Feb. 18, 1947. W. L. SHEFFIELD 2,415,854

DRIVING AND COUNTING SYSTEM

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FIG. 1.

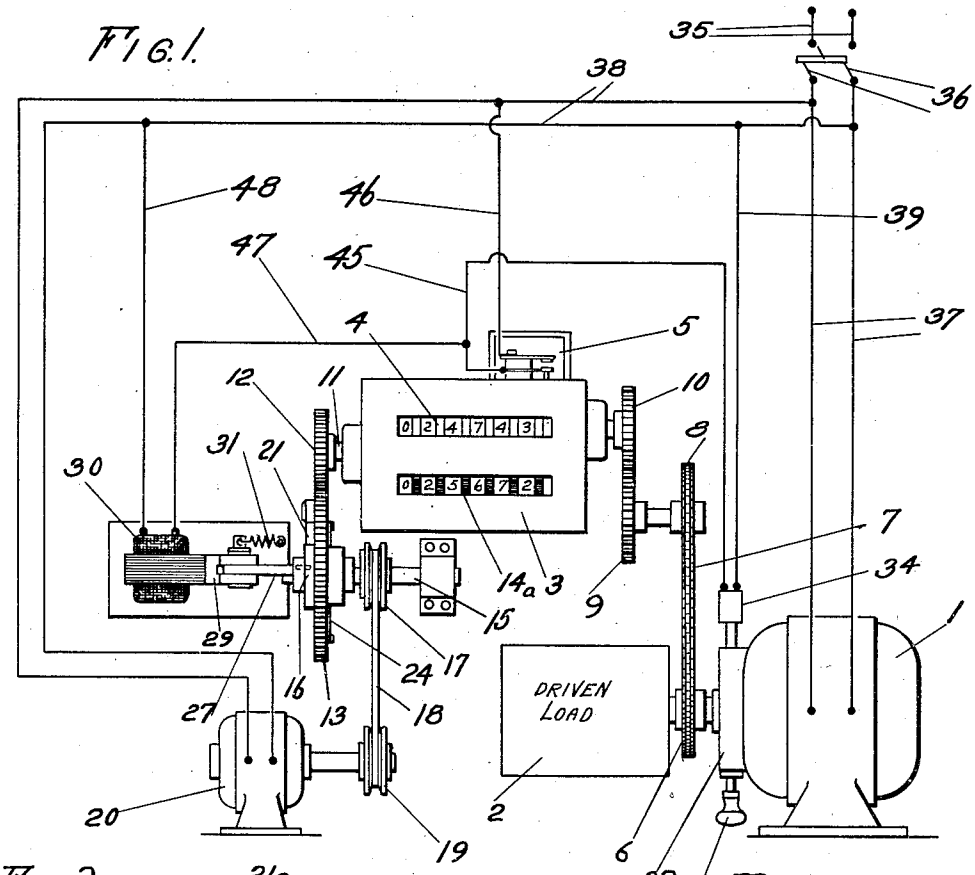


FIG. 2.

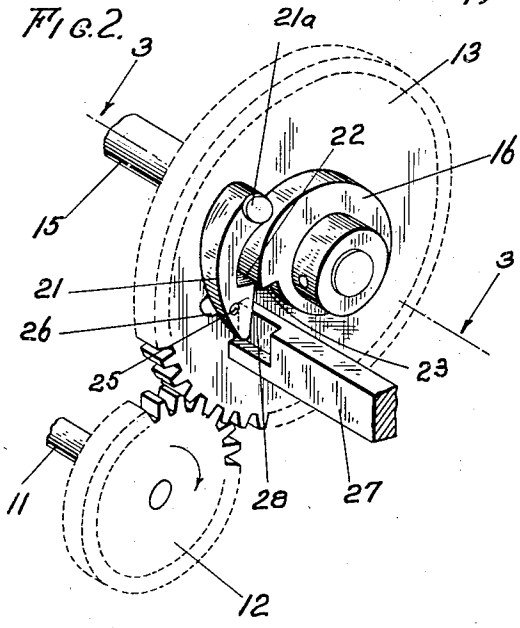
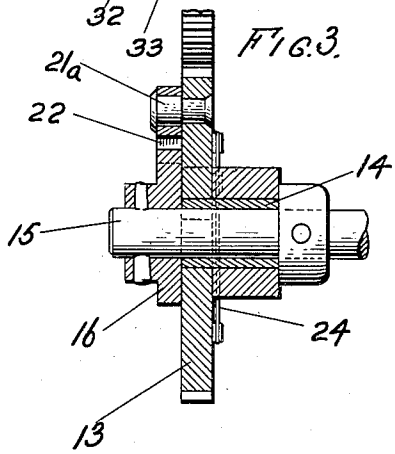


FIG. 3.



