Nov. 19, 1957 R. W. SCOTT 2,813,345

AUTOMATIC WINDING MECHANISM

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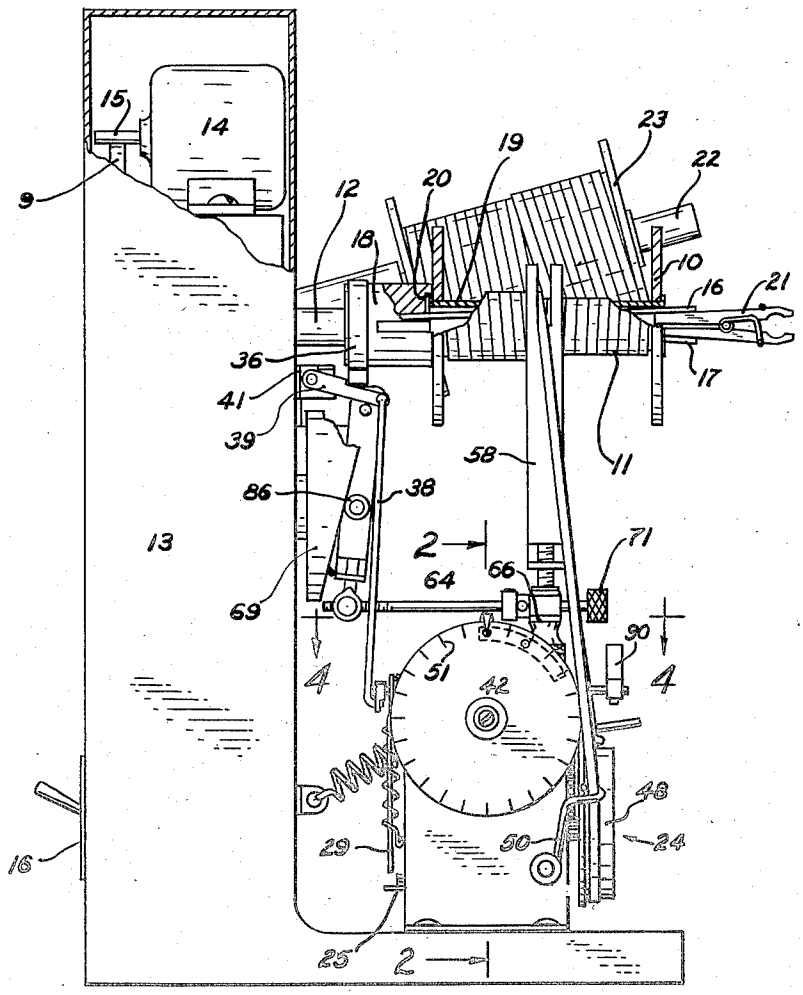


FIG. 1

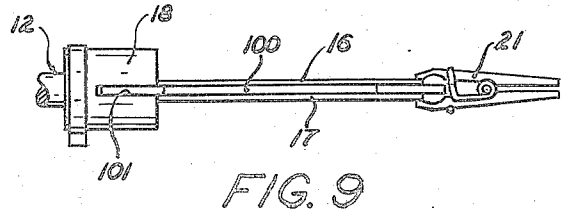


FIG. 9

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AUTOMATIC WINDING MECHANISM

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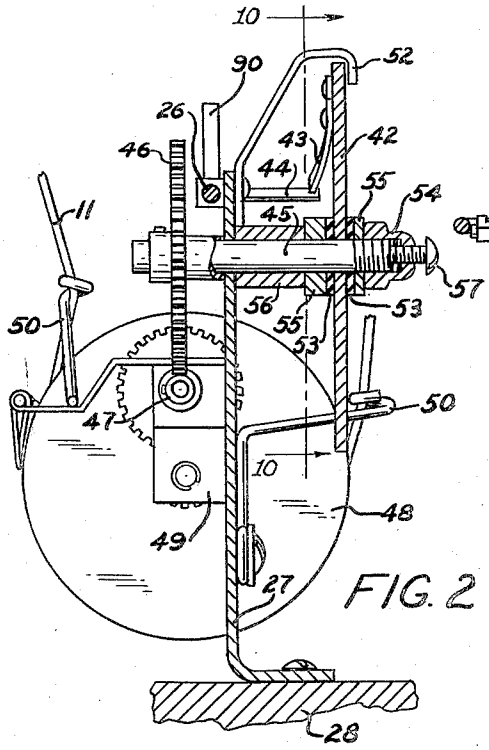


