Jan. 11, 1944. L. O. REICHELT 2,339,194

MATERIAL HANDLING APPARATUS

Filed Oct. 17, 1941 2 Sheets-Sheet 1

FIG. 1

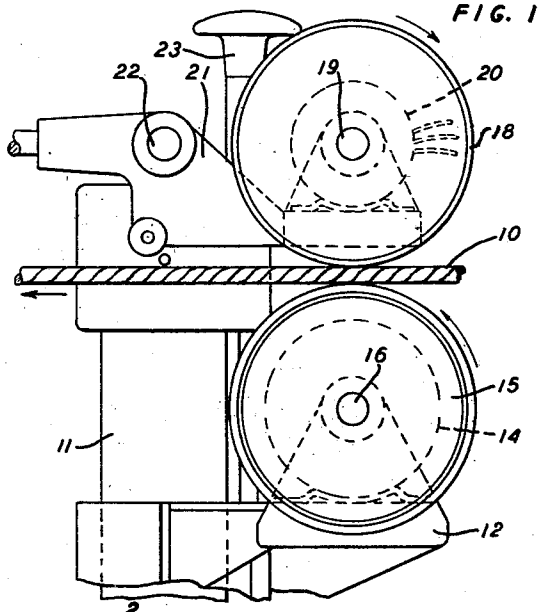


FIG. 2

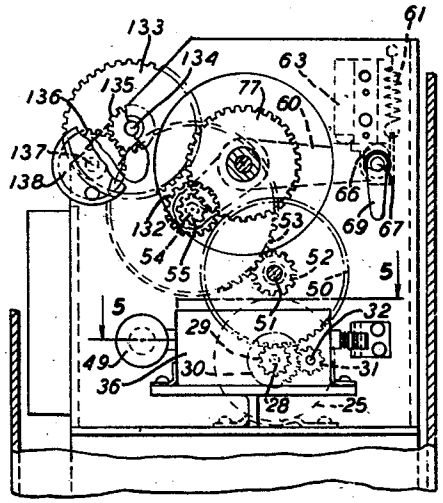


FIG. 3

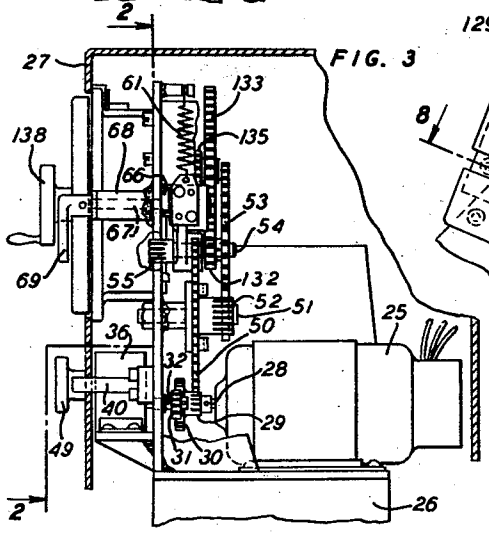


FIG. 4

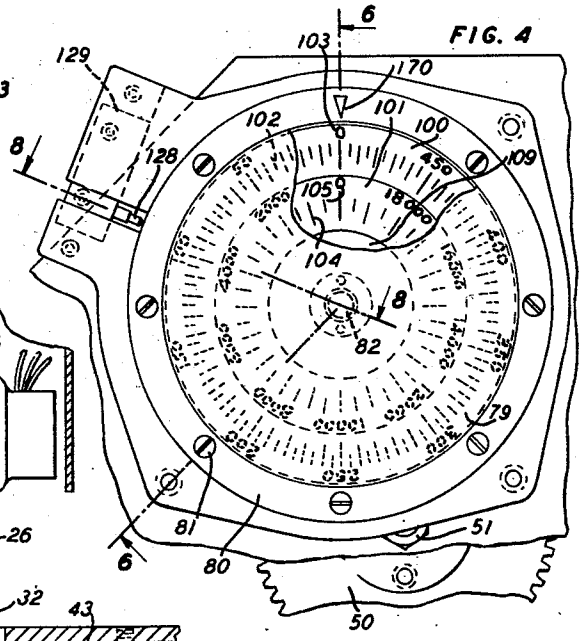
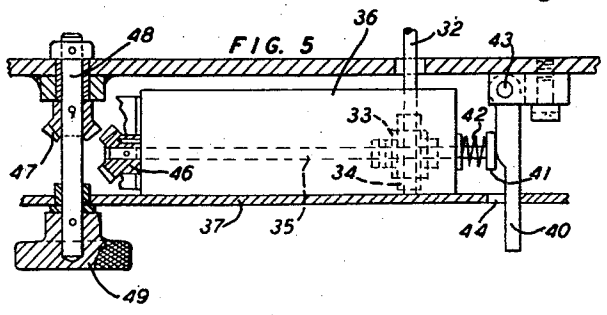


