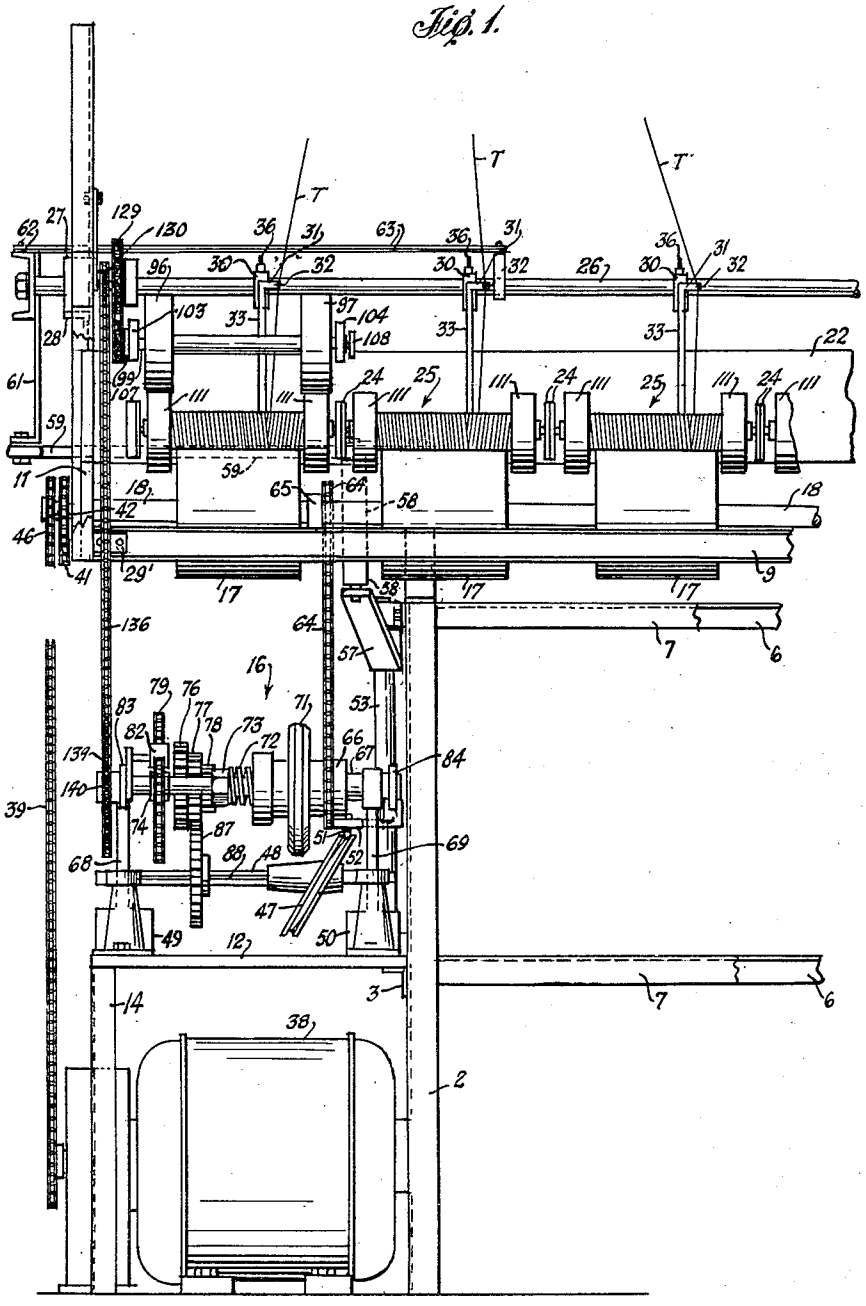
July 29, 1952 E. N. BRODEN 2,605,053

SYNCHRONOUS FOLLOWER DRIVE FOR SPOOLER TRAVERSES

Filed Feb. 16, 1950 3 Sheets-Sheet 1

Fig. 1.



