90 for rotation on the bearing member. It should be noted that the lower portion of the annular bearing member 90 illustrated in FIGURE 4 has a reduced radial dimension as compared to the upper portion of the same member. This is due to a chordal edge 108 which forms the outer periphery of the lower portion of the annular bearing member 90 as shown in FIGUURE 2. The remainder of the outer periphery of the annular bearing member is circular as illustrated in the drawings. The purpose of the chordal edge 108 will become apparent hereinafter.

A snagger shield member 120 includes a radially extending annular sector support plate member 121 which is connected to the snagger shield supporting ring plate 102 by means of connectors 122. A radial edge 123 defines one side of support plate member 121 and curved peripheral end portion 124 extends from the outer circumference of member 121 to embracingly extend over and around the snaggers 88 as shown in FIGURE 4. Another radial edge 125 defines the other side of support plate member 121 and the shape of the shield is such that when the shield is in the solid line position illustrated in FIGURE 2, the wire 22 cannot possibly engage the snaggers during a crossover operation from the left reel to the right reel.

However, it is obviously desirable for the shield to be moved downwardly from the upper solid line position illustrated in FIGURE 2 to the dashed line position of the same figure so as to enable the snaggers of the left reel 24 to engage the wire during crossover from the right reel 26. This movement of the snagger shield 120 is enabled by means of a radially extending lever arm 126 which is pivotally conneced at 128 to a piston rod extension member 130 which forms a radial extension of a piston rod 132 of a hydraulic cylinder 134 as shown in FIGURE 2. Control of hydraulic cylinder 134 is provided by a control relay CR14 which, when activated, activates a solenoid valve coil LS to cause cylinder 134 to retract and

pivot shield **120** to its lower position so as to uncover snaggers **88**. A control relay CR**13** and solenoid valve coil RS control the right cylinder **134'** in the same manner.

The chordal edge **108** provides the clearance necessary for the piston rod extension **130** to assume the position shown in FIGURE 2. When cylinder **134** is actuated, piston rod **132** moves outwardly to position the shield in the solid line position shown in FIGURE 2. This position can be referred to as the upper or shielding position in that it shields the snaggers **88** from engagement with the wire. The end of hydraulic cylinder **134** opposite to the piston rod **132** is pivotally connected at **136** to the frame **128**. When the hydraulic cylinder is actuated to move the pistons inwardly, the shield **120** assumes the dashed line position of FIGURE 2.

A knife member **138** is connected to member **121** adjacent radial edge **123** of shield **120** and serves to cut the wire during crossover from a full reel to an empty reel in a manner to be discussed hereinafter and a smooth surfaced wire retaining transfer hook **140** extends radially outwardly from the portion **124** of shield **120** as shown in FIGURES 1, 2 and 3. The purpose of the transfer hook **140** is to prevent the wire from sliding off of the end of shield **120** during transfer of the wire from reel **24** to reel **26** as will be discused in detail hereinafter.

The elements for supporting the right reel and the snagger disc and shield associated with the right reel are identical with those discussed above with respect to the left reel and have been provided with primed designators corresponding to the same elements associated with the left reel. Therefore, there is no need to present a detailed discussion of these elements since such would be merely repetitive of the discussion of the left reel construction.

Wire fed to the reels **24** and **26** is measured by a footage meter (not shown) and when the meter reaches a reading indicating that reel **24** is approaching full condition, the shields are positioned in the manner illustrated in FIGURE 1 with shield **120** being in its upper or covering relationship with respect to its associated snagger members **88** and shield **120'** being in its lowering or uncovering relationship with respect to its associated snagger members **88'**. The reciprocable wire guide carriage is then caused to move fro mthe solid line position illustrated in FIGURE 1 to the dashed line position of the same figure. A toggle type center switch **144** located on a frame member **145** (FIG. 2) is engaged by a switch actuator **146** for movement into a "right" position as the carriage **42** moves from the left reel to the right reel. Switch **144** is moved to a "left" position when the carriage is returned to the left reel position. During the course of this movement, the wire **22** engages the shield **120** and assumes the intermediate dashed line position **22'** illustrated in FIGURES 1 and 3 with the wire being prevented from sliding off of the lower end of shield **120** by the shield transfer hook **140** as clearly illustrated in FIGURE 1. However, wire in the position **22'** is snagged by snaggers **88'** of the right shield **26** as illustrated by the position **22'** of FIGURES 1 and 3. The snagging of the wire consequently draws the wire downwardly to the solid line position of FIGURE 3 so that the wire engages the knife **138'** of shield **120'** as shown in FIGURE 3. This engagement with the knife **138'** serves to sever the wire extending from the full reel while snaggers **88'** retain the infeed wire in un-slipping relationship so that continued rotation of the snaggers serves to initiate winding of the wire onto the empty reel **26** in an obvious manner.

