July 5, 1938. W. M. HILL 2,122,468

APPARATUS CONTROL SYSTEM

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FIG. 1

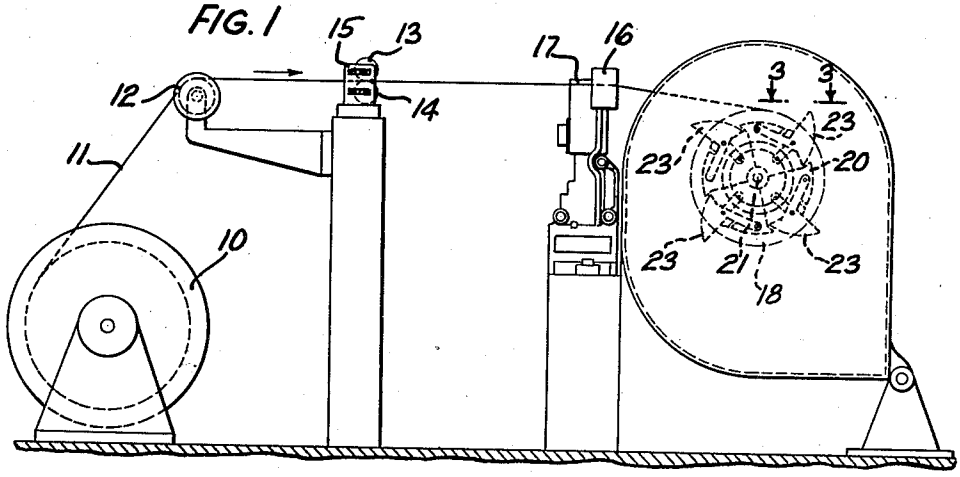
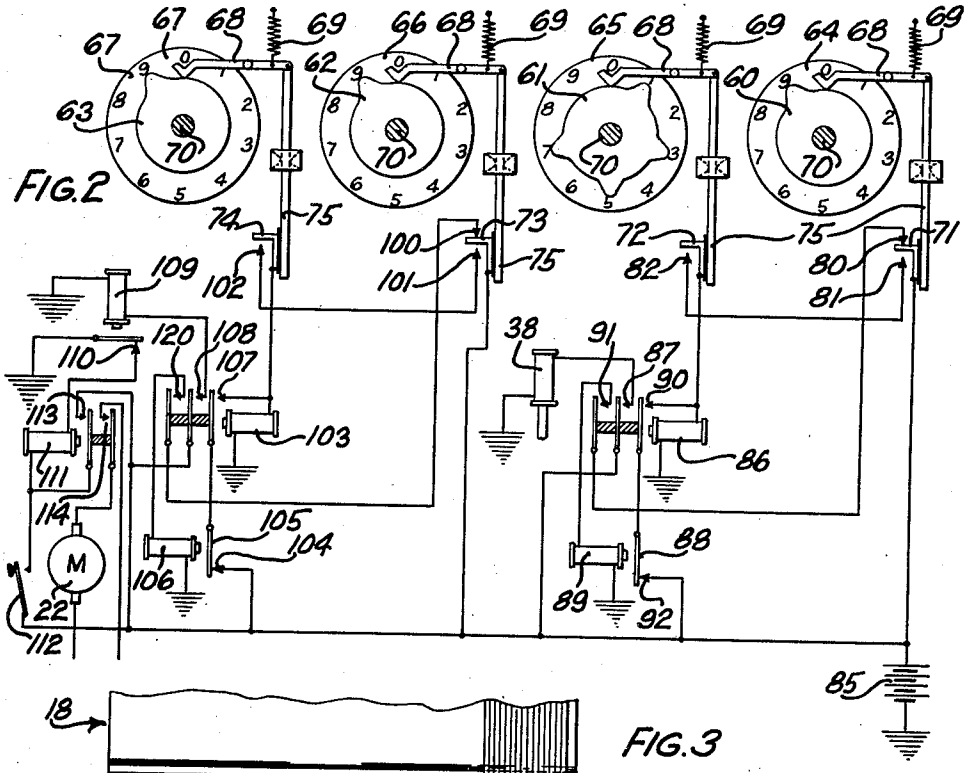


