Sept. 9, 1947. R. G. WERTH 2,427,079

UNWINDING AND COUNTING APPARATUS

Filed Oct. 28, 1944 4 Sheets-Sheet 1

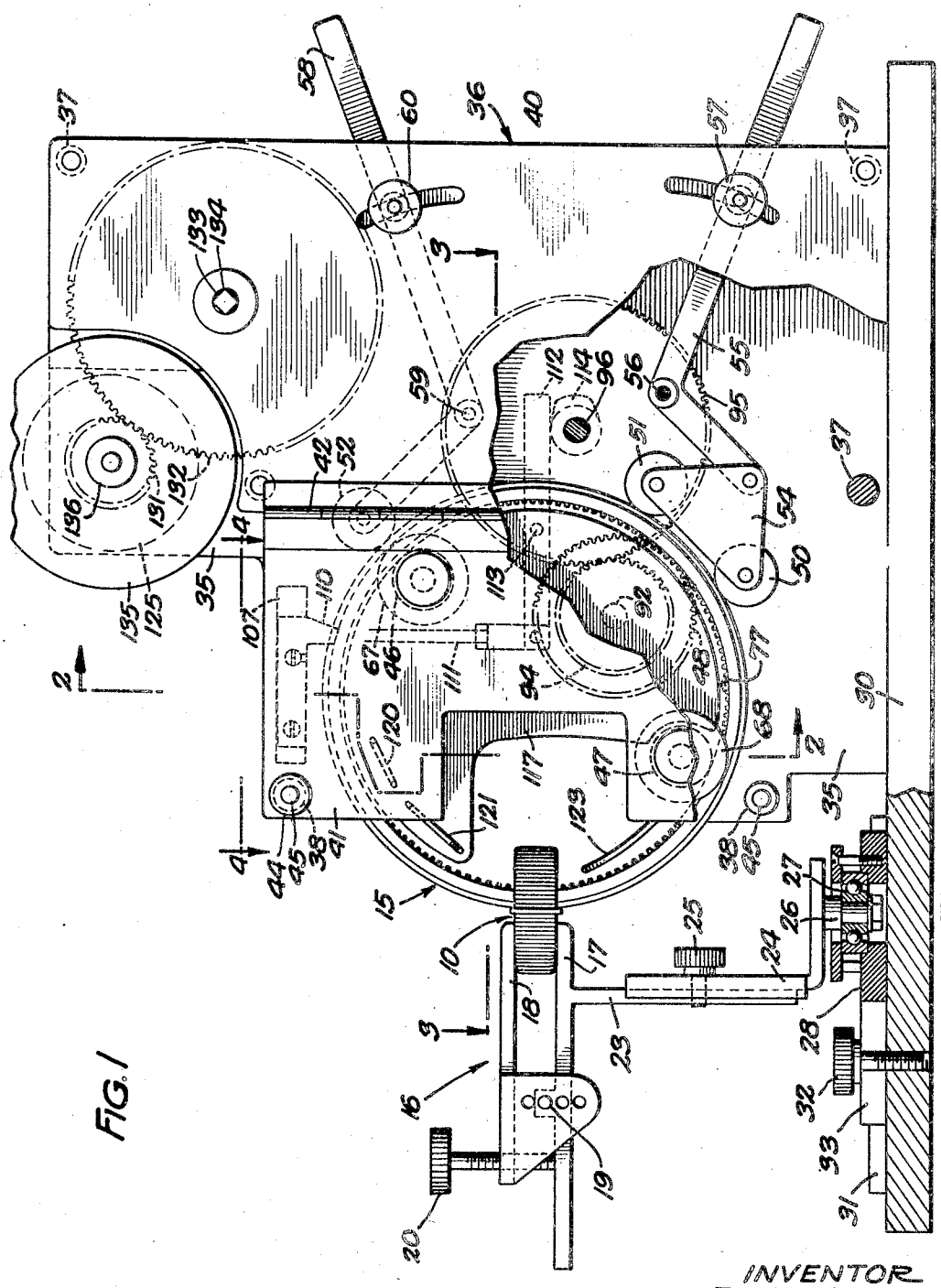


FIG. 1

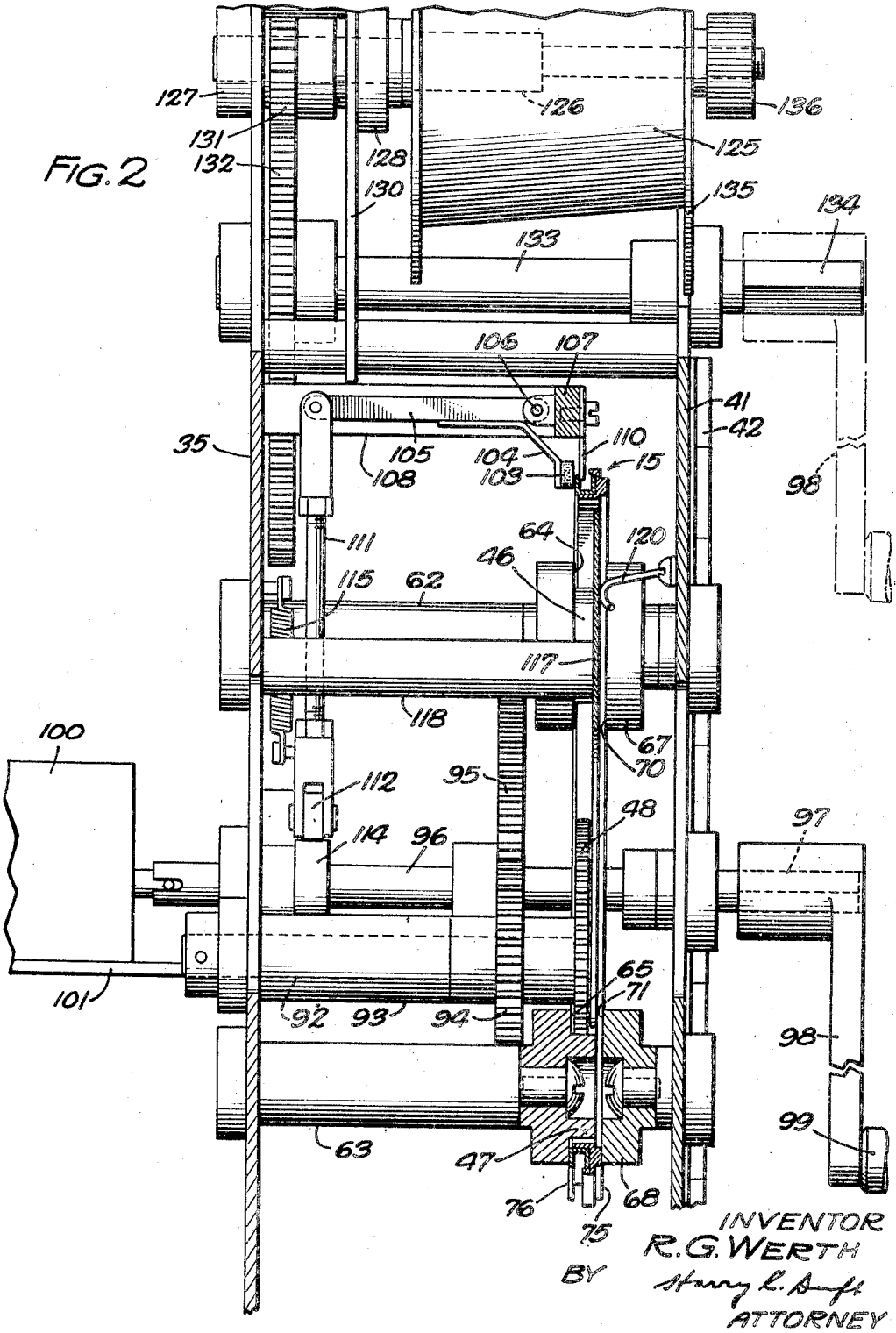
INVENTOR
R. G. WERTH
BY Harry L. Arnold
ATTORNEY