FIG. 5



INVENTOR
L.O. REICHELT

BY
E.R. Nowlan
ATTORNEY

Jan. 11, 1944. L. O. REICHELT 2,339,194

MATERIAL HANDLING APPARATUS

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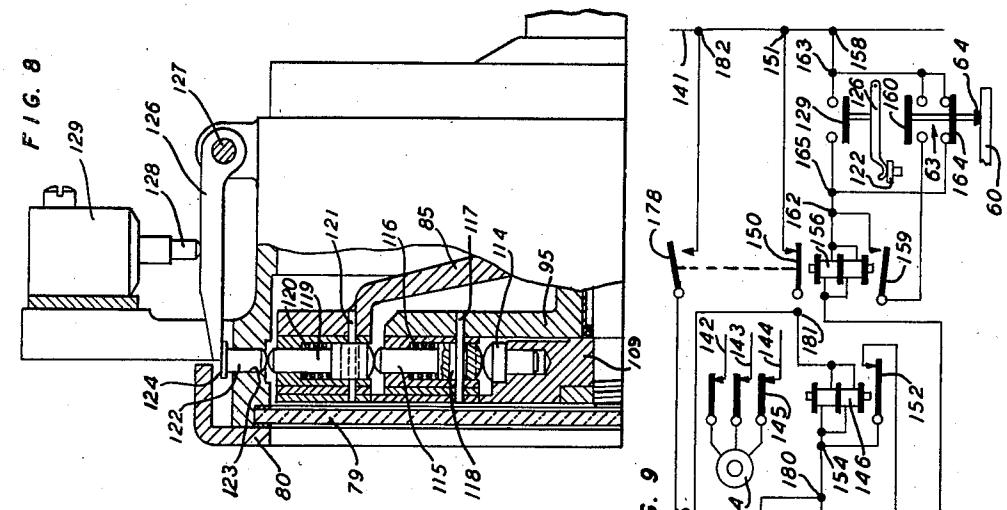