FIG. 2



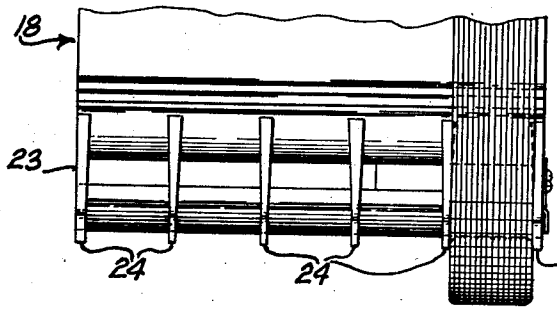


FIG. 3

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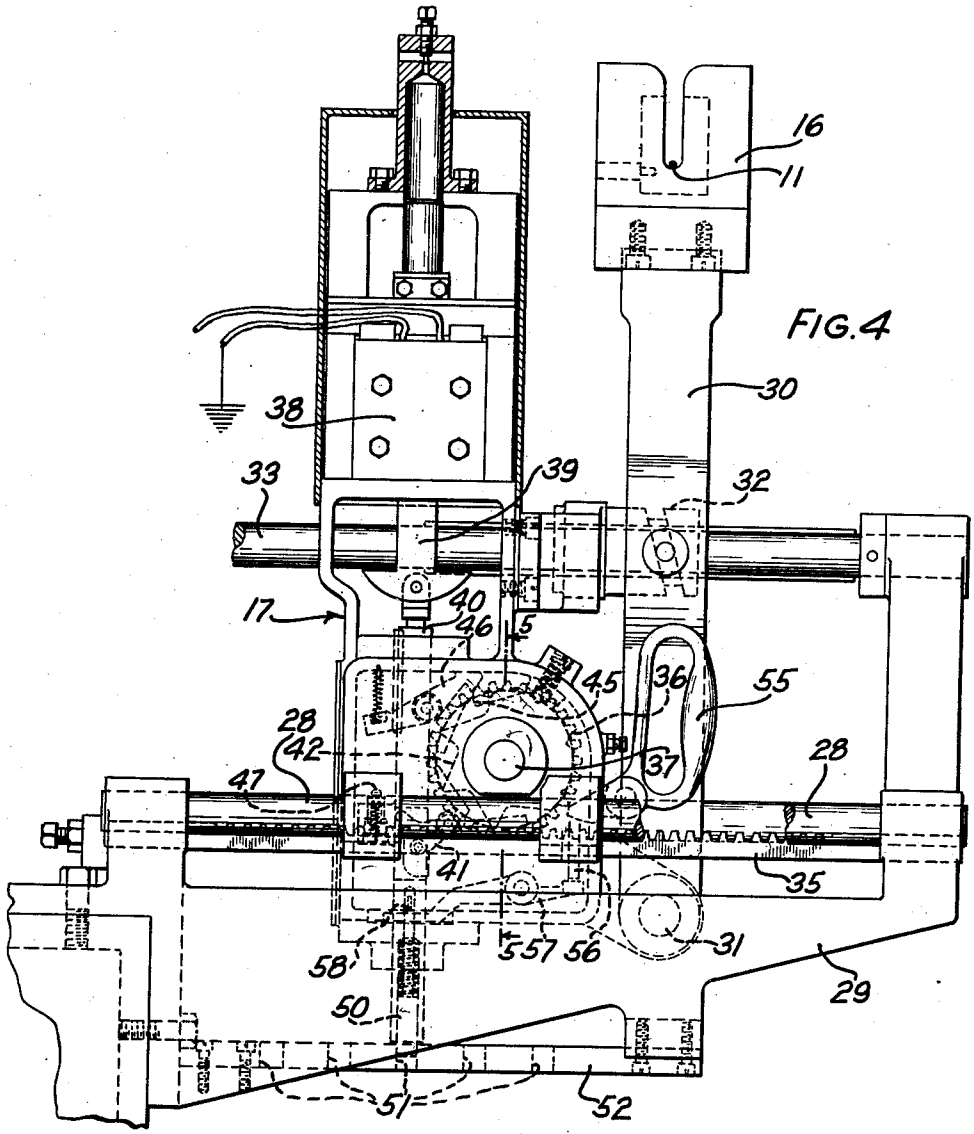


FIG. 4

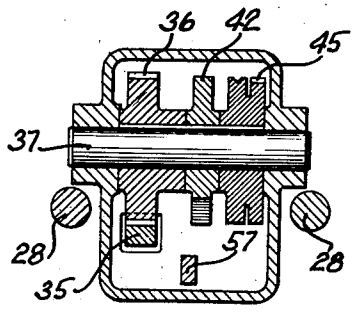


FIG. 5

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APPARATUS CONTROL SYSTEM

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Application March 23, 1934, Serial No. 717,092

11 Claims. (Cl. 242—25)

This invention relates to an apparatus control system and more particularly to a system for controlling the distribution in sequence on a coiling device of interconnected coils of measured lengths of strand.