Sept. 9, 1947. R. G. WERTH 2,427,079

UNWINDING AND COUNTING APPARATUS

Filed Oct. 28, 1944 4 Sheets-Sheet 2

FIG. 2



INVENTOR
R. G. WERTH
BY Harry R. Arndt
ATTORNEY

Sept. 9, 1947. R. G. WERTH 2,427,079

UNWINDING AND COUNTING APPARATUS

Filed Oct. 28, 1944 4 Sheets-Sheet 3

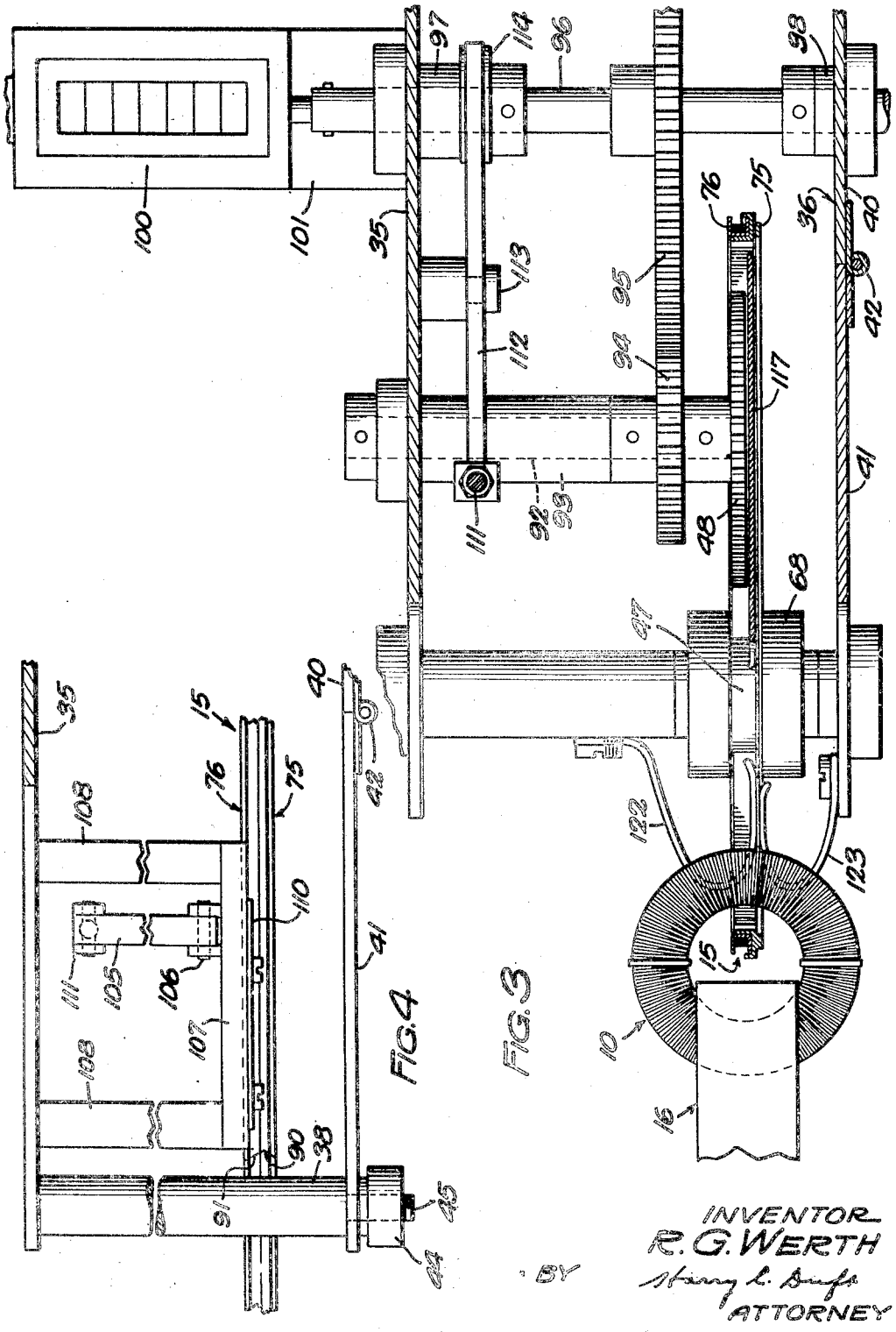


FIG. 4

FIG. 3

INVENTOR
R. G. WERTH
BY Henry L. Bruff
ATTORNEY

Sept. 9, 1947. R. G. WERTH 2,427,079

UNWINDING AND COUNTING APPARATUS

Filed Oct. 28, 1944 4 Sheets-Sheet 4

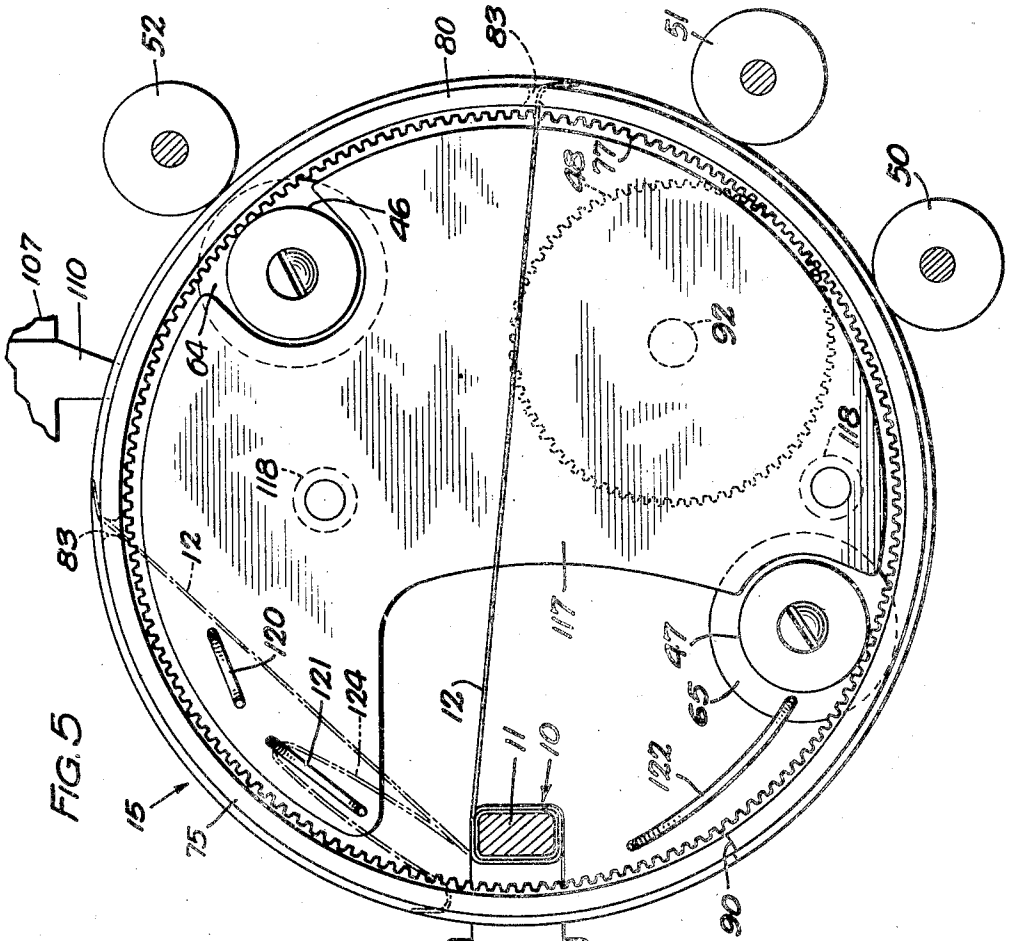


FIG. 5

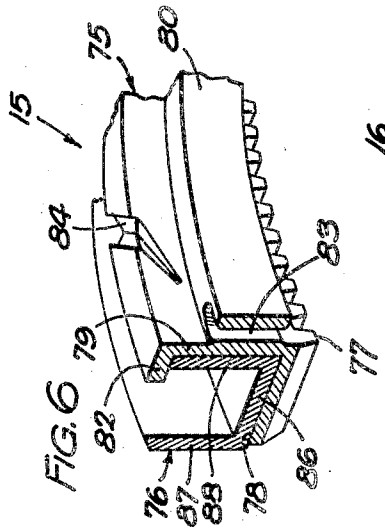
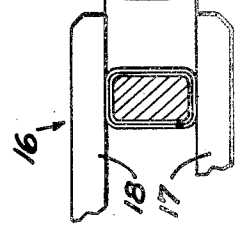


FIG. 6



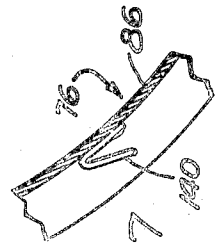


FIG. 7

INVENTOR
R. G. WERTH
BY Harry E. Smith
ATTORNEY

Patented Sept. 9, 1947

2,427,079

UNITED STATES PATENT OFFICE

2,427,079

UNWINDING AND COUNTING APPARATUS

Rudolph G. Werth, Oak Park, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application October 28, 1944, Serial No. 560,781

10 Claims. (Cl. 242—1)

1

This invention relates to unwinding and counting apparatus and more particularly to apparatus for unwinding a toroidal coil to determine the number of turns of strand of the coil.