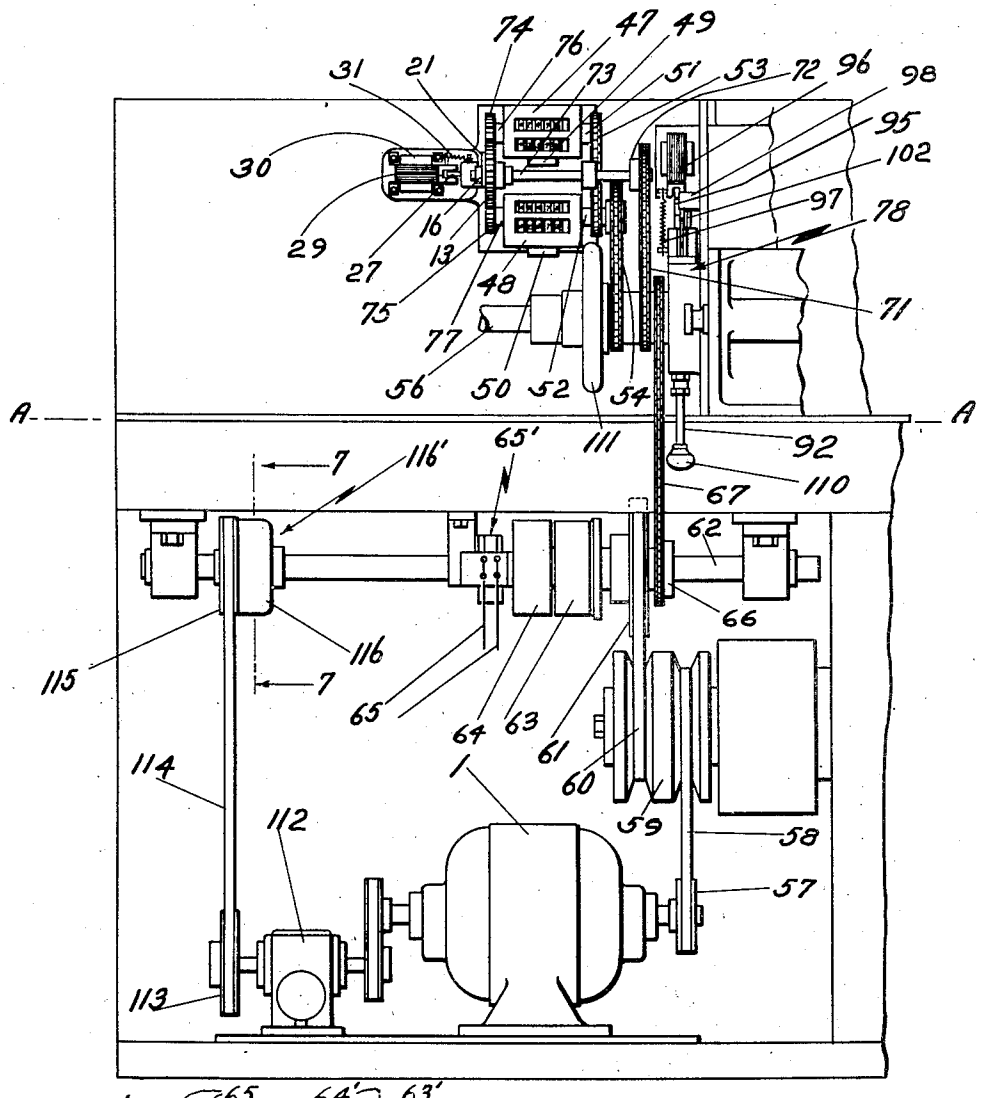
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DRIVING AND COUNTING SYSTEM

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FIG. 4.



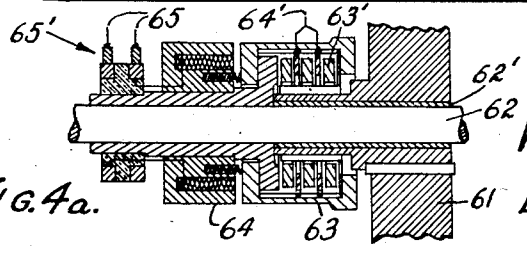


FIG. 4a.

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FIG. 5.

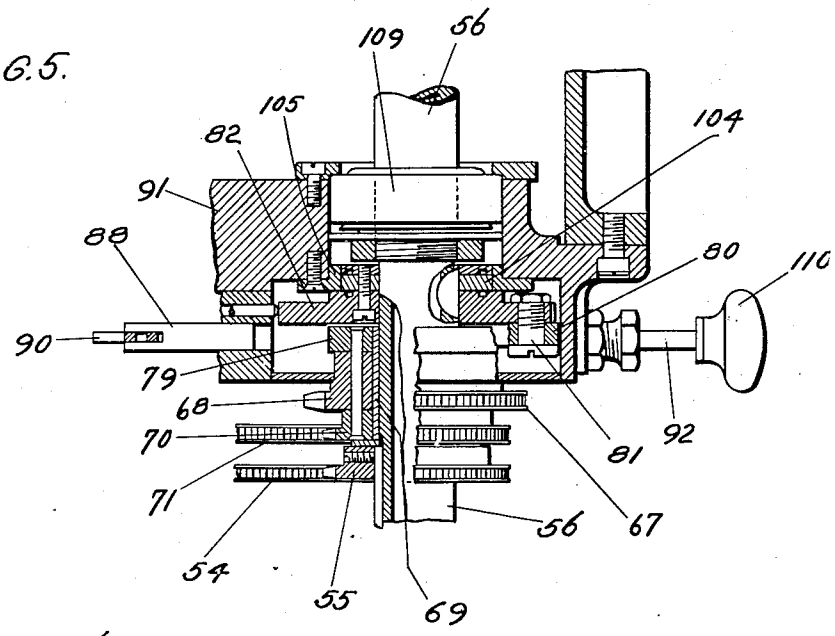
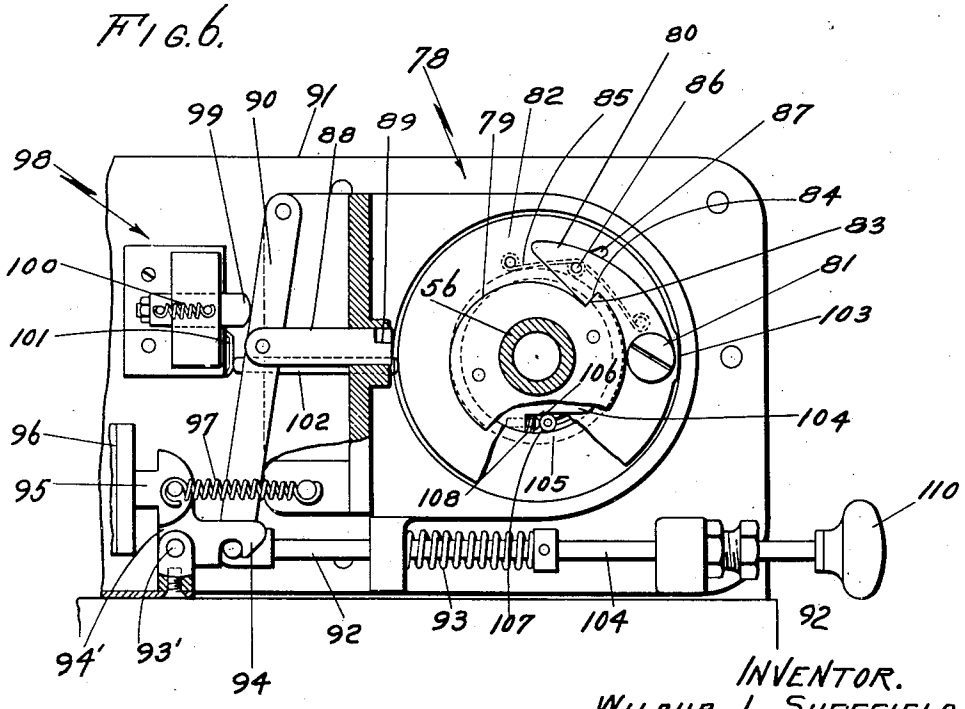


FIG. 6.