The control system described and claimed herein was primarily designed for the material handling apparatus described and claimed in the copending application of Oscar G. Nelson, Serial No. 717,089, filed March 23, 1934.

An object of the invention is to provide a simple, efficient and practical apparatus control system.

In accordance with the object, one embodiment of the invention contemplates the provision of an electrical system, including transfer and interlocking relays, controlled by cams of a counter which is actuated by the advanced strand, for energizing a solenoid in sequence to shift a distributor from one position to another along a coiling head for controlling the distribution of interconnected coils of measured lengths of the strand on the coiling head; the electrical system also including length and interlocking relays controlled by other cams of the counter for energizing a stop relay for stopping the mechanism when a predetermined number of coils have been wound upon the coiling head.

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

Fig. 1 is a schematic side elevational view of an apparatus which is to be controlled;

Fig. 2 is a wiring diagram showing schematically portions of the counter which control the circuits;

Fig. 3 is a fragmentary sectional view taken along the line 3—3 of Fig. 1;

Fig. 4 is an enlarged front elevational view of the distributor; and

Fig. 5 is a fragmentary sectional view taken along the line 5—5 of Fig. 4.

Referring now to the drawings, wherein like reference numerals designate similar parts throughout the various views, numeral 10 designates a supply reel (Fig. 1) for supplying strand material 11 which, when threaded through the apparatus, passes over an idler sheave 12, between rollers 13 and 14 of a counter 15, through a forked member 16 of a distributor 17, to a coiling head 18 where the forward end of the strand is secured.

The coiling head 18 may be of any suitable construction arranged to receive coils of strand material, such as wire, of predetermined interconnected lengths. In the present instance the coiling head 18 consists of a drum 20 mounted upon a shaft 21 which is driven continuously by a motor 22 shown in Fig. 2, which motor will be further described hereinafter. Mounted upon the drum 20 are spacing members 23 which are arranged to be moved inwardly beyond the peripheral surface of the drum 20 by suitable means (not shown), each spacing member having a plurality of equally spaced fingers 24.

The distributor 17 is shown in detail in Figs. 4 and 5 and is mounted for movement upon horizontal supporting bars 28 which are carried by a stationary frame 29. A distributor arm 30 pivotally carried at 31 by the distributor 17 supports the forked member 16 and is continuously oscillated by a drum cam 32 to which the arm is operatively connected, the drum cam being movable with the distributor 17 and keyed to a continuously rotatable shaft 33.

A rack 35 mounted upon the frame 29 interengages a gear 36 which is keyed to a shaft 37. The shaft 37 is rotated a predetermined distance whenever a solenoid 38 is energized to move its core 39 upwardly, moving with it a pull rod 40 upon which a pawl 41 is mounted to move a toothed wheel 42 clockwise, moving the shaft 37 with the gear 36 in the same direction due to the fact that the toothed wheel is fixed to the shaft. A ratchet wheel 45 is also fixed to the shaft 37 and has teeth positioned to be engaged by a pawl 46 which is actuated by a plunger 47 carried by the pull rod 40 to limit the rotation of the shaft 37. The rotation of the shaft clockwise rotates the gear 36 in the same direction and due to the connection of the gear 36 with the rack 35 the distributor 17 will be moved a predetermined distance to the right, moving with it the distributor arm 30 to another position with respect to the coiling head 18.

When the solenoid 38 is de-energized, the pull rod 40 with the core 39 drops downwardly until a locking pin 50 mounted in the lower end thereof extends into an aperture 51 of a locking plate 52 and the lower end of the pull rod rests upon the locking plate. When the last coil has been wound, the distributor may be moved to its starting position by manually moving a hand lever 55 to the left (Fig. 4), forcing a pin 56 downwardly to rock a lever 57 clockwise and to lift the locking pin 50 free of the locking plate 52. A pin 58 carried by the locking pin 50 and extending through an elongated aperture in the pull rod 40 rests upon the lever 57 so that the

actuation of the lever will move the locking pin 50 free of its aperture, so that with further pressure upon the hand lever 55 the distributor may be moved into its starting position where the releasing of the hand lever will allow the locking pin 50 to be moved by means of a spring into the first aperture 51 of the locking plate 52.