While the means for driving the reels **24** and **26** and for controlling the movement of the wire guide means **38**, etc. is conventional, it is necessary that the means for actuating the respective shields **120** and **120'** be cooperatively associated with the means for controlling these machine elements in order that a proper timed operation of the shields is obtained. Therefore, the following discussion is directed to the manner in which the shields **120** and **120'** are associated with the other control means of the machine for proper timed actuation.

Attention is invited to FIGURE 6 which is a timing cycle illustrating a complete cycle of operation transfer of the infeed wire from reel **24** to reel **26** and the subsequent transfer back to a replacement in reel occupying the position of original reel 24 FIGURE 5 illustrates the the circuitry for controlling the actuation of the shields **120** and **120'** and this figure, in conjunction with the timing charts, should be referred to in order to better understand the following discussion of the operation of the preferred embodiment.

Assuming that wire is being reeled onto the left reel 24, the wire guide **38** will be receprocating between limit positions **48** and **50** and shield **120** will be in its down or lowered position (CR**14** being actviated) leaving the upper periphery of the snagger disc **84** uncovered as illustrated by the dashed line position of shield **120** in FIGURE 2. Similarly, the right shield **120'** associated with the right reel **26** will be in its upper or shielding position. Also, center switch **144** will be in its left position since the wire guide carriage will have positioned the switch in the left position during the prior traverse of the carriage from the right reel to the left reel and control relay CR**10** will be on (activated). Relay CR2 is also in an activated condition at this time. These conditions are illustrated at time T_0 on the timing chart of FIGURE 6.

At time T_1, final count relay contacts FC (FIG. 5) of a conventional footage meter are closed when the meter reaches a predetermined footage reading indicative that the left reel has received a predetermined number of feet of wire and is approaching its total capacity. Closure of the final count contacts FC is effective for only a short period of time to provide an initiating final count pulse signal of short duration (approximately .2 second) as shown on the timing chart; however, this final count signal actuates a changeover cycle triggering relay RY**1** to begin the changeover cycle. Actuation of the triggering relay RY**1** causes relay contacts RY1A (FIG. 5) to close which, in turn, causes a circuit to be established from a first primary power line **156** through the normally closed contacts of a right stop switch RST, through closed relay contacts CR9D, through contacts RY1A and through three parallel connected relays TD3, CRT and TD5 to a second primary power line **157** to activate the three parallel connected relays.

The relay TD5 is of the "off delay" type which is immediately actuated upon the flow of current to the relay coil but which has a 0.5 second delay in deactivation of its contacts following termination of current flow to its coil. In other words, the contacts of the relay are not deactivated until one half second after the current to the relay coil is interrupted. Relay TD5 is provided with a normally open set of contacts TD5A and a normally closed set of contacts TD5B as shown in FIGURE 5. Upon actuation of the relay coil TD5 at T_1, the normally closed contacts TD5B immediately open to deactivate control relay CR**10**. Deactivation of control relay CR**10** serves to close normally closed contacts CR**10**A of that relay so that a circuit is established through closed contacts CRCA, CR6C and contacts CR**10**A to activate a relay CR5. Activation of relay CR5 closes that relay's contacts CR5A and CR5B and opens its contacts CR5C.