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FIG. 7.

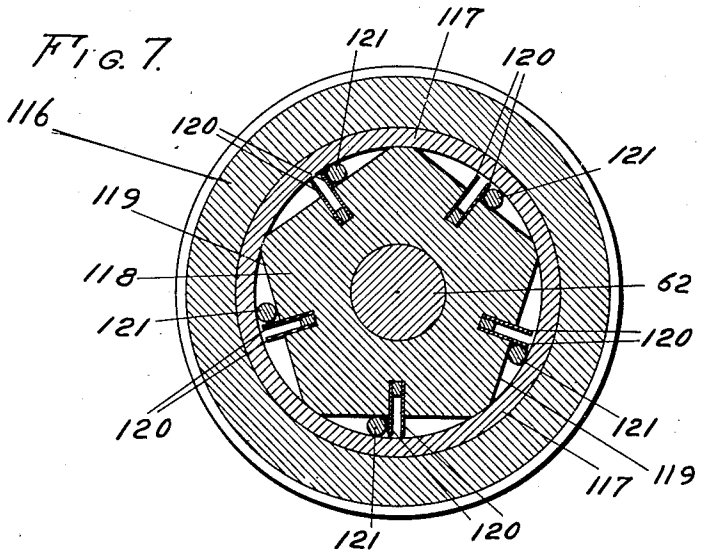
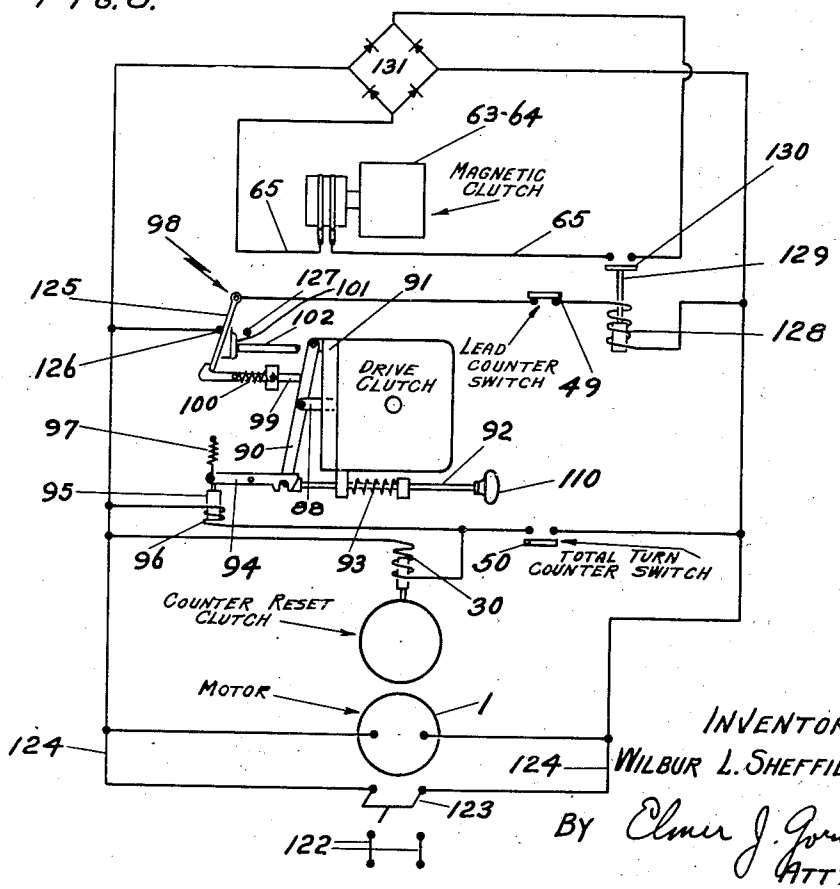


FIG. 8.



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UNITED STATES PATENT OFFICE

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DRIVING AND COUNTING SYSTEM

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Application May 18, 1944, Serial No. 536,190

7 Claims. (Cl. 235—132)

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This invention relates to a system in which a driven load is rotated through a predetermined number of revolutions, the rotation of said driven load is stopped, and the cycle of operations repeated. In such a system a counting mechanism is used, whereby the predetermined number of revolutions may be selected. In such systems it is desirable that the counting mechanism be reset to its zero position at the completion of the predetermined number of revolutions. Heretofore it has been the practice for the counting mechanism to be reset by manually-operated means.

An object of this invention is to devise a simple and reliable mechanism for automatically resetting to its zero position the counting mechanism of a system as described above.

Another object is to devise such a system as will operate without undue shock during each of the various stages of operation through which the system passes.

A further object is to improve certain mechanism details of such a system in the interest of simplicity of fabrication and adjustment.

The foregoing and other objects of this invention will be best understood from the following description of exemplifications thereof, reference being had to the accompanying drawings, wherein:

Fig. 1 is a diagrammatic view of a system comprising an embodiment of my invention;

Fig. 2 is an enlarged perspective view of the counter reset clutch mechanism incorporated in the system of Fig. 1;

Fig. 3 is a fragmentary cross-section taken along line 3—3 of Fig. 2;

Fig. 4 is a diagrammatic vertical view of another embodiment of my invention, the portion above the line A—A being rotated out of a horizontal plane into a vertical plane in the interest of simplicity of illustration;

Fig. 4a is an enlarged cross-sectional view of the magnetic clutch shown in Fig. 4;

Fig. 5 is an enlarged section, partly broken away, of the driving clutch mechanism incorporated in the arrangement of Fig. 4;

Fig. 6 is an enlarged end view of said driving clutch mechanism, partly broken away, as viewed from the bottom of Fig. 5;

Fig. 7 is a section of an over-running clutch taken along line 7—7 of Fig. 4; and

Fig. 8 is a diagram of the electrical portions of the system illustrated in Figs. 4–6.