Inventor

Edwin N. Broden

By Ely & Frye

Attorneys

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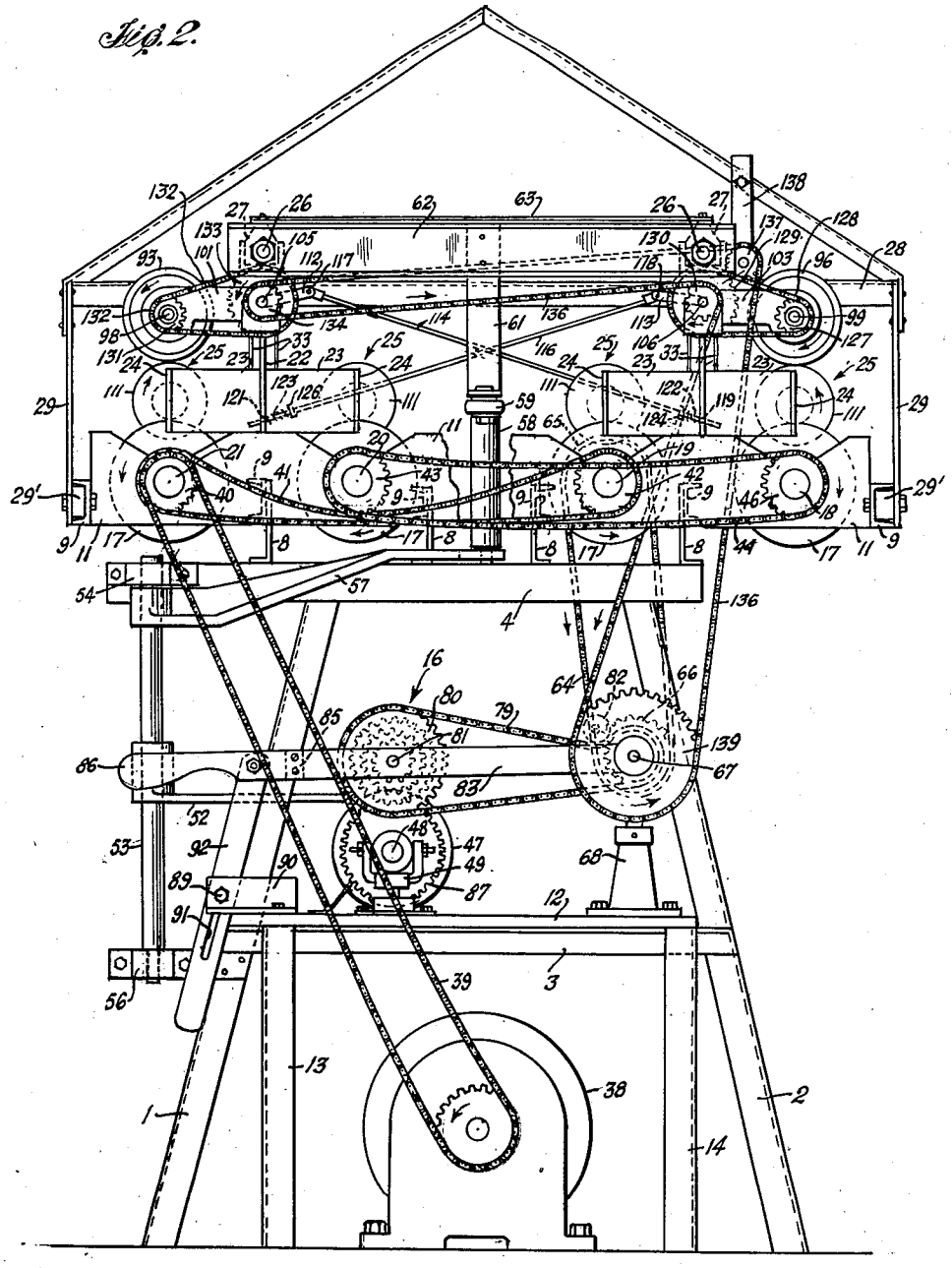
Fig. 2.