Closure of contacts CR5A establishes a circuit from conductor **156** through the closed contacts CR14D of relay CR14 and contacts CRTC of relay CRT to activate the right shield control relay CR**13**. This activation of the right shield relay CR**13** closes the right shield solenoid contacts CR13A and CR13B and CR13D; closure of contacts CR13B actuates the right shield solenoid valve coil RS to actuate the control valve to cause the piston in hydraulic cylinder **134'** to move inwardly to lower its associated shield **120'** to its lower position illustrated in FIGURE 1. Simultaneously, the normally closed contacts CR13C open to deactivate the left shield relay CR**14**. Deactivation of CR14 opens that relay's contacts CR14B to interrupt the circuit to the left shield valve coil LS so

that the valve moves so as to position the hydraulic cylinder 134 in its extended position wherein pivot shield 120 assumes its upper or shielding position illustrated in FIGURE 1.

Activation of relay CRT at T_1 immediately closes contacts CRTA, CRTB and CRTC of that relay. Closure of contacts CRTB at T_1, causes a circuit to be established through these contacts, contacts CR2A and normally closed contacts CR9A of relay CR9 to activate relay CR11. Closure of contacts CR11C of relay CR11 activates relay CR3 in an obvious manner. Relay CR9 remains deactivated at this time due to the fact that actuation of relay CR11 opens contacts CR11A in the coil circuit of relay CR9.

Relay TD3, which is also actuated by the closure of contacts RY1A at T_1 is an "on delay" type of relay having a fourteen second delay following the initiation of current to the relay coil before the relay contacts actually close. Therefore, the fourteen second delay period is started at time T_1 and expires at time T_2 fourteen seconds after T_1. Feed of the infeed wire to the left reel continues without interruption during the fourteen second delay period.

Closure of normally open contacts TD3A at T_2, completes a circuit to a traverse control relay CR4 which immediately activates conventional means for rapidly shifting the wire guide means 38, etc. from above the left reel 24 to a position above the right reel 26. It should be noted that the traversal of the wire guide carriage moves such into engagement with the center switch 144 to shift the switch from its "left" to its "right" position at T_3. This shifting of switch 144 causes relay CRC to be activated at time T_3 in an obvious manner. Energization of relay CRC, among other things, opens contacts CRCA.

Movement of the wire guide carriage to a position above the right reel 26 causes the wire to engage the left shield 120 (which prevents snaggers 88 from snagging the wire) with transfer hook 140 preventing the wire from dropping off of the lower side of the shield. However, since shield 120′ is in its lowered position, the wire is snagged by snaggers 88′ and pulled downwardly into contact with the cutting means 138′ which severs the wire. Continued rotation of snagger disc 84′ and reel 26 begins the winding of the wire onto reel 26 in an obvious manner as illustrated in FIGURE 3. This rapid traverse movement of the wire guide carriage 42 continues to the right until time T_4 when the carriage engages and opens a right stop switch RST located adjacent the position of maximum rightward travel of the wire guide carriage.

When the carriage engages right hand stop switch RST at T_4, it opens this switch to deactivate relays TD3, CRT and TD5 at time T_4 (CR11D being open at this time). Deactivation of relay CRT opens this relay's contacts CRTB to deenergize relay CR11 and also opens the latching contacts CRTA so that the consequential closing of contacts CR11D cannot reactivate relay CRT.

Right stop switch RST is a spring biassed switch that is normally closed and is only opened for a short period of time since the carriage immediately moves to the left after contacting the switch. The left stop switch LST is identical with the right switch and operates in an analogous manner.

Deactivation of time delay relay TD3 at T_4 opens relay contacts TD3A; however, relay CR4 remains activated through its latching contacts CR4A for an additional one half second by virtue of the half second time delay in the off delay relay TD5 which consequently retains contacts TD5A in closed position until T_5. The normally open contacts TD5A open at time T_5 and the normally closed contacts TD5B close at time T_5.

The opening of contacts TD5A at time T_5 immediately deactivates relay CR4. Deactivation of the drive to the left reel is also accomplished at T_5.

Similarly, closure of the normally closed contacts TD5B at T_5 reactivates control relay CR10. This reactivation of relay CR10 opens the normally closed contacts CR10A to deenergize relay CR5 and also opens contacts CR10B. Deactivation of relay CR5 opens the normally open contacts CR5A in the power circuit to relay CR13; however, relay CR13 remains activated by virtue of the fact that contacts CR13A and CR13D maintain the relay in latched (activated) condition. Moreover, deactivation of relay CR5 closes contacts CR5C to actuate relay CRA (contacts CRCB being in a closed condition). Consequently, contacts CRAA of relay CRA open to deactivate relay CR2; however, the normally open contacts CRAB simultaneously close to retain relay CR3 in activated condition.