Referring now to Fig. 2, which illustrates the control system for the mechanism previously described, there are shown cams 60, 61, 62 and 63, which are respectively associated with indicating wheels 64, 65, 66 and 67 of the counter 15. The cams 60 and 62 with their respective indicating wheels are mounted on a shaft 70 and are rotated intermittently counterclockwise one revolution for each 100 revolutions of the roller 14, this roller being rotated by the advancement of the strand 11 and completing one revolution for each foot of strand passing between the rollers 13 and 14. The mechanism connecting the wheels 64 and 66 to the roller 14 is not shown since it is of a conventional type. The indicating wheels 65 and 67 which carry the cams 61 and 63 are rotated intermittently in a counterclockwise direction through a conventional type of mechanism controlled through the actuation of the wheels 64 and 66 so that the cams 61 and 63 will be rotated one-tenth of a revolution for each revolution of the cams 60 and 62 or one complete revolution for each 10 revolutions of cams 60 and 62. While four indicating wheels have been shown for the purpose of making the illustration more easy to follow, in practice indicating wheels 64 and 66 may be the same element and indicating wheels 65 and 67 may be the same element.

Switch controlling levers 68 are pivotally supported and are urged in a counterclockwise direction by springs 69 so that the left ends thereof will ride upon their respective cams 60 to 63, inclusive. The right ends of these levers are connected to rods 75 upon which terminals 71, 72, 73 and 74 are mounted. The cams 60 and 61 through their switch controlling mechanisms complete circuits for energizing the solenoid 38 when a predetermined length of wire has passed between the counter rolls 13 and 14. For example, let it be assumed that five interconnected coils of wire, each containing 200 feet of wire are to be wound upon the coiling head, totalling 1,000 feet of wire formed into 5 coils.

As shown in Fig. 2 the cam 60 has a high portion positioned to actuate the lever 68 associated therewith at the ninth position of the counter wheel 64 so that when ninety feet of wire have passed through the counter 15 a break contact 80 will be opened and a make contact 81 will be closed. This action, however, will not complete a circuit until a make contact 82 is closed due to the actuation of the switch control lever 68 of the cam 61. The cam 61 has four high portions located at positions 1, 3, 5 and 7 on the indicating wheel 65. Therefore, when the cam 60 completes one revolution, the cam 61 will be moved so that the high portion at position 1 will be moved beneath its lever 68 to move the lever clockwise to close the make contact 82, which remains closed until the high portion of cam 60 at position 9 again actuates its lever 68 to complete a circuit from grounded battery 85 through make contacts 81 and 82, a transfer relay 86 to ground. The energization of the relay 86 completes a locking circuit through a make contact 90 and completes a circuit from grounded battery 85 through a make contact 87 and through solenoid 38 to ground, thus energizing the solenoid (Figs. 2 and 4) for shifting the distributor 17 from one position relative to the coiling head to another position. An armature 88 of a locking relay 89 remains closed until the high portion of the cam 60 is moved beyond its lever 68, allowing the spring 69 thereof to move the rod 75 vertically to complete a circuit from grounded battery 85, through break contact 80, through a make contact 91, and through the locking relay 89 to ground, thus energizing the locking relay to move its armature 88 free of break contact 92 to open the locking circuit through the relay 86. The solenoid 38 is thus energized after 190 feet of wire have been wound upon one portion of the coiling head, the additional 10 feet being wound upon this portion of the coiling head during the setting into operation of the mechanism for shifting the distributor from one position to another. The distributor will be shifted to the third position when the high point of cam 61 at position 3 is moved beneath its respective lever 68 and when the high portion of the cam 60 is moved for the fourth time beneath its lever 68. The solenoid 38 is, therefore, actuated to shift the distributor after 190, 390, 590, and 790 feet of wire have passed through the counter, but there will be no action to move the distributor at the completion of the 1,000 feet. The lengths of wire on each coil and the total of the five coils, as given, are of course merely illustrative and the counter can be designed to produce coils of any desired length.