In the usual apparatus for winding toroidal coils, there is a variable relationship between the number of rotations of the shuttle and the number of turns of strand wound on the coils of various sizes, and therefore it is difficult or impracticable to attach to the winding machine a counting mechanism for indicating the number of turns of strand wound on the core of a finished coil.

An object of this invention is to provide an effective and efficient apparatus for determining the number of turns of strand in a toroidal coil.

In accordance with one embodiment of the invention, there is provided an apparatus for unwinding the strand of a toroidal coil from the core and counting the number of turns thereon in which a coil is supported in interlinked relation with a rotatable shuttle. The shuttle comprises a rotatable unwinding ring for unwinding one turn of strand from the coil for each rotation of the ring and a spool ring upon which the unwound portion of the strand is accumulated. Means are provided for retarding the rotation of the spool ring relative to the unwinding ring to take up the strand as it is unwound from the coil and a counter is connected to the shuttle to indicate the number of rotations required to unwind the strand.

Other objects and advantages of this invention will be apparent from the following detailed description taken in conjunction with the following drawings showing a preferred embodiment of the invention, in which

Fig. 1 is a side view of the machine with parts broken away and parts shown in section;

Fig. 2 is a vertical section taken on the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary plan section taken on the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary plan view of the portion of the machine indicated by the line 4—4 on Fig. 1;

Fig. 5 is an enlarged fragmentary view of the shuttle and associated parts, showing the coil in section therein;

Fig. 6 is an enlarged view in perspective of a portion of the shuttle; and

Fig. 7 is a fragmentary sectional view showing the hook attached to the spool ring for receiving one end of the strand.

Before being used, the toroidal coils are individually enclosed in a housing and encased in rubber or otherwise processed. It is essential that the coils meet the standards specified including that of the number of turns of wire thereon. It is impossible with the standard toroidal coil winding machine to count the number of turns since the shuttle does not make the same number of revolutions as the number of turns of wire applied. It is necessary, therefore, to select one or more toroidal coils from each batch of coils of different sizes for testing and unwind the test coils to determine the number of turns thereon before further processing the remainder of the coils. The present apparatus is designed to accomplish the unwinding and counting of the turns of the wire on the coil.

2

Referring to the drawings, especially Figs. 1 and 5, a toroidal coil 10 comprising a core 11 and a strand 12 wound thereon is shown interlinked with a shuttle 15, and is held in place by a coil support or clamp 16. The toroidal coil 10 may have a double winding thereon with each winding occupying one half of the coil and separated from the other by spacers as illustrated in Fig. 3.

The support or clamp 16 comprises a fixed jaw 17, upon which a movable jaw 18 is pivotally mounted, as at 19. A thumb screw 20 engages a threaded aperture in the jaw 18 and abuts against the jaw 17 for moving the jaw 18 about the pivot 19 to securely hold the coil 10 in place as shown in Fig. 1. The jaw 17 has a depending leg 23 adjustably clamped to the vertical portion of an L-shaped supporting member 24 by a thumb screw 25. A stud 26 projects from the horizontal portion of the supporting member 24 and is secured to the inner race of a ball bearing 27, the outer race of which is secured to an adjustable supporting plate 28. The plate 28, movable toward and away from the shuttle, rests on a base 30 of the apparatus and is held in adjusted position between guide rails 31 by a thumb screw 32, the shank of which passes through a slot in the plate 28 and engages a threaded aperture in the base. With this construction, a toroidal coil within a certain size range may be firmly clamped in coaxial alignment with the axis of rotation of the support 16 so as to freely oscillate about this axis and may be adjusted horizontally to and from the shuttle and vertically relative thereto so as to align the coil properly relative to the shuttle 15.

A pair of spaced frame members or plates 35 and 36 are secured to the base 30 and are spaced apart by and secured to spacing rods 37—37 and

38—38 and form a frame for supporting the shuttle 15 and other mechanism later to be described. The frame member 36 is made in two sections and comprises a fixed section or plate 40 and a movable section or plate 41 attached thereto by a hinge 42. The section 41 is adapted to swing about the hinge 42 to an open position to render the shuttle accessible and is locked in the closed position against shoulders on rods 38 by thumb nuts 44 engaging reduced threaded ends 45 of the rods 38 projecting through apertures in the section 41.