Also, the traverse control for the wire guide means is operating at this time to reciprocate the wire guide between positions 48′ and 50′ for the filling of reel 26. During this time, when the right reel is being filled, the full left reel will be removed and replaced with an empty reel.

The infeed wire continues to be reciprocated between the limit positions 48′ and 50′ until T_6 at which time the footage meter reaches its predetermined value and closes contacts FC which activate the trigger relay RY1 to begin initiation of the changeover cycle from the almost full reel to the new empty left reel.

Activation of RY1 at T_6 closes contacts RY1a to activate the three relays TD3, CRT and TD5 in the same general manner as occurred at T_1. The circuit condition at the time immediately prior to time T_6 is different from the condition at the time immediately prior to T_1 (time of initiation of changeover from the left reel to the right reel) in that relay CR3 is energized and relay CR2 is deenergized whereas the reverse was true immediately prior to T_1.

Energization of the relay TD5 at T_6 closes contacts TD5A and opens contacts TD5B. The opening of contacts TD5B immediately deactivates control relay CR10 and this deactivation serves to close the normally closed contacts CR10B to activate relay CR6. Consequently, the contacts CR6A of relay CR6 are closed and the contacts CR6B are closed to latch relay CR6. Closure of contacts CR6A establishes a circuit from conductor 156 through the closed contacts CR13D (also through CRTC) of relay CR13 to activate the left shield control relay CR14. This activation of the left shield relay CR14 closes the left shield solenoid contacts CR14B, contacts CR14A and CR14D and opens contacts CR14C; closure of contacts CR14B activates the left shield solenoid valve coil LS to energize the control valve for that shield to cause the piston in hydraulic cylinder 134 to move inwardly to lower the shield 120 to its lower position uncovering the snaggers 88. Simultaneously, the normally closed contacts CR14C are opened to deactivate the right shield relay CR13. Deactivation of relay CR13 opens that relay's contact CR13B to break the circuit to the right shield valve coil RS so that the valve moves so as to position the hydraulic cylinder 134′ in its extending position wherein shield 120′ assumes its upper or shielding position with respect to snaggers 88′. The activation of relay CRT at T_6 immediately closes contacts CRTA, CRTB and CRTC of that relay. Closure of contacts CRTB at T_6 causes a circuit to be established through these contacts, contacts CR3A and the normally closed contacts CR11A to activate relay CR9. Closure of contacts CR9C activate the relay CR2 in an obvious manner. Relay CR11 remains deactivated at this time due to the fact that energization of relay CR9 opens contacts CR9A in the coil circuit of relay CR11.

Relay TD3, which is also actuated by the closure of contacts RY1A at T_6 initiates the fourteen second delay for relay TD3 in the same manner as occurred at T_1. This fourteen second delay period expires at T_7. It should also be noted that the drive to the left reel is activated at T_6 to begin accelerating the left reel to its full operating speed. Closure of contacts TD3A at T_7 again completes the circuit to the traverse control relay CR4 which immediately activates the conventional means for rapidly shifting the wire guide means from above the right reel

26 to a position above the left reel 24. It should be noted that the traversal of the wire guide carriage from the right position to the left position causes engagement of switch actuator 146 with switch 144 to move switch 144 into its "left" position at T_8 midway through the rapid traverse movement. Consequently, the opening of the contacts of switch 144 immediately deactivates relay CRC at T_8 to open contacts CRCB and close contacts CRCA. Deenergization of relay CRC causes the closing of contacts CRCA. Also, the rapid traversal of the wire guide to the left position causes the infeed wire to engage the raised shield 120' which prevents the wire from engaging snaggers 88'. However, snaggers 88 of the empty reel 24 snag the wire and draw same down into cutting relationship with cutter 138. Reeling of the wire onto reel 24 then proceeds by virtue of the rotation of the reel.