In the embodiment illustrated in Figs. 1–3 there is provided a driving motor 1 which is adapted to

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drive a driven load 2 through a predetermined number of revolutions during each of a plurality of cycles of operation. In order to count the revolutions through which the driven load 2 is rotated, there is provided a counting mechanism 3 which may be of any suitable standard type such as a Vedder-Root predetermining counter, Model CF–106715. Such a counting mechanism may be provided with a register 4, so that the revolutions counted may be observed thereon. Also such a standard counting mechanism is supplied with a switch 5 the contacts of which are adapted either to be separated or to be brought into contact with each other when the number of revolutions counted by the mechanism 3 reaches a predetermined number. As is well known with counting mechanisms of this type, such a predetermined number of revolutions can be set up in the counting mechanism 3 by the operator by means of suitable presetting members 14a.

In order that the revolutions of the driven load 2 may be transmitted to the counting mechanism 3, a positive drive must be established between the counting mechanism 3 and the driven load 2. Such a positive drive may be provided by a sprocket 6 mounted on and attached to the same shaft that carries driven load 2. Said sprocket 6 drives a chain 7 which in turn drives sprocket 8 mounted on and attached to a shaft that carries a gear 9 which meshes with a gear 10 carried on and attached to the input shaft of the counting mechanism 3. Thus as the driven load 2 is rotated, the counting mechanism 3 will count rotations of said driven load.

In accordance with well-known constructional features, the counting mechanism 3 is also provided with a reset shaft 11, whereby at any desired time after the counting shaft has been subjected to a number of counted revolutions, the counting mechanism 3 may be reset to its zero position. In order to actuate the reset shaft 11, said shaft is provided with a gear 12 engaged by a driving gear 13, which during the counting operation of the system is maintained in the stationary position. The gear 13 is provided with a central bushing 14 (Fig. 3) in which is journalled a reset shaft 15. Said shaft 15 has secured to one end thereof a reset cam 16 which thus rotates as the shaft 15 rotates. Said shaft 15 may be driven by a pulley 17 secured thereto, said pulley being driven by a belt 18 engaging a pulley 19 driven by a relatively small reset motor 20.

The gear 13 is provided with a pawl 21 pivoted at 21a to the side of said gear. The pawl 21 is

provided with a shoulder 22 which is adapted to be engaged by a corresponding shoulder 23 on the cam 16. The pawl 21 is forced toward the cam 16 by means of a spring 24 (Fig. 3) mounted on the back side of the gear 13, and engaging a pin 25 (Fig. 2) and extending through a slot 26 in the gear 13, and secured to the pawl 21. In order to hold the pawl 21 out of engagement with the cam 16 and thus maintain the gear 13 in a stationary position, there is provided a stop rod 27 having a shoulder 28, so that when the rod 27 is moved into a position adjacent the pawl 21, the nose of said pawl engages said shoulder 28 and is thus held out of engagement with the cam 16. The stop rod 27 is carried and actuated by an armature 29 which is adapted to be moved by an electromagnetic coil 30. The armature 29 and thus the stop rod 27 are biased toward the pawl 21 by means of a spring 31.

The motor 1 drives the driven load 2 through a main clutch 32, which may be identical with the clutch 78 described in greater detail in connection with an additional embodiment of this invention and illustrated in detail in Figs. 5 and 6. The clutch in Fig. 1 may be supplied with a clutch-engaging handle 33 (corresponding to handle 110 of Figs. 5 and 6) which when actuated causes the clutch to be engaged, whereby the motor 1 drives the driven load 2. Said clutch 32 is also provided with a magnetically-operated disengaging mechanism 34 (corresponding to members 95—96 of Figs. 5 and 6), which when supplied with energizing current disengages the clutch and causes the driven load to stop.

The system illustrated in Fig. 1 is supplied with electrical energy from a pair of power lines 35. These power lines are connected by means of a main switch 36 to a pair of lines 37 connected to the motor 1. Likewise said switch connects the power lines 35 to a pair of lines 38 connected directly to the motor 20. It will be seen, therefore, that when the switch 36 is closed, both motors 1 and 20 are rotated continuously. A conductor 39 connects one of the conductors 38 to one terminal of the clutch-disengaging mechanism 34, the other terminal thereof being connected through a conductor 45, the switch 5, and through conductor 46 to the other line 38. Thus it will be seen that when switch 5 closes, the clutch-disengaging mechanism 34 operates to disengage the clutch 32 and stop the driven load 2. A conductor 47 extends from conductor 45 to one terminal of the coil 30, the other terminals thereof being connected by means of a conductor 48 to the lower of the lines 38. Thus when switch 5 closes, it also actuates coil 30 to pull the stop rod 27 out of engagement with the pawl 21, thus permitting the spring 24 to move said pawl 21 toward the cam 16.