The shuttle 15 is rotatably mounted and is supported on its inner periphery by a pair of rollers 46 and 47 and a gear 48 and on its outer periphery by adjustable rollers 50, 51 and 52. The rollers 50 and 51 are carried by equalizing plates 54, which are pivoted at one end of the lever 55. The lever 55 is pivoted at 56 to the frame member 40 and is adjustably secured thereto by a locking screw 57, the shank of which passes through a slot in the frame 40. The roller 52 is carried by one end of a lever 58, which is pivoted at 59 to the frame 40 and locked in adjusted position by a locking screw 60. The rollers 46 and 47 (Fig. 2) are rotatably mounted on posts 62 and 63 carried by the frame plate 35 and are provided with enlarged portions forming shoulders 64 and 65 for engaging one side of the shuttle for preventing lateral displacement thereof in one direction. Rollers 67 and 68, in axial alignment with the rollers 46 and 47 mounted on the movable frame member 41 are provided with flat radial surfaces 70 and 71 for engaging the other side of the shuttle 15 to prevent lateral displacement thereof in the other direction.

The shuttle 15 (Fig. 6) comprises an unwinding member or ring 75 and a spool ring or take up member 76. The unwinding ring 75 is L-shaped in cross-section, the axially extending portion of which forms an internal ring gear 77 and provides a seat 78 for the spool ring 76. The ring gear 77 meshes with the gear 48 and engages the rollers 46 and 47. The radially extending wall portion 79 of the unwinding ring is increased in thickness to form an annular rail 80, which engages the surfaces 70 and 71 of the rollers 67 and 68. At its outer edge, the unwinding ring 75 is provided with a flange 82, which overlies a portion of the spool ring 76 and which forms an annular bearing surface for engagement with the supporting rollers 50, 51 and 52. The unwinding ring 75 is provided with a strand guide or eyelet 83 in the form of an aperture passing radially through the rail member 80 and a groove 84 formed in the flange 82 and the wall 79. The spool ring 76, comprising a cylindrical base 86 and spaced flanges 87 and 88, is rotatably mounted on the seat 78 of the unwinding ring 75 and abuts against the wall 79 thereof. The spool ring 76 is frictionally driven by and normally rotates with the unwinding ring 75. The rings 75 and 76 are slitted transversely at 90 and 91 (Fig. 4) to form a joint in each ring so that when the joints are aligned side by side, they may be separated and a portion of the shuttle deflected laterally to permit the interlinking of the coil 10 therewith.

The coil gear 48, which meshes with the ring gear 77 of the shuttle, is secured to a shaft 92 journalled in a bearing 93, which is carried by the frame member 35. The shaft 92 has secured to it another gear 94, which meshes with a gear 95 fastened to a drive shaft 96. The drive shaft 96 is journalled in bearings 97 and 98 of the frame members 35 and 36 and is provided with a square end portion 97 to receive a crank 98 thereon. The crank 98 is provided with a handle 99, which may be engaged by the operator to rotate the shuttle. The ratio of the drive is such that one complete turn of the crank will impart one complete revolution to the unwinding ring 75.

A rotation counter 100 is connected to one end of the drive shaft 96 and is supported on a bracket 101 fixed to the frame 35. The counter 100 will register the number of rotations of the drive shaft 96 and of the unwinding ring 75.

The spool ring 76, in order to take up the unwound strand, has to move relative to the unwinding ring 75, and, to accomplish this, there is provided means for retarding its movement relative to the unwinding ring during a portion of each cycle of rotation of the unwinding ring 75. A brake shoe 103 (Fig. 2) is secured to a flexible arm 104 attached to a lever 105. The lever 105 is pivoted at 106 to a bracket 107 having arms 108—108 secured to the frame member 35. The brake shoe 103 is adapted to be moved into engagement with the flange 87 of the spool ring and press it against a backing member 110 secured to the bracket 107 and grip the flange 87 to effect a braking or retarding action of the spool ring 76. The free end of the lever 105 is connected to one end of a link 111, the other end of which is connected to a lever 112. The lever 112 is pivoted at 113 to the frame 35 and has its free end engaging a cam 114 mounted on the drive shaft 96. The cam 114 will actuate the lever 112 to apply the brake during approximately 100° of rotation of the shuttle. A spring 115 (Fig. 2) is connected at one end to the frame member 35 and at the other end to the link 111 to effect the release of the brake.