Inventor
Edwin N. Broden

By Ely & Frye
Attorneys

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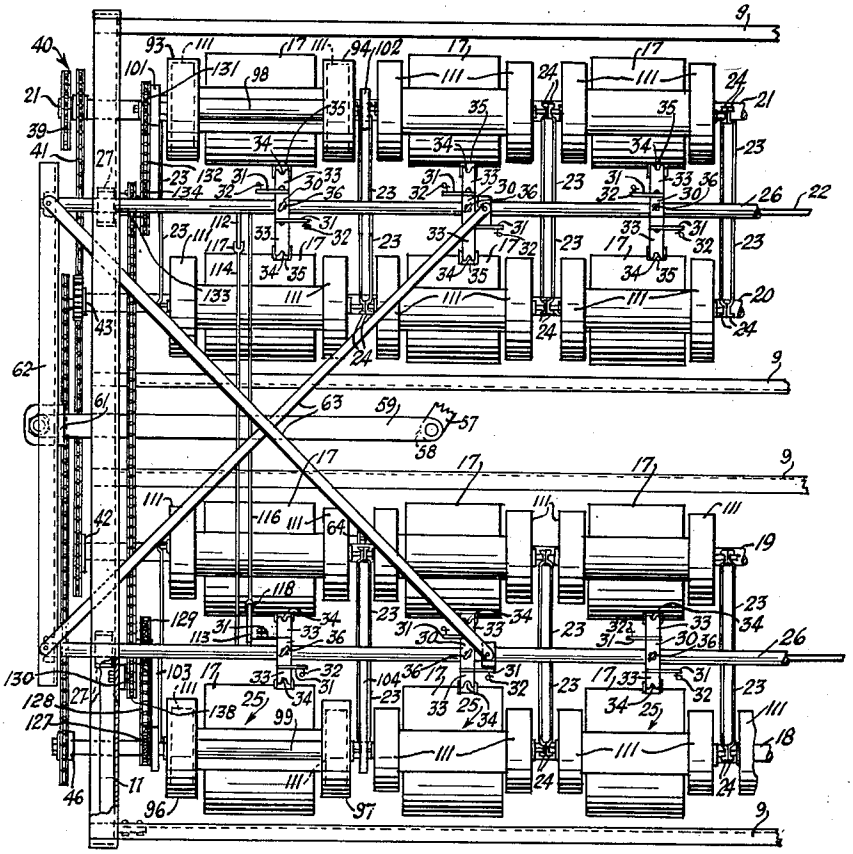
Fig. 3.



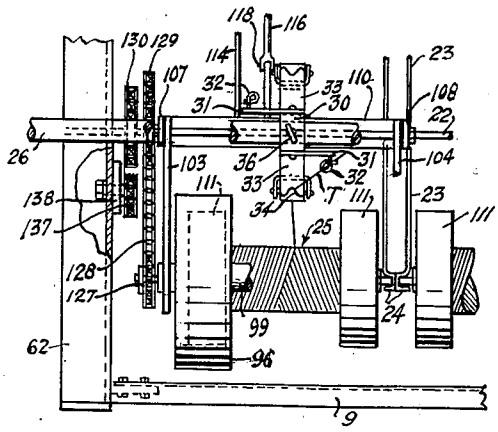


Fig. 4.

Inventor
Edwin N. Broden
By Elliott & Fuge
Attorneys

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SYNCHRONOUS FOLLOWER DRIVE FOR SPOOLER TRAVERSES

Edwin N. Broden, Assonet, Mass., assignor to The Firestone Tire & Rubber Company, Akron, Ohio, a corporation of Ohio

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13 Claims. (Cl. 242—26)

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In the winding of filamentary material as it emerges from a processing apparatus, the linear speed of the material is substantially constant, as determined by the rate of the processing machinery. As the material is wound on spools, this constant linear speed requires a decreasing angular velocity of the spool as the radius of the wound portion increases. Thus, if the spool itself is directly driven to take up the winding, it becomes necessary to vary the speed of the power drive in inverse relation to the radius of the winding on the spool.

According to the present invention, the power drive for windup is communicated directly to the outer surface of the wound material by a rotating drum so that the said outer surface has a constant linear speed equal to that of the outer surface of the drum. The traverse mechanism or level winder is powered from the main drive to the drums but the rate thereof is modified by a "take-off" device which reflects the angular speed of the spool.