The purpose of the cams 62 and 63 is to stop the apparatus when the coils are completed and when the required length of wire has been wound upon the coiling head. The cam 62 has a single high portion at position 9 upon its indicating wheel 66 for actuating its lever 68 when ninety feet of wire have passed through the counter 15. The cam 62 will, therefore, open break contact 100 to close make contact 101 at each 9 position of the indicating wheel 66, but a circuit will not be completed until the high portion of the cam 63 has been moved beneath its respective lever 68, which occurs when the cam 62 with its indicating wheel 66 has completed nine revolutions. At the completion of nine revolutions of the cam 62, the high portion of the cam 63 will move its lever 68 clockwise, moving the rod 75 connected therewith downwardly to close a make contact 102, which will remain closed until the indicating wheel 66 again registers 90, positioning the high portion of the cam 62 beneath its respective lever 68 to again close make contact 101 to complete a circuit from grounded battery 85 to make contacts 101 and 102 through a length relay 103 to ground.

The energization of the relay 103 will attract its armatures to complete a locking circuit from grounded battery through a break contact 104, an armature 105 of a locking relay 106 through a make contact 107 through the relay 103 to ground. The energization of the relay 103 will also complete a circuit from grounded battery 85, through make contact 108, through a stop relay 109 to ground, resulting in the attraction of the armature of the stop relay from a break contact 110 to open a circuit of electrical energy which circuit includes a magnetic switch for the motor circuit, thus stopping the motor 22 and the coiling head 18 to which the motor is operatively connected. The magnetic switch consists of a relay 111 which is energized when a momentary push switch 112 is closed completing a circuit from grounded battery 85 through switch

112, relay 111, the break contact 110 to ground. A locking circuit for the relay 111 is traced from grounded battery 85 through a make contact 113 when the armatures of the relay 111 are attracted through relay 111 and break contact 110 to ground. The circuit for the motor 22 is completed through make contact 114 and will remain closed until the stop relay 109 is energized to open break contact 110.

The additional ten feet of wire is wound upon the coiling head by the time the coiling head is stopped. Therefore, the counter will be moved to position the cams at their zero or starting position. This will cause the switch controlling levers 68 of the cams 62 and 63 to open the make contacts 101 and 102, and to close the break contact 100 completing a circuit from grounded battery 85 through break contact 100, through a make contact 120, and through the locking relay 106 to ground, energizing the locking relay to attract its armature and open the circuit through the relay 103.

After the winding of the five coils has been completed, they may be removed from the coiling head and the apparatus conditioned for another operation. The distributor is disposed at the farthest position to the left; and after the forward end of the wire is secured to the coiling head the motor 22 is energized by closing the momentary push switch 112, the break contact 110 being normally closed to energize the relay 111, thus closing the motor circuit to energize the motor and thus rotate the coiling head. The counter 15 is immediately set up in operation rotating the cams to effectively close circuits to shift the distributor through the energization of the solenoid 38 from one position to another when a predetermined length of the wire has passed through the counter so that 200 feet of wire will be wound between the fingers 24 of the coiling head at each position without breaking the wire so that at the end of the operation when a circuit is completed through the stop relay 109 by the actuation of the levers 68 associated with the cams 62 and 63, each space upon the coiling head will have a coil of wire totalling 200 feet, making a grand total of 1,000 feet upon the coiling head.

Although the invention has been shown and described in connection with coiling wire, it should be understood that the controlling system may be used for other purposes and that it is capable of other modifications and adaptations without departing from the spirit and scope of the appended claims.

What is claimed is:

1. A control system for material handling apparatus, comprising a rotatable coiling head for winding material thereon, a distributor for distributing material upon the coiling head, means for oscillating the distributor, a solenoid effective when energized for moving the distributor relative to the coiling head and means controlled by the movement of the material toward the coiling head for completing the circuit from a source of electrical energy through the solenoid for energizing the solenoid when a measured length of material has been wound upon the coiling head.

2. A control system for material handling apparatus, comprising a rotatable coiling head for winding material thereon, a distributor, means for imparting to and fro motion to said distributor through a fraction of the length of the coiling head, cams actuated by the advancement of the material to the coiling head, means operated by the cams for completing an electrical circuit from a source of electrical energy, and means energized by the completion of the circuit for shifting the distributor from one position to another relative to the coiling head.