FIG. 8

FIG. 9

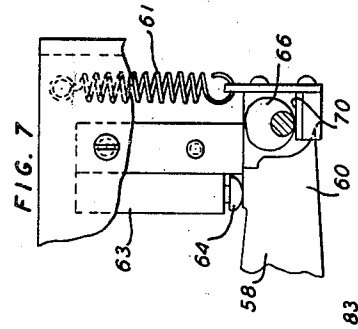


FIG. 7

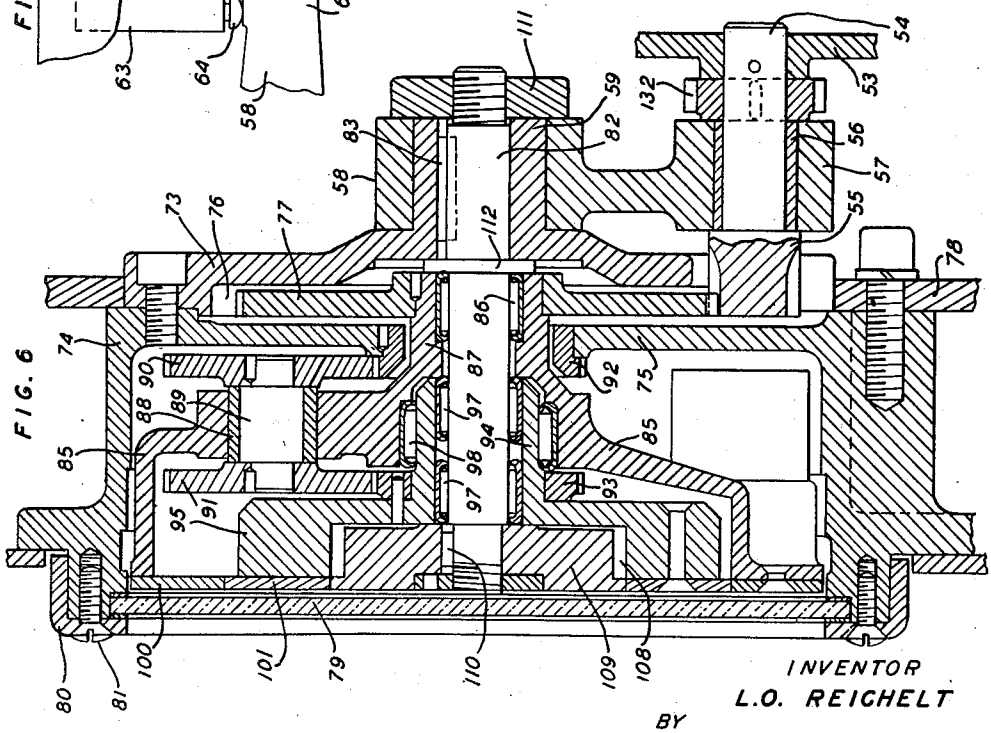


FIG. 6

INVENTOR
L.O. REICHELT

BY

E.R. Moulan
ATTORNEY

Patented Jan. 11, 1944

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UNITED STATES PATENT OFFICE

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MATERIAL HANDLING APPARATUS

Lester O. Reichelt, Cranford, N. J., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application October 17, 1941, Serial No. 415,371

3 Claims. (Cl. 33—132)

This invention relates to material handling apparatus, and more particularly to control mechanisms for stopping stranding machines used in forming cables after cables of selected lengths have been formed.

Stop counters have been used frequently with material handling or working apparatus to render the power means for driving such apparatus ineffective after predetermined lengths of material have passed by the counters thereof. Such counters must be reset for repeated operations and the time required to reset the counters and to condition the apparatus with which they are associated for further operations and to condition the apparatus for intermittent operations to produce additional lengths of material, is of great importance in determining the output of the apparatus.

An object of the invention is to provide a material handling apparatus including a stop control which is simple in structure, accurate and dependable, and easily and readily reset.

With this and other objects in view, the invention comprises a material handling apparatus having mechanisms to advance material past a roll, to rotate a roll at a speed determined by the speed of advancement of the material and to actuate a transmitting unit, a receiving unit under the control of the transmitting unit being adapted to drive a counter to indicate the length of material moved past the roll, and a subtracting indicator to effect stopping of the apparatus when a selected length of material has passed the roll.

Other objects and advantages will be apparent from the following detailed description when taken in conjunction with the accompanying drawings, wherein

Fig. 1 is a fragmentary side elevational view of a material handling apparatus showing driving means for advancing material and a roll rotated by the advancement of the material;

Fig. 2 is a sectional view illustrating the control mechanism for the apparatus, this view being taken substantially along the line 2—2 of Fig. 3;

Fig. 3 is a vertical sectional view of the mechanism shown in Fig. 2;

Fig. 4 is a fragmentary front elevational view of the subtracting indicator;

Fig. 5 is a fragmentary top plan view of the counter portion taken along the line 5—5 of Fig. 2;

Fig. 6 is an enlarged sectional view taken substantially along the line 6—6 of Fig. 4;

Fig. 7 is an enlarged fragmentary elevational view of a portion of a resetting mechanism;

Fig. 8 is an enlarged fragmentary sectional view taken along the line 8—8 of Fig. 4, and

Fig. 9 is a wiring diagram illustrating the electrical circuits affected by the apparatus.

Referring now to the drawings, attention is first directed to Fig. 1, which illustrates but a small portion of a material handling apparatus. In the present instance this apparatus is for stranding or twisting a plurality of electrical conductors into a group and wrapping the group with paper or cotton or the like in the forming of an electrical cable for use in the transmission of intelligence electrically. The material, indicated at 10, is in the present embodiment a cable unit and the structure shown in Fig. 1 is disposed adjacent the exit end of the apparatus in advance of a take-up reel (not shown) upon which the material is wound. In this structure a frame 11 is provided with a motor supporting bracket 12 extending laterally therefrom, the bracket supporting a driving motor 14 which drives a roll 15 through a motor shaft 16. In actual construction the motor 14 merely assists in continuing the advancement of the material, other power means being provided in the apparatus or through the take-up reel mechanism to effect advancement of the material. However, for the purpose of illustrating the invention let it be assumed that the motor 14 is the entire force or power means for advancing the material. In this manner the invention may be clearly illustrated without the necessity of showing and describing the other complicated structures of the apparatus.