The operation of the system as described above is substantially as follows. The operator sets up in mechanism 3 by means of the presetting members 14a the predetermined number of revolutions through which the driven load 2 is to be rotated. Thereupon the switch 36 is closed and the motors 1 and 20 are started. The clutch 32 is in its disengaged position, and thus the driven load 2 is not rotated until the clutch-engaging handle 33 is actuated. The switch 5 being in its open position, the coil 30 is deenergized, and thus the stop rod 27 holds the pawl 21 out of engagement with the cam 16, so that the gear 13 is maintained stationary. Thereupon the clutch-engaging handle 33 is actuated, and the driven load 2 is rotated. At the same time the counting shaft of the counting mechanism 3 is rotated so that the rotations of the driven load 2 are counted. When the predetermined number of revolutions is reached, the counting mechanism 3 closes the switch 5. This energizes the clutch-disengaging mechanism 34 which disengages the clutch 32 and stops the rotation of the driven load 2. Closure of the switch 5 also energizes coil 30 which pulls the stop rod 27 out of engagement with the pawl 21. Therefore the shoulder 23 on the cam 16 will engage the corresponding shoulder 22 on the pawl 21, and thus drive the gear 13. This in turn rotates the counter reset shaft 11, which thus resets the counting mechanism 3 toward its zero position. As the resetting is initiated, the switch 5 reopens which deenergizes the clutch-disengaging mechanism 34. However, as previously indicated, the clutch 32 is not reengaged until the handle 33 is again actuated. Also the coil 30 is deenergized which causes the spring 31 to again move the stop rod 27 toward the gear 13. As the gear 13 approaches the end of a complete revolution, the nose of the pawl 21 will engage the shoulder 28. This moves the pawl 21 out of engagement with the cam 16, which thus is permitted to continue its rotation while the gear 13 is held stationary by the shoulder 28. The proper gear ratio is selected between the gears 13 and 12, so that a single complete revolution of the gear 13 is sufficient to rotate the reset shaft 11 to reset the counting mechanism 3 to its zero position. Thereupon the motors 20 and 1 continue to rotate, but neither the driven load 2 nor the counting mechanism 3 is actuated. In order to restart the cycle, the clutch-engaging handle 33 is actuated, whereupon the driven load 2 is again rotated and the above sequence of operations repeated.

Of course the principles of my invention, as illustrated by the above embodiment, may be incorporated in a wide variety of devices. For example, it may be desired to utilize a common drive both for the counting and the resetting shafts of the counting mechanism. It also may be desirable to introduce variations in the speeds at which the main clutch and the counter reset clutch are engaged and run. Under these conditions it may be desired to use a plurality of counting mechanisms. An embodiment of my invention incorporating such variations is illustrated in Figs. 4–8.

In Figs. 4–8 the same reference numerals are used as in Figs. 1–3, where the elements are identical. In the embodiment of Figs. 4–8 there is provided a lead counter 47 and a total turn counter 48. The lead counter 47 is provided with a switch 49 similar to switch 5 in Fig. 1, which switch 49 is normally closed until the predetermined number of revolutions set up in the counter 47 is reached, at which time the switch 49 opens. The total turn counter 48 is provided with a similar switch 50, which however is normally in its open position until the counter 48 reaches the predetermined number of revolutions set up therein, at which time the switch 50 closes. The counters 47 and 48 are provided, respectively, with counting shafts 51 and 52. These counting shafts carry sprockets which are caused to rotate synchronously by means of a chain 53 or other positive means engaging both of said sprockets. The shaft 52 is provided with an additional sprocket which is engaged by a chain belt 54 driven by a sprocket 55 connected to the shaft 56 which rotates a load member (not shown). Thus as the shaft 56 rotates, the rotations thereof are imparted to the counting shafts 51 and 52, and these revolutions are counted by

the counters 47 and 48. The motor 1 is provided with a pulley 57 driving a belt 58, which in turn drives an idler pulley 59. The idler pulley drives a belt 60 which in turn engages a pulley 61 which, as shown in Fig. 4a, is journalled on a shaft 62 so as to rotate freely on bushing 62' on said shaft unless connected thereto. In order to connect the pulley 61 to the shaft 62, said pulley carries one element 63' of a magnetic clutch, said element consisting of a plurality of clutch plates non-rotatably connected to said pulley 61 and surrounded by a magnetic armature 63. Said armature 63 is non-rotatably mounted upon shaft 62 but may move to a limited extent along said shaft 62 under the influence of an electromagnet 64 likewise fixed to the shaft 62. Said armature 63 has non-rotatably mounted therein a plurality of clutch plates 64' interposed between the clutch plates 63'. The electromagnet 64 may be energized from a pair of leads 65 connected to a brush and slip-ring arrangement 65' likewise carried by the shaft 62. Thus when the electromagnet 64 is energized it attracts armature 63 which causes the clutch plates 63' and 64' to engage with each other thus connecting the pulley 61 to the shaft 62. Also directly fastened to the shaft 62 is a sprocket 66 which drives a chain belt 67, which in turn engages and drives a sprocket 68. The sprocket 68 is provided with an interior bushing 69 within which the shaft 56 is journalled. In this way the sprocket 68 and the elements connected thereto can rotate freely around the shaft 56 unless coupled thereto by a suitable clutch mechanism. Rigidly secured to the sprocket 68 is a sprocket 70 driving a chain 71 which drives a sprocket 72 mounted on a counter reset shaft 73. This shaft 73 is analogous to the shaft 15 in Fig. 1, and thus drives the counter reset driving gear 13. In the embodiment of Fig. 4 the gear 13 engages and drives gears 74 and 75 mounted respectively on reset shafts 76 and 77 of the counters 47 and 48, respectively.

A clutch, generally designated as 78, is provided for causing the sprocket 68 to drive the shaft 56. The details of the clutch 78 are shown in Figs. 5 and 6. Rigidly connected to the sprocket 68 is a cam 79 which during the driving period is adapted to engage with a pawl 80 pivoted by a pin 81 to a driving plate 82 fastened to the shaft 56. The cam 79 is provided with a shoulder 83 which during the driving period engages a corresponding shoulder 84 on the pawl 80. A spring 85 fastened to the back face of the driving plate 82 engages a pin 86 which projects through a slot 87 and is fastened to the pawl 80. In this way the spring 85 biases the pawl 80 toward its position of engagement with the cam 79.

In order to disengage the pawl 80 from the cam 79, there is provided a stop rod 88 having a shoulder 89 which when moved toward the cam 79 engages the nose of the pawl 80, thus moving said pawl out of engagement with the cam 79 and holding said pawl thus disengaged. The stop rod 88 is adapted to be moved into its stop position by a link 90 pivoted at its upper end to the frame 91 of the machine and pivoted at an intermediate point to the stop rod 88. The lower end of the link 90 is pivoted to one end of a clutch-actuating rod 92 which is biased toward its stop position by means of a spring 93. The stop mechanism including the stop rod 88 is adapted to be held in the running position by means of a latch 94 pivoted at a pivot point 93' to the base 91. The latch 94 carries a fulcrum arm 94' pivoted to one end of an armature 95 adapted to be actuated by an electromagnetic coil 96. The armature 95 is adapted to be biased to its outer position by means of a spring 97.