Continued rapid traversal of the wire guide means 3*u* etc. to the left causes the wire guide carriage to engage left stop switch LST at time T_9 to open the contacts of said switch. Switch LST is adjacent the leftward extent of movement for the carriage and the opening of its contacts immediately deenergizes the relays TD3, CRT and TD5. Deenergization of relay CRT at T_9 immediately opens contacts CRTA and CRTB. The opening of contacts CRTB immediately deactivates relay CR9. Moreover, deactivation of relay CRT also opens that relay's latching contact CRTA so that the consequential closing of contacts CR9d by deactivation of relay CR9 cannot reactivate relay CRT.

Deenergization of time delay relay TD3 at T_9 opens relay contacts TD3A. However, relay CR4 remains activated through its latching contacts CR4A for an additional one half second by virtue of the half second time delay in the off delay relay TD5. This off delay consequently retains contacts TD4A in closed condition until T_{10} one half second after time T_9. When contacts TD5A open at time T_{10}, CR4 is immediately deactivated. The drive to the right reel is also deactivated at T_{10}.

Relay CR10 is activated by the closure of normally closed contacts TD5B at T_{10}. Activation of relay CR10 at time T_{10} immediately opens relay contacts CR10B to deactivate relay CR6. Deenergization of relay CR6 opens that relay's contacts CR6B to consequently interrupt the circuit to relay CRA (contacts CRCB being open at this time). Deenergization of relay CR6 serves to open the normally open contacts CR6A in the circuit to relay CR14. However, the relay CR14 remains energized by virtue of the closed conditions of contacts CR14A and CR14D. Relay CR2 remains energized by virtue of the closure of contacts CRAA at T_{10} despite the opening of contacts CR9C. However, the deactivation of relay CR4 at T_{10} deenergizes relay CR3. The guide control for the wire guide means is operated at T_{10} to provide the normal reciprocating movement of the wire guide between positions 48 and 50 for the filling of the left reel 24. During this time, when the left reel is being filled, the full right reel will be removed and replaced with an empty reel. All elements of the device are in the same condition as at T_0 and the cycle of operation has been completed. The eventual closure of contacts FC indicating approximate completion of reeling onto the left reel will initiate another cycle of operation in the same manner as occurred at time T_1.

What is claimed is:

1. An on-the-fly method of transferring a moving infeed wire from a driven full reel to a driven empty reel, said method comprising the steps of feeding wire to the full reel by means of a shiftable wire guide means, moving a snagger shielding means into blocking position with respect to wire snagger means associated with the full reel and shifting said wire guide means to an infeed position adjacent the empty reel so that the wire crossing over from the full reel to the empty reel is snagged solely by snagger means associated with the empty reel.

2. A method of operating an on-the-fly wire reeling device of the type having driven first and second coaxial reels having inner facing flanges and being drivingly supported for alternately receiving an infeed wire from a wire guide means which is reciprocable for feeding wire to either of said reels and is shiftable from a position adjacent either reel to a position adjacent the other reel, each of said reels including wire snagger means associated with the periphery of the inner flange of each of said reels and individual snagger shielding means associated with the snaggers of each of said reels and each being positionable in an activated position for shielding its respective snagger means from engagement with the wire during shifting of the wire guide means from a position above one reel to a position above the other reel and a deactivated position in which said infeed wire would be snagged by that shield's snagger means, said method comprising the steps of: positioning one of said shielding means associated with a substantially full reel in its activated position and positioning the other said shielding means associated with an empty reel in its deactivated position, and subsequently shifting said wire guide means to a position above said empty reel so that said infeed wire is engaged and snagged solely by said snagger means associated with said empty reel to initiate the beginning of reeling wire onto said empty reel.

3. The method of claim 2 wherein said positioning of said shielding means is in response to a signal from a wire measuring means indicative that said substantially full reel has essentially approached its full wire holding capacity.

4. The method of claim 2 additionally including the step of cutting the infeed wire on cutting means mounted on said snagger shielding means associated with said empty reel.