The roll 15 is assisted in advancing the material by a counter roll 18, the latter being mounted upon a shaft 19 of an electrical transmitting unit 20. The unit 20 is supported by a bracket 21 pivoted at 22 upon the frame 11. Suitable means under the control of a hand screw 23, associated with the bracket 21 and the frame 11, is provided to vary the pressure of the roll 18 on the material 10, to create a definite advancement of the material with the roll 15 and an accurate rotation of the roll 18 with the material. With this construction the transmitting unit 20 is driven at a definite speed determined by the speed of advancement of the material. This unit is electrically connected to an electrical receiving unit 25 (Figs. 2 and 3) through a suitable electrical circuit (not shown) to effect driving of the receiving unit at the same speed the transmitting unit is driven. The transmitting unit 20 is in the form of a generator, while the receiving unit 25 is in

the form of an electrical motor, they having independently excited three-phase field windings and three-phase wound rotors, the latter being directly connected to each other.

The receiving unit 25 is supported upon a suitable base 26 at a remote position from the structure shown in Fig. 1, for example in a control cabinet 27 disposed at a suitable position in front of the apparatus in general. A shaft 28 of the receiving unit 25 has gears 29 and 30 mounted thereon. The gear 30, when rotated, drives a gear 31 which in turn, through its shaft 32, drives a worm 33, the latter being fixed to the shaft. The worm 33 interengages a worm gear 34, the latter being mounted upon and keyed to a counter shaft 35 of a counter unit 36.

The mechanism in the counter unit 36, including counter wheels under the control of the shaft 35, may be of the conventional type to register in numbers the feet of material 10 which have passed beyond the roll 18. It is believed that a detailed structure of the counter and its inner workings are not essential for a clear understanding of the invention, excepting the connection of the shaft 35 with its driving means just described and the mechanism for disconnecting the shaft from its driving means and connecting it with a resetting means through which the counter mechanism may be reset. The counter may be provided with a transparent cover 37, in the cabinet 27, through which the operator may clearly view the numbers registered by the counter during the operation of the apparatus. The resetting mechanism includes an actuating lever 40 positioned to engage an enlarged or head portion 41 of the shaft 35, to move the shaft to the left (Fig. 5) against the force of a spring 42 which normally holds the shaft in its operating position. The lever 40 is pivoted at 43 and extends through an aperture 44 in the cover 37, so that the operator may have access thereto. Movement of the shaft 35 to the left (Fig. 5) through the actuation of the lever 40 will move a bevelled gear 46, which is mounted upon the outer end of the shaft, in engagement with a bevelled gear 47, the latter being mounted upon a shaft 48 which is mounted for rotation by a hand wheel 49 for manual rotation of the shaft 35 through the bevelled gears 46 and 47 to reset the counter unit 36.

Attention is again directed to Figs. 2 and 3, beginning with the gear 29 which drives a gear 50 on a shaft 51, the gear 50 driving a gear 52 which is mounted upon the same shaft. The gear 52 when driven, drives a gear 53 which is mounted upon a shaft 54 (Figs. 2, 3 and 6), the latter driving a gear 55. The shaft 54 is journalled in a bearing 56 of one end 57 of an arm 58 which is in the form of a bellcrank lever pivotally supported intermediate its ends upon a stationary member 59. The other end of the arm, indicated at 60, is normaly urged upwardly by a spring 61 to position the gear 53 in engagement with the gear 52. When in this position, this being called the "operating position," the arm 58, that is the end 60 thereof, allows positioning of a switch 63 through a switch actuating plunger 64, to condition an electrical circuit shown in Fig. 9 and, as hereinafter described, to stop the apparatus or to render the motor 14 ineffective.

The arm 58 is under the control of a cam 66 mounted upon a shaft 67, the latter being supported in a suitable bearing 68 (Fig. 3) and having its outer end provided with a handle 69 for the manual rotation thereof. Through the actuation of the handle 69, the cam may be moved from the position shown in Figs. 2 and 7 to a position 180° therefrom, the cam riding upon a shoulder 70 fixed to the arm 58 to effect clockwise movement of the arm about its pivot. This movement of the arm 58 disconnects the gear 53 from the gear 52 and conditions a resetting mechanism to reset the subtracting indicator of which all of this is a part.