FIG. 2

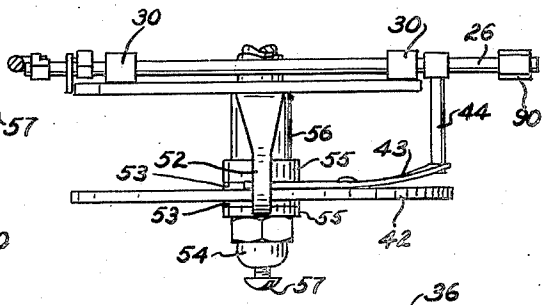
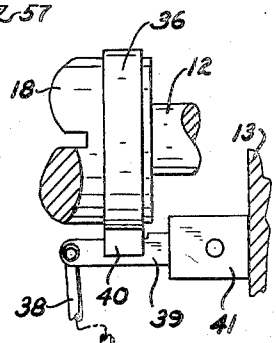


FIG. 3



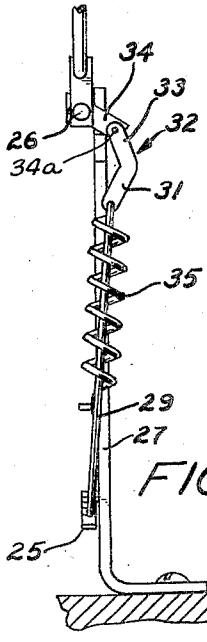


FIG. 4

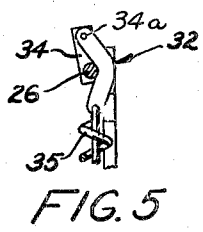


FIG. 5

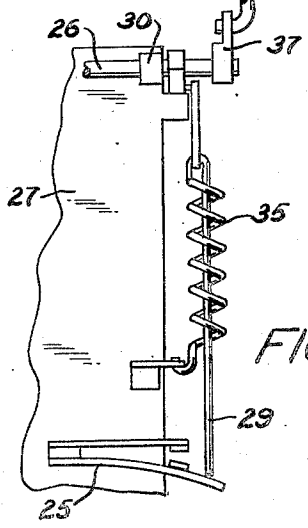


FIG. 6

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FIG. 10

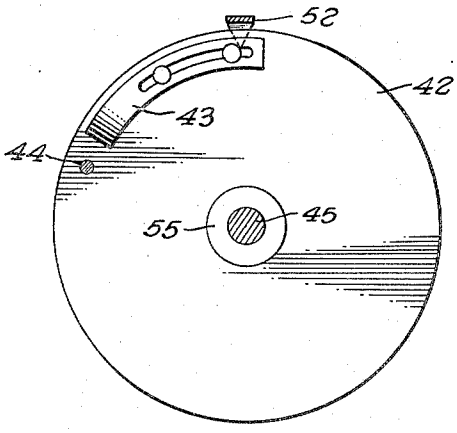
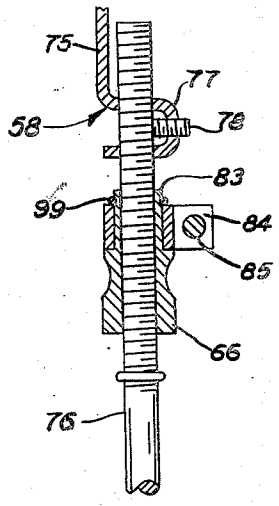