For purposes of control to be described below, there is also associated with the stop mechanism a micro-switch 98 provided with a reset button 99 biased outwardly from the micro-switch by a spring 100. The button 99 is engaged by the link 90 in its running position, and thus the spring 100 is prevented from moving the button 99 outwardly from the micro-switch 98. The micro-switch 98 is of a well-known type in which the switch opens if the button 99 is moved outwardly therefrom by the spring 100. In this well-known type of micro-switch when the spring member 101 is pushed inwardly, the micro-switch 98 recloses, provided at that time the reset button 99 is also moved inwardly against the action of the biasing spring 100. The spring member 101 is adapted to be actuated by a switch-closing rod 102 which when moved inwardly against the action of the spring 101 is adapted to re-close the micro-switch 98. The spring arm 101 also biases the rod 102 toward the edge of the driving plate 82, and thus the inner end of said rod engages and rides on the edge of said driving plate. The driving plate 82 is provided with a cam projection 103 which is thus adapted to force the rod 102 inwardly against the action of the spring arm 101 so as to re-close the micro-switch 98.

It will be noted that when the nose of the clutch 80 engages the shoulder 89 so as to stop rotation of the shaft 56, the action of the spring 93 exerts a pressure on the pawl 80 tending to rotate it together with its driving plate 82 in a reverse direction. Since it is desirable to stop the shaft 56 in a definite predetermined position without any reversal of its rotation, I have provided a stop mechanism to prevent such reverse rotation. For this purpose the driving plate 82 is provided with a clutch plate 104 adapted to rotate inside the stop race 105 fixed to the frame 91. The clutch plate 104 is provided with one or more cut-away portions 106, each of which receives a roller 107. Each roller 107 is engaged by a spring-biased pin 108 tending to move the roller 107 into engagement with the stop race 105. If the driving plate 82 rotates in a counter-clockwise direction, as viewed in Fig. 6, the rollers 107 are disengaged from the stop race 105 and thus permit the driving plate 82 together with the shaft 56 to rotate freely. If, however, the driving plate 82 tends to rotate in a clockwise direction, the rollers 107 will bind against the stop race 105, prevent such rotation, and lock the plate 82 and the shaft 56 in their stopped position.

The shaft 56 may be carried in a suitable bearing 109. The clutch-actuating rod 92 may be provided with a suitable handle 110 so that the operator may manually reengage the clutch. The shaft 56 may also be provided with a hand wheel 111, so that the operator may rotate the shaft 56 by hand if so desired.

Under certain conditions of operation, it is desired that the shaft 56 as well as the counter reset shaft 73 be rotated at a reduced speed. For this purpose the motor 1 also drives a speed-reducing gear mechanism 112, the output pulley 113 of which drives a belt 114. The belt 114, in turn drives a pulley 115 mounted on the casing member 116 of an overrunning clutch 116'. The casing 116 is provided with an inner race surface

117 within which rotates a clutch plate 118 fastened to the shaft 62. The edge of the clutch plate 118 is machined off to provide a plurality of flat surfaces 119 each at substantially right angles to the radius of said clutch plate and each extending completely across its respective portion of said clutch plate 118. At the center of each surface 119 there is provided a spring-biased assembly consisting of a pair of leaf springs 120 set into a recess provided in the surface 119. A roller 121 is inserted at one side of each of the spring-biasing assemblies. Thus if the casing 116 tends to rotate in a clockwise direction, as viewed in Fig. 7, the rollers 121 will bind against the inner race surface 117, and thus drive the clutch plate 118 and the shaft 62. If, however, an attempt is made to drive the shaft 62 in a clockwise direction, as viewed in Fig. 7, the rollers 121 will be disengaged from the race surface 117 and the shaft 62 can rotate freely without driving the casing 116. Therefore the desired over-running clutch action is secured for purposes to be described below. By the above construction it will be noted that the rollers 121 may be inserted on either side of each of the spring-biasing assemblies 120. In some instances it may be desired that the rotation of the entire assembly be reversed. In this case, all that is necessary is to remove a face plate from the over-running clutch assembly and move the rollers 121 from one side to the other of the spring-biasing assemblies 120. This provides a simple and effective overrunning clutch arrangement capable of providing overrunning clutch action in alternative directions.

The circuit arrangement for the electrical portions of the system illustrated in Figs. 4–7 is shown in Fig. 8. A pair of supply lines 122 are adapted to be connected to any suitable source of alternating current. A switch 123 is adapted to connect said supply lines 122 to a pair of local supply lines 124. The motor 1 may be connected directly across the lines 124 so that when the switch 123 is closed, the motor 1 is set in rotation. The actuating coil 30 of the counter reset mechanism is connected in series with the switch 50 of the total turn counter 48 across the lines 124. The actuating coil 96 of the main clutch 78 is likewise connected in series with the switch 50 across the lines 124. The micro-switch 98 is provided with a switch arm 125 which is adapted to engage either a live contact 126 or a dead contact 127. The contact 126 may be connected to one of the lines 124. The switch arm 125 is connected through the switch 49 of the lead counter 47 and the actuating coil 128 of a relay 129 to the other line 124. The relay 129 is provided with a contact 130 connected in series with one of the leads 65 extending to the magnetic clutch 63—64. The magnetic clutch is adapted to be energized through said contact 130 from a rectifier bridge 131, the input to which is provided by the lines 124.