Attention is first directed, however, to the remaining portions of the indicator, referring again to the member 59 which is an integral portion of a cover plate 73 mounted upon a housing 74 and cooperating with a wall 75 of the housing, to provide a compartment 76 for a gear 77. The housing 74 is supported by a panel 78 and has its open front end closed by a transparent cover 79 for observation of the indicating portions of the indicator. The cover 79 is held in place by an annular member 80 through the aid of screws 81. The member 59 together with the adjacent portion of the cover 73, is apertured to receive a spindle 82 held against rotation by a key 83. An outer indicating element 85 of the cross sectional contour illustrated in Fig. 6, this element being circular in general contour, is rotatably supported on the spindle 82 by the aid of a bearing 86, the latter being disposed in a hub-like portion 87 of the element. On the hub-like portion 87 the gear 77 is mounted, and due to the fact that the gear 77 is driven by the gear 55 the element 85 will be driven at the same speed as the gear 77.

A bearing 88 is disposed in an aperture of the element 85 for a shaft 89, the ends of which support planet gears 90 and 91, these gears travelling in a circuitous path with the element 85. The planet gear 90 interengages a sun gear 92, the latter being fixedly mounted in an aperture of the wall 75 of the housing 74. The planet gear 91 interengages a sun gear 93 which is mounted upon a hub portion 94 of an inner indicating element 95. The sun gears 92 and 93 are similar in structure excepting in their number of teeth, the gear 92 having one or more teeth more than the gear 93, the purpose of which will hereinafter be described. The hub portion 94 of the element 95 is supported by the aid of bearings 97 upon the spindle 82 and serve, through the aid of a bearing 98, to additionally support the outer element 85 for rotation relative to the spindle and to the inner element. The elements 85 and 95 have indicating plates 100 and 101 respectively mounted thereon and disposed in a common plane concentric with each other. The plate 100 is provided with graduations 102, each representing five feet and convenient markings being provided, extending from a zero position 103, to assist the operator in accurately locating the desired graduation. In other words, one complete rotation of the outer indicating element with its plate 100 will indicate that five hundred feet of material have passed the roll 18. The plate 101 is also provided with a circular arrangement of markings 104, each mark in this instance representing five hundred feet or one complete cycle of the outer element 85 and its plate 100. In other words, a complete cycle of the inner element 95 with its plate 101 indicates that twenty thousand feet of material have passed the roll 18, the markings on the plate 101 extending also from a zero position, this position indicated at 105.

Returning now momentarily to the sun gears

92 and 93, the difference in their structures, namely their number of teeth, affects movement of the inner element 95 the distance of one marking during each complete cycle of the outer element 85.

The inner element 95 has a central hollow portion 108 in which a control member 109 is disposed, this member being held against rotation through a key 110, fixing the member to the spindle 82. The spindle 82 is also assured against rotation and against longitudinal movement by a retaining nut 111 mounted on the opposite end thereof and functioning with a collar 112 which engages the cover plate 73 and also serves to maintain proper location of the hub 87 of the outer element 85 and its gear 77.

The member 109, as illustrated in Fig. 8, carries a cam member 114 which is of the contour shown and adapted to cause axial movement of a spring pressed plunger 115 of the inner element 95, when the plunger is moved into registration with the cam.

The plunger 115 is normally urged toward the axis of the inner element 95 by a spring 116 but is limited in its movement by a pin 117 supported by the element and extending through an elongate aperture 118 of the plunger. Another plunger 119, identical in structure to the plunger 115 and under the control of a spring 120 and a pin 121, is carried by the outer element 85, as shown in Fig. 8. The plungers 115 and 119 have their outer ends rounded to provide cam-like surfaces for engagement with each other and for the engagement of the plunger 115 with the cam 114 when they are all brought into general alignment with each other. Another plunger 122 is disposed in an aperture 123 of the housing 74 and normally rests upon a head portion 124 but is movable outwardly in its aperture when the plungers 115 and 119 are both brought into alignment with the cam 114. This occurs only when the selected length of material has passed the roll 18 and the elements 85 and 95 with their plates 100 and 101 respectively, have returned to zero positions. The plunger 122 engages an end of a lever 126, which is pivoted at 127 and engages intermediate its ends an actuating plunger 128 of a switch 129.