FIG. 8



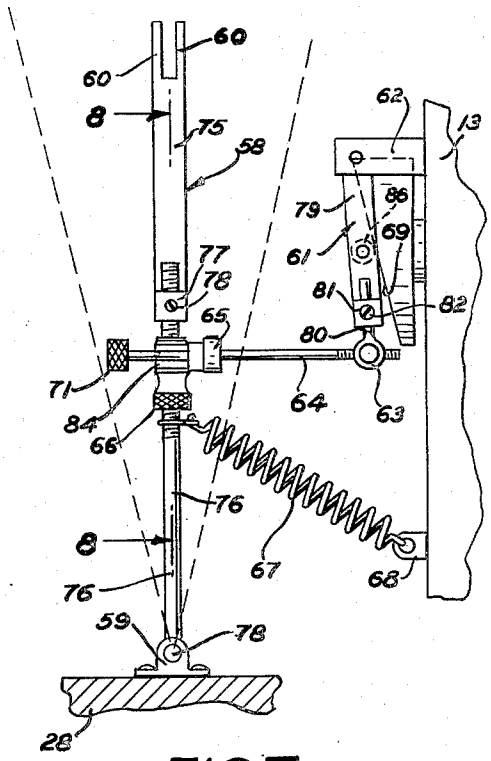


FIG. 7

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2,813,345

AUTOMATIC WINDING MECHANISM

Ray W. Scott, Los Angeles, Calif.

Application July 16, 1953, Serial No. 368,338

10 Claims. (Cl. 33—132)

This invention relates to an automatic winding mechanism.

It is an object of this invention to provide an improved winding mechanism incorporating a control for automatically stopping the winder after a predetermined length of material has been wound.

It is another object of this invention to provide a device of this character utilizing a motor operated slipping transmission in which a preset control simultaneously deenergizes the motor and halts rotation of the winding roller after passage of a predetermined length of material.

It is another object of this invention to provide an improved automatic measuring device that can easily be reset.

It is another object of this invention to provide an improved traverse mechanism for guiding the material upon a spool, or the like, and that can be easily adjusted to center the traverse and also vary the length of the traverse sweep.

It is another object of this invention to provide a novel winding shaft that can accommodate either a spool or a flat element or card, such as of cardboard or the like, upon which the material is to be wound. For this purpose, the shaft is of bifurcated form, a cardboard being capable of being carried between the bifurcations, and the aperture of a spool being capable of passing both bifurcations.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of one embodiment of the invention. For this purpose, there is shown a form in the drawings accompanying and forming part of the present specification. This form will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of this invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is an elevation of a device incorporating the present invention, some of the parts being broken away and others being shown in fragmentary section;

Fig. 2 is an enlarged fragmentary sectional view, taken along the plane indicated by line 2—2 of Fig. 1;

Fig. 3 is a top plan view of the apparatus shown in Fig. 2;

Figs. 4 and 5 are fragmentary elevations, taken in a direction corresponding to line 4—4 of Fig. 1 and respectively showing different positions of the mechanism;

Fig. 6 is a diagrammatic view showing the structure for simultaneously operating a circuit controller and a brake for the winding shaft;

Fig. 7 is an elevation of the traverse mechanism;

Fig. 8 is an enlarged sectional view, taken along the plane indicated by line 8—8 of Fig. 7;

Fig. 9 is a view showing an alternate mode of using the winding shaft and

Fig. 10 is a sectional view, taken along a plane indicated by line 10—10 of Fig. 2.

As shown in Fig. 1, a spool 10, upon which material 11, such as belt lacing, is to be wound, is carried by a winding shaft 12 that projects from a housing 13.

The winding shaft 12 is operated by a transmission mechanism enclosed within the casing 13. A motor 14 has a shaft 15 for driving a friction wheel 9 of the transmission mechanism. A toggle switch 16, supported on the casing 13, controls the energization of the motor 14.

That portion of the winding shaft 12 upon which the spool 10 is supported comprises bifurcations 16 and 17. The bifurcations 16 and 17 both project through the spool 10.

A collar 18, carried for rotation by the shaft 12, has a recess 20 receiving the usual flanged-over inner cylinder 19 of the spool 10. The spool 10 is coupled to the winding shaft 12 by friction created by opposite flexure of the bifurcations 16 and 17 to engage the inner cylinder 19 of the spool 10. This is accomplished by driving a wedge or other suitable device 21 between the bifurcations. Conveniently, the legs of a spring clamp comprise the wedge.

An inclined shaft 22 projecting from the housing 13 supports a material supply spool 23.

A measuring device 24 operates a circuit controller 25 interposed in the energization circuit for the motor for deenergizing the motor upon a passage of predetermined length of material 11 on the winding spool 10.