5. A method of transferring a continuously fed infeed wire being fed by wire guide means from reeling relationship onto a driven full reel to reeling relationship onto a driven empty reel, said method comprising the steps of shifting said wire guide means from a feeding position adjacent the full reel to a feeding position adjacent the empty reel while concurrently preventing said infeed wire from engaging snagger means associated with the full reel but allowing said infeed wire to be engaged by snagger means associated with the empty reel to initiate the winding of wire onto the empty reel.

6. In a wire reeling apparatus of the type having coaxial first and second driven reels having inner facing flanges, a wire guide means mounted for reciprocating movement adjacent either of said reels for feeding a continuously fed infeed wire to either of said reels and being shiftable from a feeding position adjacent a full reel to a feeding position adjacent an empty reel in response to a control signal to effect changeover of wire feed from the full reel to the empty reel and a plurality of wire snagger means mounted adjacent the periphery of each of said inner facing flanges for rotation, the improvement comprising first and second snagger shielding means mounted respectively adjacent the wire snagger means of said first and second reels, first and second actuator means for respectively moving said first and second snagger shields between an activated position in which said shielding means is between said snagger means and said wire guide means so that the infeed wire will be blocked from contacting said snagger means and will not be snagged by said snagger means during changeover of said wire guide means from a full reel to an empty reel and a deactivated position in which said wire is not blocked from engagement of said snagger means so that said wire snagger means snags said wire during changeover of said wire guide from a full reel to an empty reel and control means actuable in response to said changeover signal for causing the snagger shielding actuator means associated with the full reel to move the full reel's snagger shield to its activated position and for causing the snagger shield associated with the empty reel to

move the empty reel's snagger shield to its deactivated position so that the infeed wire will be snagged by the empty reel's wire snagger means upon movement of the wire guide means to its position adjacent the empty reel to initiate reeling of the infeed wire onto the empty reel.

7. The invention of claim **6** wherein each of said snagger shielding means comprises a support member extending radially outward with respect to the axis of said reels, rotary bearing means supporting said support member for rotation about said axis, said support member having an arcuate outer termination from which a curved peripheral end portion extends over the snaggers with which the particular shielding means is associated.

8. The invention of claim **7** wherein said each of said support members has an annular sector configuration having first and second radially extending edges with a wire cutting means being attached to said member adjacent said first radial edge adjacent the path of travel of said wire snaggers so that a crossing-over wire snagged by said wire snaggers will be moved against said cutting means for severing said crossing over wire when the particular snagger shielding means is in its deactivated position.

9. The invention of claim **8** additionally including a transfer hook extending radially from said curved peripheral end portion at a position adjacent said second radial edge.

10. The invention of claim **9** wherein said first and second actuator means are hydraulic cylinders.

11. In an on-the-fly reeling device of the type having coaxial first and second reels having inner facing flanges with each of said inner facing flanges having an adjacent wire snagger disc having peripherally mounted wire snaggers and a wire guide means mounted for reciprocating movement adjacent either of said reels for feeding a continuously fed infeed wire to either of said reels and being shiftable from a feeding position adjacent a full reel to a position adjacent an empty reel in response to a control signal to cross over the infeed wire to the empty reel to effect changeover of wire feed from the full reel to the empty reel, the improvement comprising shielding means for causing the crossing-over wire to be snagged solely by the snagger disc associated with the empty reel while preventing engagement of the crossing-over wire from being engaged by the snaggers on the snagger disc associated with the full reel.

12. The invention of claim **11** wherein said shielding means comprises first and second shields respectively associated with said snagger discs and movable between a shielding position and an unshielding position with respect to said discs.

13. The device of claim **12** wherein said shielding means includes means for simultaneously moving the shield associated with the full reel to its shielding position while simultaneously moving the shield associated with the empty reel to its unshielding position in response to said control signal.

14. The invention of claim **13** wherein each of said shielding means associated with each of said snagger discs comprises a pivotable member mounted for pivotal movement about the axis of rotation of said snagger disc.

15. The invention of claim **14** wherein said pivotable member includes wire cutting means mounted adjacent one edge thereof for severing a crossing over wire when the shield upon which said wire cutting means is in its unshielding position.

References Cited

UNITED STATES PATENTS

2,971,712 2/1961 Jacobs et al.

NATHAN L. MINTZ, Primary Examiner