Attention is now directed to the resetting mechanism which is linked with the arm 58 and its actuating means, namely the cam 66 and the handle 69. The shaft 54 supported by the end 57 of the arm 58 has a gear 132 mounted thereon (Figs. 2, 3 and 6) which is adapted to be moved into engagement with a gear 133 when the cam 66 is moved into a position opposite that shown in Figs. 2 and 7. The gear 133 is mounted upon a shaft 134, the latter being supported by suitable bearings and having a smaller gear 135 also mounted thereon. The gear 135 interengages a gear 136 on a shaft 137, the latter being journalled in suitable bearings and having a hand wheel 138 mounted upon the outer end thereof externally of the cabinet 27.

Attention is now directed to Fig. 9, which illustrates a simple wiring diagram of the control circuits. Reference numerals 140 and 141 indicate the lines of a general circuit receiving electrical energy from a suitable source. The motor 14 is illustrated schematically as a three-phase induction motor, receiving a source of electrical energy through conductors 142, 143 and 144. In these conductors are contacts, indicated generally at 145, which are under the control of a relay 146, the contacts being of the normally open type. The relay 146 is in a starting circuit which may be traced from line 140 at connection 147, through a normally closed stop switch 148, a start switch 149 when closed, as illustrated, through the relay 146, a normally closed contact 150, to the line 141 at connection 151. When the relay 146 is energized the contacts 145 are closed, conditioning the motor circuit to energize the motor 14. When the circuit has been completed through the relay 146, a locking circuit is also completed by the closing of the contact 152, this locking circuit shunting the start switch 149 from connection 153 through the contact 152 to connection 154. The relay 146 then remains energized through this locking circuit after the starting switch has been released. The contact 150 is under the control of a relay 156, the latter being energized when the switch 129 is closed through the cam 114 (Fig. 8), the plungers 115, 119 and 122 and lever 126. When the circuit has been completed through the closing of the switch 129 it may be traced from line 140 at connection 157 through the relay 156, switch 129, to line 141 at 158. A locking circuit for the relay 156 is completed through a contact 159 and a contact 160 of switch 63, this locking circuit shunting the switch 129 from a connection 162, through contacts 159 and 160, to connection 163. There is also a contact 164 in the switch 63 which maintains a locking circuit for the relay 156 during and after the actuation of the cam 66, to render inoperative the indicating unit and to render operative the resetting mechanism therefor. This locking circuit also shunts the switch 129 and may be traced from connection 165 through contact 164 to connection 163. Another control circuit is provided to cause jogging of the apparatus. This circuit is under the control of a double switch 175 having two contacts 176 and 177 and a normally open contact 178 of the relay 156. The circuit may be traced from line 140 at 179, through contact 176, when closed, connection 180, relay 146, connection 181, contact 177, when closed, contact 178 to line 141 at 182. Through this circuit the relay 146 may be energized to start the motor 14 through the closing of the contacts 145, only, however, after the stopping circuits have been completed through the relay 156.

During the operation of the apparatus, let it be assumed that the apparatus is idle and that the operator is desirous of producing fourteen thousand three hundred feet of material thereby. With the knowledge of the length of time it takes for the apparatus to stop completely after the power means therefor has been rendered ineffective and the length of material produced during this stopping period of the apparatus, the operator may readily determine proper setting of the indicating plates 100 and 101 in order that the apparatus may be stopped at the desired moment. For example, let it be assumed that fifty feet is the additional amount produced by the apparatus during the stopping period. Therefore, in order that the apparatus may be stopped after the desired length of material has been produced, the indicating plates 100 and 101 are set, with respect to a pointer 170, for the desired length minus fifty feet. The setting of the plates is made possible through the resetting mechanism by first moving the handle 69, causing the cam 66 to move the arm 58 clockwise, moving the gear 132 into engagement with the gear 133 while the gear 55 maintains engagement with the gear 77. The gear 53 has, however, during this movement, been moved out of engagement with the gear 52, disconnecting the indicating unit from its power means and coupling it with the receiving unit