The operation of the system described, as illustrated in Figs. 4–8, is substantially as follows. The total turn counter 48 has set up therein the predetermined number of revolutions which it is desired to impart to shaft 56 and the load driven thereby. The lead counter 47 has set up therein a number of revolutions which is smaller than the predetermined number set up in the total turn counter 48 by any desired number. The clutch-actuating rod 92 is in its outer position in which the shoulder 89 of the stop rod 88 is in engagement with the pawl 80 and is holding said pawl disengaged from the cam 79. The micro-switch 98 is in its open position, and thus the relay 129 is in its open position so that the circuit to the magnetic clutch 63—64 is open. Under these conditions the switch 123 is closed, whereupon the motor 1 is set in rotation. This causes the shaft 62 to rotate at slow speed, and the pulley 61 carrying the portion 63 of the magnetic clutch rotates idly at the higher speed around the shaft 62. The rotation of the shaft 62 at low speed in turn rotates the sprocket 66, the chain belt 67, the sprockets 68 and 70, and thus the cam 79. Thereupon the clutch-actuating handle 110 may be pushed inwardly. This moves the stop rod 88 out of engagement with the pawl 80, whereupon the cam 79 as it rotates in a counter-clockwise direction at low speed causes its shoulder 83 to engage the shoulder 84 on the pawl 80, thus causing the driving plate 82 and the shaft 56 to be driven. The speed of rotation is selected to be of a sufficiently low value, so that upon the engagement of the pawl 80 by the cam 79, no undue shocks are imparted to any part of the system. Once the cam 79 has engaged the pawl 80 and has started to rotate the shaft 56, it is no longer necessary to maintain the slow speed of rotation. Within substantially a quarter of a turn after the initiation of rotation of the shaft 56, the cam surface 103 comes into contact with the rod 102 and pushes said rod in a direction to move the switch arm 125 of the micro-switch 98 into engagement with the live contact 126. This completes the circuit to the actuating coil 128 of the relay 129, which therefore closes the contact 130. This energizes the magnetic clutch 63—64, which thus connects the rapidly rotating pulley 61 directly to the shaft 62. The shaft 62 is thereupon driven at the higher speed, causing the shaft 56 to be driven at its higher speed. No interference is encountered with the slow speed drive due to the fact that the overrunning clutch 116' permits the shaft 62 to overrun the slowly driven clutch casing 116. The shaft 56 in turn drives the countershafts 51 and 52 through the chain drive already described so that the counters 47 and 48 record the rotations of shaft 56. The shaft 56 continues to rotate at full speed until the lead counter 47 reaches the number set up therein, which as previously indicated is less than the total number of turns to which it is desired to support shaft 56. However, when the counter 47 reaches its set number, the switch 49 opens, thus deenergizing the relay 129 and opening the circuit to the magnetic clutch 63—64. Thus the high-speed pulley 61 is disengaged from the shaft 62, which thereupon assumes its slow speed operation through the slow speed drive 112—116'. Thereupon the shaft 56 is rotated at this slow speed for the remaining number of revolutions until the predetermined number set up in the total turn counter 48 is reached. At this point the switch 50 of said counter 48 is closed. This energizes the circuit for the coil 96 which attracts the armature 95, thus rotating the latch 94 out of engagement with the clutch stop mechanism. Thereupon the spring 93 forces the rod 92 together with the link 99 and the stop rod 88 toward its stop position. This causes the shoulder 89 to move into a position where it is engaged by the nose of the pawl 80. The pawl 80 is thus disengaged from the driving cam 79 and the shaft 56 is thus stopped accurately in a predetermined position, due to the provision both of the pawl 80 engaging the shoulder 89 as well as the reverse stop mecha-

nism 104—108. It will be noted that the stopping of rotation likewise occurs at slow speed. Furthermore this speed is sufficiently slow so that none of the mechanism is subjected to undue shock.

When the spring 93 moves the rod 92 to its outer position, the link 90 is pulled away from the button 99, and therefore the spring 100 is enabled to move said button 99 to its outer position, to the right in Fig. 8. This causes the switch arm 125 of the micro-switch 98 to leave its live contact 126 and move into engagement with its dead contact 127. At the same time that the coil 96 of the stop mechanism is energized, the switch 50 also completes the circuit for the coil 30 of the counter reset mechanism. The energization of the coil 30 moves the stop rod 27 out of engagement with the pawl 21, and therefore the cam 16 engages the pawl 21 and drives the reset gear 13. This in turn drives the gears 74 and 75 on the counter reset shafts 76 and 77, respectively. As soon as the resetting begins, the switch 49 is reclosed and the switch 50 is reopened. Reclosing of the switch 49, however, does not reenergize the relay 129 since its circuit is broken by the microswitch 98, the switch arm 125 being in contact with the dead contact 127. Reopening the switch 50 deenergizes the coil 30 which permits the stop rod 27 to move back into position where it may reengage the pawl 21. Thus as the gear 13 completes a revolution, the pawl 21 engages the shoulder 28 and is moved out of engagement with the cam 16. Thus the gear 13, after rotating through said revolution, is again stopped. The gear ratio between the gear 13 and the gears 74 and 75 is such that one revolution of the gear 13 resets the counters 47 and 48 to their zero position. Reopening of the switch 50 also deenergizes the coil 96 which thus releases the armature 95, and thus the latch 94 is moved into a position where it is ready to reengage the stop mechanism upon actuation by the handle 110.

Upon completion of the above sequence the shaft 62 continues to drive the sprocket 68 and the elements directly connected thereto at low speed. However, the shaft 56 is held stationary in its stop position, and no counting occurs. To restablish the rotation of the shaft 56 for its predetermined number of cycles together with the associated cycle of events, the handle 110 is pushed inwardly by the operator, whereupon the operation as above described is repeated.

Of course it is to be understood that this invention is not limited to the particular details as described above as many equivalents will suggest themselves to those skilled in the art. It is accordingly desired that the appended claims be given a broad interpretation commensurate with the scope of the invention within the art.

What is claimed is:

1. In a counting system, a main driving member, a driven member, a counting mechanism, means for setting up a predetermined number to be counted by said counting mechanism, an actuating member for causing said counting mechanism to count the actuations of said actuating member, a reset member for resetting said counting mechanism to its zero position, means for causing said driven member to actuate said actuating member, a main clutch for coupling and uncoupling said main driving member to said driven member, means for causing said clutch to couple said main driving member to said driven member, an auxiliary driving member, an auxiliary clutch for coupling and uncoupling said auxiliary driving member with said reset member, means responsive to the counting by said counting mechanism of said predetermined number for causing said main clutch to uncouple said main driving member from said driven member and for stopping further movement of said driven member, means responsive to the counting by said counting mechanism of said predetermined number to cause said auxiliary clutch to couple said auxiliary driving member to said reset member to reset said counting mechanism to its zero position, and means for causing said auxiliary clutch to uncouple said auxiliary driving member from said reset member and for preventing further movement of said reset member upon completion of said resetting operation.