An angularly movable shaft 26 (Figs. 2, 3, 4, 5 and 6), appropriately supported by a bracket 27 secured to the base 28 of the device, is connected by a mechanism, now to be described, to a striker rod 29 engageable with a flexible arm of the circuit controller 25. The shaft 26 is freely rotatable in bearing brackets 30 (Fig. 3). The shaft 26 and rod 29 comprise a trip mechanism for opening circuit controller 25. An overcenter spring linkage mechanism is provided for causing movement of the striker 29 upon a predetermined angular movement of the shaft 26.

As shown most clearly in Figs. 4 and 5, the upper end of the striker 29 is pivotally secured to one arm 31 of an angled lever or link 32. The other arm 33 of the angled lever 32 is pivoted to a crank 34 carried by the shaft 26. For this purpose, a pin 34*a* is provided. The arms 31 and 33 define a concavity between them. A helical tension spring 35, secured to the bracket 27, engages the arm 31 of the angled lever 32 to urge the angled lever 32 downwardly.

In the angular position of the shaft 26 shown in Fig. 5, the spring 35 exerts a force tending to move the crank 34 in a counterclockwise direction about the shaft 26. The concavity between the arms 31 and 33 permits the link to occupy a position in which the spring exerts a torque in this direction. Furthermore, movement in such counterclockwise position is limited by engagement of the shaft 26 with the apex of the angled lever 32.

Upon slight angular movement of the shaft 26 in a clockwise direction from the position shown in Fig. 5, the force exerted by the spring 35 shifts from one side of the axis of rotation of the shaft 26 to the other. Accordingly, the linkage for the striker mechanism is tripped upon a slight angular movement of the shaft 26, and the striker suddenly moves to open the circuit controller 25. The position of the crank 34 and the lever 32 after such tripping movement is shown in Figs. 4 and 6.

When the shaft 26 is tripped, a wraparound brake band 36 is also operated. The band 36 is carried in a groove of the collar 18, in which it may slip. A crank 37 (Fig. 6), carried at the end of the trip shaft 26, moves a connecting link 38 upwardly when the shaft 26 is tripped. The link 38 rotates a dog lever 39 upwardly to interpose the dog lever 39 in the path of rotation of a projection

40 formed integrally on the band 36. The dog lever 39 is pivoted on a bracket 41 mounted on the housing 13. The dog lever 39 prevents rotation of the brake band 36, and the band 36 wraps around the collar 18 and quickly halts rotation of the winding shaft 12.

When the brake hand 36 is operated, the inertia of the motor causes slippage between the motor shaft 15 and the friction wheel 9 of the transmission mechanism. The winding shaft 12 is thus stopped simultaneously with the opening of the motor circuit, and precise measuring can be achieved by eliminating the inconstant effects of motor inertia and transmission friction.

The measuring device 24 includes a rotatable disc 42 (Figs. 1, 2 and 3). The disc 42, as shown most clearly in Figs. 2 and 3, mounts an arcuately disposed leaf spring 43, the free end of which is spaced from the rear surface of the disc 42 and forms a projection engageable with an arm 44 of the shaft 26 upon sufficient angular movement of disc 42. The end edge of spring 43 then engages the arm 44 to move the shaft 26 and trip the crank 34 and lever 32 when the disc 42 moves clockwise to a definite angular position.

The leaf spring 43 is adjustably secured to the disc 42 by a bolt and elongate slot (Fig. 10) so that the angular position of the spring 43 on the disc 42 may be accurately adjusted.

The disc 42 is frictionally mounted on a shaft 45 that is supported for rotation on the bracket 27 (Fig. 2). The shaft 45 and the disc 42 frictionally coupled thereto are driven by a transmission that is operated directly in accordance with the amount of material 11 being wound. After first positioning the disc 42 counterclockwise from shaft tripping position and resetting the shaft 26 and the trip device to the position of Fig. 5 to close the circuit controller 25, the winding mechanism is started by throwing the main switch 16. The mechanism then automatically stops after passage of material in an amount directly proportional to the initial setting of the frictionally mounted disc 42. Calibrations 51 on the face of the disc 42 cooperate with an indicator 52 secured to the bracket 27, and permit the operator accurately to set the mechanism. The tripping may be made to correspond precisely to a zero indication by adjustment of the angular position of the leaf spring 43 on the disc 42.