25. During this movement the gear 55 is moved in an arcuate path about the axis of the gear 77, maintaining its connection therewith. Therefore, during rotation of the hand wheel 138, the gear 136 drives the gear 135 which, through the shaft 134, drives the gear 133, the latter at this time being connected to the gear 132 which, when driven, drives the gear 55 to drive the gear 77. The gear 77 is directly connected with the outer element 85 and through its rotation in a proper direction, will move its indicating plate relative to the pointer 170. The outer element 85 with its indicating plate 100 must, however, be rotated a definite number of revolutions to cause rotation of the inner element 95 and its indicating plate 101 through the epicyclic gearing, namely the planet gears 90 and 91 and their sun gears 92 and 93. This operation is continued until the indication 14,000 on the plate 101 registers with the pointer 170 and the indication 250 on the plate 100 registers also with the pointer. The indication 250 has been selected instead of the 300 indication on the plate 100 to allow for the additional fifty feet produced by the apparatus during the stopping period. The indicating or subtracting unit is thus conditioned to prepare the apparatus for operation. At this time the plungers 115 and 119 have been moved out of alignment with the cam 114 and plunger 122, allowing the lever 126 to move downwardly about its pivot and effect opening of the switch 129. The relay 156, however, remains energized until the elements 85 and 95 of the indicating unit have been disconnected from the resetting mechanism and operatively connected to the driving mechanism during actuation of the cam 66 through the handle 69, to render the resetting mechanism effective. The switch 63 is moved into its downward position, rendering effective the locking circuit for the relay 156 through the contacts 159 and 160, continuing a locking circuit which originally was completed through the contact 164. However, during the movement of the arm 58 through the movement of the cam 66 into the position shown in Figs. 2 and 7, the switch 63 is again actuated, closing the circuit including the contact 164, but during this movement of the switch the contact 160 opens its circuit through the contact 159 prior to the closing of the circuit through the contact 164, and due to the fact that the switch 129 is open through the previous resetting of the elements 85 and 95 and their indicating plates, the relay 156 is deenergized, allowing the contact 150 to make, conditioning the circuit with the relay 146 to be closed by the start switch 149 when the operator is ready to start the apparatus in motion. At this time the operator may press the start switch, completing the circuit through the relay 146 and the normally closed contact 150, closing the contacts 145 to condition the motor 14 for operation and locking in the relay through the contact 152.

Once the apparatus is set in motion by the driving of the motor 14, the material 10 will be advanced, causing rotation of the roll 18 at a speed determined by the speed of advancing of the material. Rotation of the roll 18 will drive the transmitting unit 20 and, through its connection with the receiving unit 25, will cause rotation of the latter at the same speed. The gear connection between the receiving unit 25 and the counter 36 is such that the counter will accurately register in feet the length of the material 10 as it passes the roll 18. The connection between the receiving unit and the counter, as previously described, includes gears 30 and 31, the shaft 32, the bevelled gears 33 and 34, and the shaft 35 of the counter. At the same time the gear 29 of the receiving unit 25 will drive the gear 50, driving also the gears 52, 53 and 55. The gear 55 will drive the gear 77, which in turn will drive the outer element 85 clockwise (Fig. 4) at a speed, determined by the train of gears just described, equal to one indication for each five feet of the material passing the roll 18. During the clockwise rotation of the outer element 85 with its plate 100, the planet gears 90 and 91 are moved in a circuitous path about their sun gears 92 and 93 and through the variations in the sun gears the inner element 95 and its plate 101 will be moved the distance of one indication on the plate for each revolution of the outer element 85 or each five hundred feet of the material passing the roll 18. This operation continues, the outer element 85 during each cycle causing alignment of its plunger 119 with the cam 114 and the plunger 122 but not effecting actuation of the switch 129 through the lever 126 due to the absence of the plunger 115. However, when the inner element 95 has moved a sufficient distance to locate the zero position in alignment with the pointer 170, the plunger 115 will be disposed in engagement with the cam 114, the cam causing the plunger to move upwardly against the force of the spring 116, positioning the upper end of the plunger 115 so that, during the next cycle of the outer element 85, the indicating unit will be conditioned to effect actuation of the switch 129 the moment the indicating plate 100 presents its zero position at the pointer 170. At this time the plunger 119 moves between the plunger 115 and the plunger 122, riding upon the former and moving the latter upwardly, effecting movement of the lever 126 to move the switch plunger 128 upwardly to close the switch 129. This condition exists only momentarily, for the reason that due to the momentum of the apparatus this operation will continue to advance the material. However, the motor 14 is deenergized through the effect of the closing of the switch 129. This completes the previously described circuit through the relay 156, opening the contact 150 to deenergize the relay 146 and effect opening of the contacts 145 to deenergize the motor 14.