3. A control system for material handling apparatus, comprising a rotatable coiling head for winding material thereon, a distributor, means for imparting to and fro motion to said distributor through a fraction of the length of the coiling head, cams actuated by the advancement of the material to the coiling head, means operated by the cams for completing an electrical circuit from a source of electrical energy, means energized by the completion of the circuit for shifting the distributor from one position to another relative to the coiling head, and means controlled by the advancement of the material for stopping the rotation of the coiling head when a predetermined measured length of material has been wound thereupon.

4. A control system for material handling apparatus, comprising a rotatable coiling head for winding material thereon, a distributor for guiding the material to the coiling head, a set of cams actuated by the advancement of the material to the coiling head, a relay controlled in response to the actuation of the cams for completing an electrical circuit when a measured length of the material has been wound upon the coiling head, and means energized by the completion of the circuits for moving the distributor relative to the coiling head in sequence to form interconnected coils of measured lengths upon the coiling head.

5. A control system for material handling apparatus, comprising a rotatable coiling head for winding material thereon, a distributor for guiding the material to the coiling head, a set of cams actuated by the advancement of the material to the coiling head, a relay controlled in response to the actuation of the cams for completing an electrical circuit when a measured length of the material has been wound upon the coiling head, means energized by the completion of the circuits for moving the distributor relative to the coiling head in sequence to form interconnected coils of measured lengths upon the coiling head, another set of cams actuated by the advancement of the material, a relay controlled by the actuation of the last mentioned set of cams for completing an electrical circuit from a source of electrical energy, means for rotating the coiling head, and means energized by the completion of the last mentioned circuit for rendering ineffective the actuating means for the coiling head.

6. A control system for material handling apparatus, comprising a rotatable coiling head for winding material thereon, a member for guiding the material to the coiling head, a set of cams operated through the advancement of the material to the coiling head, transfer and interlocking relays operated by the cams, and means under the control of the relays for shifting the material guiding member relative to the coiling head for forming interconnected coils on the coiling head.

7. A control system for material handling apparatus, comprising a rotatable coiling head for winding the material thereon, a member for guiding the material to the coiling head, a set of cams operated through the advancement of the material to the coiling head, transfer and inter-

locking relays operated by the cams when a predetermined length of material has been wound on the coiling head, and means for shifting the material guiding member relative to the coiling head for forming interconnected coils of measured lengths on the coiling head.

8. A control system for material handling apparatus, comprising a rotatable coiling head for winding material thereon, means for rotating the coiling head, a member for guiding the material to the coiling head, a set of cams operated through the advancement of the material to the coiling head, transfer and interlocking relays operated by the cams when a predetermined length of material has been wound on the coiling head, means under the control of the relays for shifting the material guiding member relative to the coiling head for forming inter-connected coils of measured lengths upon the coiling head, and means controlled by the advancement of material for rendering ineffective the rotating means when a predetermined length of material has been wound upon the coiling head.

9. A control system for controlling the distribution in sequence on a coiling head of interconnected coils of measured lengths of material comprising a rotatable coiling head, means for rotating the coiling head, a distributor for guiding the material to the coiling head, mounted for movement relative thereto, transfer and interlocking relays, a set of cams operated through the advancement of the material for operating the relays, and means under the control of the relays for shifting the distributor relative to the coiling head when each measured length of material has been wound.

10. A control system for controlling the distribution in sequence on a coiling head of interconnected coils of measured lengths of material comprising a rotatable coiling head, means for rotating the coiling head, a counter member through which a material passes to the coiling head having means engaging the material for measuring the material wound upon the coiling head, a distributor for guiding the material to the coiling head, and electrical means under the control of the counter member for shifting the distributor relative to the coiling head after each measured length of material has been wound upon the coiling head for forming interconnected coils of the material thereon.

11. A control system for controlling the distribution in sequence on a coiling head of interconnected coils of measured lengths of material comprising a rotatable coiling head, means for rotating the coiling head, a counter member through which a material passes to the coiling head for measuring the material wound upon the coiling head, a distributor for guiding the material to the coiling head, electrical means under the control of the counter member for shifting the distributor relative to the coiling head after each measured length of material has been wound upon the coiling head for forming interconnected coils of the material thereon, and electrical means under the control of the counter member for rendering the rotating means ineffective when a predetermined length of material has been wound upon the coiling head.

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