The leaf spring 43 makes it possible to reset the mechanism in any desired sequence. If the shaft 26 and trip mechanism are first reset by a reset lever 90 (Fig. 1), the spring 43 may move in a resetting or counterclockwise direction, as viewed in Fig. 1, without disturbing the shaft 26 from its reset position. In the event that the leaf spring 43 engages the arm 44 in such movement, the leaf spring 43 flexes toward the disc 42 until the end of the leaf spring 43 clears the arm 44. The engagement between the spring 43 and the arm 44 is ineffective to move the arm 44 since the shaft is then in the limiting position of Fig. 5.

A worm wheel 46 operated by a worm 47 is driven through suitable reduction gearing by a pulley 48 about which the material 11 passes. The pulley 48 is rotatably supported on a bracket 49 secured to the rear of the bracket 27. Suitable guides 50 are provided for directing the material 11 about the pulley 48. Accordingly, the disc 42 rotates in proportion to the amount of material 11 that is wound.

A friction connection between the disc 42 and shaft 45 makes it possible to set the disc and the projection 43 without overcoming the torque of the reduction gearing. For this purpose, apertured friction members 53 are disposed on opposite sides of the disc 42. The shaft 45 passes through an aperture in the disc 42 and through the friction members 53. The friction members 53 are accommodated between washers 55. A cap nut 54, threadedly accommodated on the shaft 45, engages the outer washer to urge the assembly against a spacer sleeve 56 and lightly compress resilient members 53 frictionally to hold the measuring disc 42 in place. A set screw 57 locks the cap nut 54 in an adjusted position.

In the position shown in Fig. 2, the mechanism is being operated, and the shaft 26 is in an angular position corresponding to Fig. 5.

Upon rotation of the control disc 42 in a clockwise direction, as viewed in Fig. 1, the projection 43 engages the arm 44 to angularly move the shaft 26 and trip the mechanism.

A transverse mechanism is provided for appropriately guiding the material onto the spool 10. The traverse mechanism is shown most clearly in Figs. 7 and 8.

A traversing arm 58 comprises two parts 75 and 76 adjustably secured together to determine, within limits, an effective combined length of the arm 58. The lower part 76 is rod-like and circular in section, and its upper end is threadedly received in an aperture of a transverse flange 77 of the upper arm. A set screw 78 secures the parts 75 and 76 in an adjusted position.

The arm 58 is mounted for angular movement about an axis 78 spaced from and extending in a direction normal to the axis of the winding roller in order that a movable portion of the arm 58 sweeps substantially axially of the spool. A bracket 59 carried by the base 28 provides a bearing for a bent end of the lower part 76 of the traversing arm 58.

The upper part 75 of the traversing arm 58 terminates in upwardly extending bifurcations 60. The material 11 between the winding spool 10 and the measuring pulley 48 is guided by the bifurcations 60. Adjustment of the length of the traversing arm 58 properly locates the bifurcations with respect to the winding spool 10.

For reciprocating the traversing arm 58 about the axis 78, a linkage system is provided. A reciprocating lever arm 61 is of two-part construction, the parts 79 and 80 being adjustably secured together to vary the effective length of the reciprocating lever 61. For this purpose, the lower part 80 is of circular cross section slidably accommodated in an aperture of a transverse flange 81 of the upper part 79. A set screw 82 secures the parts 79, 80 in an adjusted position.

The two-part reciprocating lever arm 61 is pivotally mounted at its upper end on a bracket 62. The movable end of the reciprocating lever arm 61 has a swivel socket member 63 threadedly receiving one end of a connecting link 64. The other end of the connecting link 64 is pivotally connected to the traversing arm 58. For this purpose, a nut 66, threadedly accommodated on the threaded portion of rod 76, has a reduced cylindrical extension 83 mounting a relatively rotatable ring 84. A snap ring 99 enters a groove in this extension, and prevents relative longitudinal movement between the adjusting nut 66 and the ring 84. The end of the connecting link 64 passes with substantial clearance through aperture 85 of the ring 84. The connecting link 64 carries an abutment collar 65 abutting the ring.

A tension spring 67, secured at one end to the casing 13, engages a bracket 68 carried by the traversing arm 58 to urge the entire linkage mechanism toward the right, as viewed in Fig. 7, and in such direction as to maintain the collar 65 and ring 84 in engagement.