Although the switch 129 is closed momentarily, the relay 156 is locked in through the contact 164 of the switch 63 and the contact 159 is closed to condition the locking circuit through the contact 160 when the cam 66 is moved to render the driving means for the indicating unit ineffective and rendering effective the resetting mechanism through the shifting of the gears 53 and 132 relative to their respective gears 52 and 133. At this time the counter 36 should be observed to determine exactly the length of material which has passed the roll 18. If the counter 36 registers fourteen thousand three hundred feet, the material may then be severed and removed on its take-up reel from the apparatus, an empty take-up reel being provided for an additional length of the material to be wound thereon. If the next length produced by the apparatus is to be the same as that previously produced, the indicating unit may again be set through the resetting mechanism to locate the plates with the indication 14,000 on the plate 101 adjacent the pointer 170 and the indication 250 on the plate 100 adjacent the pointer. The apparatus may again be set in motion in the same manner as previously described and the same results will

be accomplished. If it is desirable to produce different lengths the same operations may take place governed only by the variations in the positioning of the indicating plates 100 and 101 with respect to the pointer 170. Furthermore, if the apparatus should stop prior to the time assumed at the setting of the indicating unit, the motor 14 may be temporarily energized through the jogging switch 175. The closing of this switch may close a circuit through the relay 146, when the contact 178 is closed, to close the contacts 145 and condition the motor 14 to rotate the roll 15 and further advance the material. In this instance the material will travel at a slower speed, due to the possible slow starting of the motor and, if desired, the repeated opening and closing of the jogging circuit, until the desired length of material has been produced, the operator viewing the counter 36 during this operation.

The counter 36 may be readily reset by movement of the lever 40 clockwise about its pivot (Fig. 5), moving the shaft 35 against the force of the spring 42 to move the bevelled gear 34 out of engagement with the bevelled gear 33 and move the bevelled gear 46 into engagement with the bevelled gear 47. When in this position the hand wheel 49 may be rotated in the proper direction, to move the mechanism of the counter so as to return it to zero position. The counter is thus conditioned prior to each operation of the apparatus.

The embodiment of the invention herein disclosed is merely illustrative and may be widely modified and departed from in many ways without departing from the spirit and scope of the invention as pointed out in and limited solely by the appended claims.

What is claimed is:

1. A material handling apparatus comprising motor driven means to advance material, an indicating unit adapted to be set for a selected length of the material, a mechanism driven by the material and adapted to actuate the indicating unit when operatively connected thereto, a setting mechanism actuable to set the unit when operatively connected thereto, and connecting means adapted for selective movement into engagement with either mechanism to operatively connect them singly with the unit.

2. A material handling apparatus comprising cooperating drive and counter rolls to advance a material, a motor energizable to rotate the drive roll, the counter roll being driven by the material, an indicating unit remotely disposed with respect to the said rolls and having an element adjustable from a normal position to a selected position to register a given length of material to be advanced, an electrically operated receiving unit disposed adjacent the indicating unit and adapted to move the element toward the normal position when operatively connected thereto, an electrical transmitting unit driven by the counter roll to cause operation of the receiving unit, means actuable by the element when returned to its normal position to cause deenergization of the motor, a mechanism actuable to adjust the element when operatively connected thereto, and connecting means adapted for selective movement into engagement with either the adjusting mechanism or the receiving unit to operatively connect them singly with the element.

3. A material handling apparatus comprising cooperating drive and counter rolls to advance a material, a motor energizable to rotate the drive roll, the counter roll being driven by the material, an indicating unit remotely disposed with respect to the said rolls and having an element adjustable from a normal position to a selected position to register a given length of material to be advanced, an electrically operated receiving unit disposed adjacent the indicating unit and adapted to move the element toward the normal position when operatively connected thereto, an electrical transmitting unit driven by the counter roll to cause operation of the receiving unit, means actuable by the element when returned to its normal position to cause deenergization of the motor, a mechanism actuable to adjust the element when operatively connected thereto, connecting means adapted for selective movement into engagement with either the adjusting mechanism or the receiving unit to operatively connect them singly with the element, and means under the control of the connecting means to maintain the motor deenergized during adjustment of the element.

LESTER O. REICHELT.