A disc 117 is mounted within the shuttle 15, as shown in Figs. 5 and 2, and is carried by posts 118 fixed to the frame 35. The disc 117 overlies and is positioned adjacent the drive gear 48 and is cut away to provide clearance for the rollers 46 and 47 and for the toroidal coils 10. The face of the disc is in alignment with the end face of the rollers 46 and 47 and forms a wall for guiding the strand 12 as it is unwound by the strand guide 83 during the rotation of the shuttle 15. The surfaces 70 and 71 of the rollers 67 and 68 are spaced from the end faces of the rollers 46 and 47 to provide a space through which the strand 12 passes as it is being unwound (see Fig. 2). Flexible strand engaging members 120 and 121 mounted on the frame member 41 engage the disc 117 for the purpose of retarding and guiding the strand 12 during the unwinding operation. Guide members 122 and 123 (Figs. 3 and 5) are provided for guiding the strand into the space between the rollers 47 and 68.

After the strand 11 has been unwound from the core 11 and wound upon the spool ring 76 of the shuttle, it subsequently has to be unwound therefrom and for this purpose a shuttle unwinding mechanism is provided. The shuttle unwinding mechanism comprises a tapering drum 125 (Fig. 2) fixed to a shaft 126 rotatably mounted in bearings 127 and 128 carried by the frame member 35 and an auxiliary frame member 130. Also secured to the shaft 126 is a gear 131 meshing with a drive gear 132 secured to a shaft 133 rotatably mounted in the frame members 35 and 36. The shaft 133 is provided with a squared end 134, which may receive the crank 98 for turning the shaft 133 and rotating the drum 125. The drum 125 is provided with a removable disc

135, which is secured in place by a thumb nut 136 engaging the reduced threaded end of the shaft 126.

In the operation of the apparatus the thumb nuts 44 are loosened and the frame member 41 is moved slightly away from the shuttle. The shuttle 15, after the joints in the winding ring 75 and the spool ring 76 have been aligned, is opened and deflected laterally and a toroidal coil 10 is interlinked therewith. The shuttle is closed and the frame member 41 is moved to its closed position and locked in place by means of the thumb nuts 44. The coil 10 is clamped in the support 16 so that its axis is aligned with the axis of the ball bearing 27 and the support 16 is adjusted to properly align the coil 10 with the shuttle, as shown in Figs. 1, 3 and 5. The toroidal coil 10 is adjusted vertically with respect to the shuttle 15 so that it occupies a horizontal position at the level of the axis of the shuttle and is horizontally adjusted so that the unwinding ring passing through the opening of the coil is eccentric thereto and is positioned close to that half of the coil being unwound (see Fig. 3). Several turns of the strand are unwound manually from the coil and the end thereof is threaded through the strand guide 83 and passed through the groove 84 and looped over a hook 140 fixed to the spool ring 76 (Fig. 7). The operator may then turn the crank 98 and rotate the shuttle 15 to unwind the strand from the coil, which operation is continued until the strand 12 is completely unwound from the core 11 of the coil and the number of rotations of the shuttle registered on the indicator 100 is noted. The strand 12, as it is being unwound from the core 11, exerts a pull on the coil which moves the coil 10 and the coil support 16 about their common axis so that that portion of the coil 10 being unwound is close to the unwinding ring and the loop being unwound is in the plane of the unwinding ring. The strand guide 83, as it passes through the coil 10, will unwind one loop therefrom and carry it down through the guide members 122 and 123 and between the rollers 47 and 68 around to the position shown in full lines in Fig. 5, at which time the slack has been taken up and the strand 12 is taut. The application of the brake 103 begins at this point in the cycle and continues until the strand guide 83 has moved the strand 12 to the dotted line position shown in Fig. 5 or for approximately 100°, during which time the spool ring is retarded in its movement and the unwinding ring 75 advances relative thereto. This movement of the unwinding ring 75 relative to the spool ring 76 winds or guides a portion of the strand 12 onto the spool ring, the amount being substantially the same as the length of the loop of strand unwound from the coil 10. In effect the spool ring 76 while it is being retarded moves backward relative to the unwinding ring 75 and pulls the strand 12 through the eyelet 83 and over the guide groove 84 onto itself. After the brake is released, the spool ring and the winding ring of the shuttle 15 rotate together and carry the strand between guide members 120 and 121, which help to position the strand as shown at 124 in Fig. 5 to facilitate its passage through the coil 10.