The reciprocating lever arm 61 is operated by a crown cam 69 that is uniformly rotated by the transmission. The crown cam 69 engages a cam follower roller 86 carried by the upper part 79 of the reciprocating lever arm 61. The cam follower roller 86 is maintained in engagement with the crown cam 69 by the tension spring 67.

Upon rotation of the cam 69, the arm 61 and connecting link 64 reciprocate to move the traverse arm 58 between definite angular positions indicated by dot-and-dash lines in Fig. 7. These angular positions of the traversing arm 58 are determined by the pitch of the crown cam 69 and the geometric relationships of the linkage system.

The sweep or amount of angular movement of the traversing arm **58** depends upon the location along the length of the traversing arm **58** at which connection is effected with the connecting link **64**. Adjustment of the length of the sweep of the traversing arm **58** is effected within substantial limits by moving the adjusting nut **66** longitudinally of the rod **76**. Such adjustment shifts the position of the ring **84** along the length of the traversing arm **58**, downward movement of the nut **66** increasing the sweep for a given stroke of the connecting link **64**. The nut **66** can be rotated despite the continuous connection between the traversing arm **58** and the link **64** by virtue of the fact that the collar **84** effecting the connection need not rotate with the nut **66**, but it is nevertheless moved longitudinally therewith.

Adjustment of the sweep of the traversing arm can also be accomplished by changing the stroke of the connecting link **64**. This is accomplished by adjusting the length of the two-part reciprocable lever **61**. Increasing the length of the reciprocable lever **61** increases the stroke of the connecting link **64** to increase the sweep of the traversing arm **58**.

A substantial range of angular movement of the traversing arm can be accomplished by adjustment both of the nut **66** and the two-part reciprocating lever **61**.

In order to center the sweep of the traverse arm **58** with respect to the spool **10**, the operating length of the connecting link **64** is varied. Thus, for instance, if the collar **65** carried by the connecting link **64** is moved to the right, the central position of the traversing arm is moved toward the right along the length of the spool **10**. The threaded connection between the connecting link **64** and the reciprocating lever arm **61** permits such adjustment. Such adjustment is accomplished by manipulating a knurled knob **71** formed at the left-hand end of the connecting link **61**, as viewed in Fig. 7.

As shown most clearly in Fig. 9, the shaft **12**, the bifurcations **16** and **17**, and the collar **18** may receive a card **100** in place of a spool **10**. The card **100** is inserted between the bifurcations **16** and **17** and into a diametrically extending slot **101** of the collar **18**. The clamp **21** moves the bifurcations **16** and **17** together to engage the card **100** and properly maintain the latter in position on the shaft **12**.

The inventor claims:

1. In a winding mechanism: a rotary structure provided with an element upon which the material is wound; an electric motor; a transmission mechanism between the motor and the structure including a friction drive capable of slipping when the rotary structure is restrained; a brake for restraining the rotary structure; a circuit controller for the motor; means responsive to the winding of a definite measure of the material on the element for operating the circuit controller to deenergize the motor; and means operating substantially simultaneously with the operation of the circuit controller for applying the brake for causing slippage of the transmission mechanism.

2. In a winding mechanism: a rotary structure for winding material; a motor; a frictional coupling between the motor and the rotary structure and capable of slipping when the rotary structure is restrained; a brake for the rotary structure; a movable measuring element; means effecting a transmission between said material and said element for moving said measuring element; a circuit controller for the motor; a mechanism for operating said brake; and means for simultaneously operating said mechanism and said circuit controller upon a predetermined movement of said measuring element.

3. In rotary apparatus: a rotary structure; a motor; a friction coupling between the motor and the rotary structure; a wrap-around brake band loosely mounted upon said rotary structure and rotated thereby; a projection carried by the brake band at one end thereof and describing a circular path of movement; a member movable into and out of the path of movement of said projection; a trip mechanism for moving said movable member; and an actuator member movable in response to the existence of a condition for tripping the trip mechanism.

4. In rotary apparatus: a rotary structure; a motor; a friction coupling between the motor and the rotary structure; a wrap-around brake band loosely mounted upon said rotary structure and rotated thereby; a projection carried by the brake band at one end thereof and describing a circular path of movement; a member movable into and out of the path of movement of said projection; a circuit controller for the motor; a trip mechanism for moving said movable member and for operating said circuit controller; and an actuator member movable in response to the existence of a condition for tripping the trip mechanism.