2. In a counting system, a main driving member, a driven member, means for causing said main driving member to operate at a slow speed, transfer means for causing said main driving member to operate at a substantially higher speed, a counting mechanism, means for setting up a predetermined number to be counted by said counting mechanism, an actuating member for causing said counting mechanism to count the actuations of said actuating member, means for causing said driven member to actuate said actuating member, a reset member for resetting said counting mechanism to its zero position, a main non-slip clutch for coupling and uncoupling said main driving member to said driven member, means for causing said clutch to couple said main driving member to said driven member while said driven member is operating at slow speed, means responsive to the movement of said driven member for actuating said transfer means to cause said main driving member to operate at said higher speed, an auxiliary driving member, an auxiliary clutch for coupling and uncoupling said auxiliary driving member with said reset member, means responsive to the counting by said counting mechanism of said predetermined number for causing said main clutch to uncouple said main driving member from said driven member, and means responsive to the counting by said counting mechanism of said predetermined number to cause said auxiliary clutch to couple said auxiliary driving member to said reset member to reset said counting mechanism to its zero position.

3. In a counting system, a main driving member, a driven member, two counting mechanisms, means for setting up a predetermined total number to be counted by one of said counting mechanisms, means for setting up a second predetermined number less than said first predetermined number to be counted by the other of said counting mechanisms, actuating members for causing said counting mechanisms to count the actuations of its associated actuating member, a reset member for resetting said counting mechanisms to their zero positions, means for causing said driven member to actuate said actuating members, a main clutch for coupling and uncoupling said main driving member to said driven member, means for causing said clutch to couple said main driving member to said driven member, an auxiliary driving member, means responsive to the counting by said other counting mechanism of said second predetermined number for causing said main driving member to operate at a substantially reduced speed, means responsive to the counting by said first counting mechanism of said first predetermined num-

ber for causing said main clutch to uncouple said main driving member from said driven member and for stopping further movement of said driven member, and means responsive to the counting by said first counting mechanism of said first predeterimend member to cause said auxiliary clutch to couple said auxiliary driving member to said reset member to reset said counting mechanisms to their zero positions.

4. In a counting system, a main driving member, a driven member, means for causing said main driving member to operate at a slow speed, transfer means for causing said main driving member to operate at a substantially higher speed, two counting mechanisms, means for setting up a predetermined total number to be counted by one of said counting mechanisms, means for setting up a second predetermined number less than said first predetermined number to be counted by the other of said counting mechanisms, actuating members for causing said counting mechanisms to count the actuations of its associated actuating member, a reset member for resetting said counting mechanisms to their zero positions, means for causing said driven member to actuate said actuating members, a main non-slip clutch for coupling and uncoupling said main driving member to said driven member, means for causing said clutch to couple said main driving member to said driven member while said main driving member is operating at slow speed, means responsive to the movement of said driven member for actuating said transfer means to cause said main driving member to operate at said higher speed, an auxiliary driving member, means responsive to the counting by said other counting mechanism of said second predetermined number for deenergizing said transfer means to cause said main driving member to operate at said slow speed, means responsive to the counting by said first counting mechanism of said first predetermined number for causing said main clutch to uncouple said main driving member from said driven member and for stopping further movement of said driven member, and means responsive to the counting by said first counting mechanism of said first predetermined number to cause said auxiliary clutch to couple said auxiliary driving member to said reset member to reset said counting mechanisms to their zero positions.

5. In a counting system, a main driving member, a driven member, a counting mechanism, means for setting up a predetermined number to be counted by said counting mechanism, means for causing said driven member to actuate said actuating member, a reset member for resetting said counting mechanism to its zero position, a main clutch for coupling and uncoupling said main driving member to said driven member, an auxiliary clutch for coupling and uncoupling said main driving member with said reset member, means responsive to the counting by said counting mechanism of said predetermined number for causing said main clutch to uncouple said main driving member from said driven member, and means responsive to the counting by said counting mechanism of said predetermined number to cause said auxiliary clutch to couple said main driving member to said reset member to reset said counting mechanism to its zero position.

6. In a counting system, a main driving member, a driven member, a counting mechanism, means for setting up a predetermined number to be counted by said counting mechanism, a reset member for resetting said counting mechanism to its zero position, means for causing said driven member to actuate said actuating member, a main clutch for coupling and uncoupling said main driving member to said driven member, an auxiliary clutch for coupling and uncoupling said main driving member with said reset member, means responsive to the counting by said counting mechanism of said predetermined number for causing said main clutch to uncouple said main driving member from said driven member, means responsive to the counting by said counting mechanism of said predetermined number to cause said auxiliary clutch to couple said main driving member to said reset member to reset said counting mechanism to its zero position, and means for causing said auxiliary clutch to uncouple said main driving member from said reset member upon completion of said resetting operation.

7. In a counting system, a main driving member, a driven member, two counting mechanisms, means for setting up a predetermined total number to be counted by one of said counting mechanisms, actuating members for causing said counting mechanisms to count the actuations of its associated actuating member, means for setting up a second predetermined number less than said first predetermined number to be counted by the other of said counting mechanisms, a reset member for resetting said counting mechanisms to their zero positions, means for causing said driven member to actuate said actuating members, a main clutch for coupling and uncoupling said main driving member to said driven member, an auxiliary clutch for coupling and uncoupling said main driving member with said reset member, means for causing said clutch to couple said main driving member to said driven member, means responsive to the counting by said other counting mechanism of said second predetermined number for causing said main driving member to operate at a substantially reduced speed, means responsive to the counting by said first counting mechanism of said first predetermined number for causing said main clutch to uncouple said main driving member from said driven member and for stopping further movement of said driven member, means responsive to the counting by said first counting mechanism of said first predetermined number to cause said auxiliary clutch to couple said main driving member to said reset member to reset said counting mechanisms to their zero positions.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,959,779	Coxhead	May 22, 1934
1,977,781	Staegemann	Oct. 23, 1934