Upon completion of the unwinding operation, and recording the reading of the rotation indicator 100, the strand may be unwound from the spool ring 76 and wound upon the drum 125, after which it may be removed therefrom by removing the thumb nut 136 and the disc 135. The toroidal coil 10 may be released from the clamping jaws 16 and turned 180° and reclamped in position with the clamp 16 engaging the core 11 and the second half of the coil may be unwound in the same manner as the first half was unwound. When the unwinding operation is completed, the frame 41 may be moved slightly away from the shuttle, the clamp 16 may be released, the shuttle 15 may be opened and the core 11 removed.

What is claimed is:

1. In an apparatus for determining the number of turns of strand wound on a core, means encircling the core for unwinding one turn of strand for each revolution of said means, and a takeup means for said unwound strand also encircling said core and movable in the same direction but at a slower speed than said unwinding means.

2. In an apparatus for determining the number of turns of strand wound on a core, a shuttle encircling said core, said shuttle having an unwinding member for unwinding one turn of strand for each revolution of said member and takeup means concentric with said member and movable in the same direction but at a slower speed than said member to take up said unwound strand.

3. In an apparatus for determining the number of turns of strand wound on a core, means encircling said core for unwinding one turn of strand for each revolution of said means, a takeup means also encircling said core concentric with and movable in the same direction as said unwinding means to take up said unwound strand, and means for rotating said unwinding means at one speed and the takeup means at a slower speed.

4. In an apparatus for determining the number of turns of strand wound on a core, a shuttle encircling said core, said shuttle having an unwinding member for unwinding one turn of strand for each revolution of said member and takeup means carried by and normally rotatable with said unwinding member, means for driving said shuttle, and means for periodically effecting a relative movement between said unwinding member and said takeup member during the rotation of said shuttle to take up said unwound strand.

5. In an apparatus for determining the number of turns of strand wound on a core, a shuttle encircling said core, said shuttle having an unwinding member for unwinding one turn of strand for each revolution of said unwinding member and a takeup member frictionally driven by and rotatable with said unwinding member, means for driving said shuttle, and means for periodically retarding the movement of said takeup means during the rotation of said shuttle to take up said unwound strand.

6. In an apparatus for determining the number of turns of strand wound on a core, a shuttle encircling said core, said shuttle having an unwinding member for unwinding one turn of strand for each revolution of said unwinding member and a takeup member frictionally driven by and rotatable with said unwinding member, means for driving said shuttle, and means for retarding the movement of said takeup member during a part of each revolution of said unwinding member to take up said unwound strand.

7. In an apparatus for determining the number of turns of strand wound on a core, means for supporting a core, a rotatable unwinding

member encircling said core for unwinding one turn of strand for each revolution of said unwinding member, a takeup member concentric with said unwinding member also encircling said core and movable in the same direction as said unwinding member, and means for driving said unwinding ring for unwinding the strand and for driving said takeup ring a relatively fewer number of rotations than said unwinding ring to take up said unwound strand.

8. In an apparatus for determining the number of turns of strand wound on a core of a coil, means for supporting a coil, a rotatable shuttle encircling said coil and having an unwinding ring for unwinding one turn of strand for each rotation of said unwinding ring and a takeup ring rotatable with said unwinding ring for taking up the unwound strand, driving means for rotating said shuttle, and means for effecting relative movement between said takeup ring and said unwinding ring during the rotation of said shuttle to take up said unwound strand.

9. In an apparatus for determining the number of turns of strand wound on a core of a toroidal coil, means for supporting a coil to freely oscillate about its axis, a rotatable shuttle eccentrically interlinked with said coil, said shuttle having an unwinding ring for unwinding one turn of strand from the coil for each revolution of the unwinding ring and a takeup ring carried by and rotatable with said unwinding ring, driving means for rotating said shuttle, and means for retarding said takeup ring during a portion of each rotation of said unwinding ring to take up the unwound strand.

10. In an apparatus for determining the number of turns of strand wound on a toroidal core, means encircling the core for unwinding one turn of strand for each revolution of said means, a takeup means for said unwound strand also encircling said core, means for supporting said core to freely oscillate about its axis, and means for adjusting said supporting means to position said core eccentrically to the portion of the shuttle passing therethrough.

RUDOLPH G. WERTH.

REFERENCES CITED

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

FOREIGN PATENTS

Number	Country	Date
644,466	Germany	May 3, 1937