5. In a measuring device: a rotatable shaft; a plate; means frictionally coupling said plate to said shaft for rotation therewith; said plate having indicating markings thereon; means for rotating said shaft, including a pulley; means for guiding flexible material about said pulley; a trip mechanism for operating a control device, and including an angularly movable arm; and a leaf spring secured to the plate and having a free end extending away from the plate when said spring is unflexed; said arm being in the path of movement of said free end of said spring and moved thereby when said plate and spring move to a definite angular position.

6. In a measuring device: a rotatable shaft; a plate; means frictionally coupling said plate to said shaft for rotation therewith; said plate having indicating markings thereon; means for rotating said shaft, including a pulley; means for guiding flexible material about said pulley; a trip mechanism for operating a control device, and including an angularly movable arm; a leaf spring; and means adjustably securing said leaf spring to said plate for limited angular movement thereon, said leaf spring having a free end extending away from the plate when said spring is unflexed; said arm being in the path of movement of said free end of said spring and moved thereby when said plate and spring move to a definite angular position.

7. In a winding mechanism: a rotary structure for winding material; a measuring element movable in accordance with the amount of material being wound; a controller for the rotary structure; a trip mechanism for operating the controller, comprising: an angularly positionable shaft, a crank carried by the shaft; a link having arms extending on one side of the link to define a concavity between the arms, means pivotally connecting one arm to the crank, a tension spring connected to the other arm and urging the link in one direction away from said shaft, an operating arm carried by said shaft; a connection between said link and said controller; and means carried by said measuring element for moving said operating arm when said measuring element is in one position.

8. In a winding mechanism: a rotary structure for winding material; a motor for rotating said structure; a friction coupling between said motor and said rotary structure; a wrap-around brake band loosely carried by said rotary structure for rotation therewith, said band having a projection at one end thereof; a circuit for the motor, including a circuit controller; a measuring device movable in accordance with the length of material wound upon said structure; an angularly positionable shaft; a crank carried by the shaft; a link having arms defining a concavity between them; means pivotally connecting one arm to the crank; a tension spring connected to the other arm and urging said link in one direction away from said shaft; said link engaging said shaft and defining a limiting angular position of said shaft in which said spring biases said shaft in said limiting position; an operatng arm carried by the shaft for moving said shaft away from said limiting position and toward a position in which said spring urges said shaft away from said limiting position; means carried by the measuring device for moving the arm when said device reaches a definite position; a dogging projection

engageable with the projection for causing the band to grasp the rotary structure means carried by the shaft for moving said dogging projection when said shaft is moved away from said limiting position; and means operating said circuit controller when said shaft is moved away from said angular position.

9. In a winding mechanism: a rotary structure for winding material; a measuring element movable in accordance with the amount of material being wound; a controller for the rotary structure; a trip mechanism for operating the controller, comprising: an angularly positionable shaft; means determining one limited angular position of the shaft; a spring connected eccentrically to the shaft to provide alternate stable positions of the shaft and an intermediate unstable central position, one stable position corresponding to said limited position; an operating arm carried by the shaft; means operated upon movement of the shaft away from said limited position and beyond said central position for operating said controller; and a lost motion connection between said measuring element and said operating arm for moving the shaft away from said one limited position upon a predetermined movement of said element.

10. In a winding mechanism: a rotary structure for winding material; a motor for rotating said structure; a friction coupling between said motor and said rotary structure; a wrap-around brake band loosely carried by said rotary structure for rotation therewith, said band having a projection at one end thereof; a circuit for the motor, including a circuit controller; a measuring device

movable in accordance with the length of material wound upon said structure; an angularly positionable shaft; means determining one limited angular position of the shaft; a spring connected eccentrically to the shaft to provide alternate stable positions thereof and an intermediate unstable central position, one stable position corresponding to said one limited position; an operating arm carried by the shaft; means operated upon movement of the shaft away from said limited position and beyond said central position for operating said controller; a dogging projection cooperable with said band projection; means operated upon movement of said shaft away from said limited position for moving said dogging projection into dogging position; and a lost motion connection between said measuring device and said operating arm for moving said shaft away from said one limited position upon a predetermined movement of said device.

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