It is therefore an object of the invention to provide a spool windup device having a powered drive of constant angular velocity, communicating, at all times, a constant linear speed to the outer layer of windings on the spool. A further object is to provide a device of this character in which the speed of the traverse mechanism is controlled in relation to the angular velocity of the spool. In still greater particular, it is an object to provide a device according to both the foregoing objects in which the traverse mechanism has a powered drive which is modified in accordance with the angular velocity of the spool.

The machine shown and described herein is particularly adapted for winding installations in which there are a vast number of spools operated from a single source of power, in which it is essential that all of the spools be driven uniformly, and in which it is also essential that the traversing or level-wind mechanism be driven at the correct rate of speed to lay the filaments evenly over the spool. It is also an object of the invention to adapt a machine of this type to the winding of threads, filaments, or ribbons of different widths which will require differing rates of traverse for the level-wind mechanism.

In carrying out the objects of the invention, the increase in diameter of the spools is compensated for by driving the spools from the outer surface of the material. It is, however, not practical to drive the traversing mechanism directly from the spools as it is not possible to transmit

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enough power through the spools to operate the heavy traversing devices. Power to drive the traversing mechanism is mainly derived from the same source which drives the spools, but interposed in the drive to the traversing device is a modifying element controlled by the spool rotation which permits the traversing device to be driven at the exact speed required to lay the filament or thread over the spool. In the form of the invention shown, this is accomplished through a friction clutch as will be described, but equivalent means may be substituted.

This invention is described in its best known and preferred form, but it is not necessary that the details as set forth be followed, it being possible to incorporate the invention in other forms and embodiments within the scope of the appended claims.

In the drawings:

Fig. 1 is a front elevation of one end of the windup machine.

Fig. 2 is an end elevation of Fig. 1, as viewed from the left thereof.

Fig. 3 is a top view of Fig. 1.

Fig. 4 is an enlarged, fragmentary view of a portion of Fig. 3.

The main support for the machinery comprises end frames, one of which is shown, having slanted corner legs 1, 2, cross pieces 3, 4, connected by upper and lower pairs of horizontal beams 6, 7.

Angles 8, supported on upper cross members 4, support four of six longitudinally extending channels 9 of a framework having end plates 11, on which framework are mounted the spooler, the traverse, and traverse control mechanism. A table 12, resting on angle bar 3 and on a pair of legs 13, 14, extends from one end of the frame and serves as a support for the traverse cam and change-gear mechanism shown generally at 16.

In the form shown herein, the machine is designed to contain four rows of spools, the spools in a row being of a desired number.

Friction-drive drums 17, equal to the number of spools, are located in spaced relation along shafts 18, 19, 20, 21, journaled in end plates 11, the drums being keyed to the respective shafts for rotation therewith.

A pair of longitudinal plates 22, extending from one end of the machine to the other, are supported in vertical position on end plates 11 and each carries a series of laterally projecting U-shaped, sheet metal plates 23 arranged in pairs. The outer edges of the plates 23 are grooved to form channels 24 (Fig. 4). These channels receive the spindles of windup spools 25 and posi-

tion the latter so that the portions between their end flanges dwell, under the weight of the spools, on the surface of drums 17 at all times during the winding of thread on the spools.

A pair of traverse rods 26, located between each pair of spool shafts, are slidably mounted in journal housing 27 carried on cross members 28 supported on vertical legs 29 having short plates 29' bolted in the outer pair of channels 9. Carried at spaced points on rods 26 are a series of blocks 30, each having bolted thereto a plate 31 carrying the upper thread guide 32. The plates have depending legs 33 in the lower end of each of which is set a second thread guide 34 and a guide roller 35, around which the thread T passes on its way to the spool. Blocks 30 are fixed in adjusted position on rods 26, as by set screws 36, and as rods 26 reciprocate in their bearings, by means to be presently described, the thread T is distributed back and forth along the length of the spools on either side of a rod 26.

The drums 17, which frictionally drive the spools 25, are power driven by a motor 38 through a sprocket chain 39. As best seen in Fig. 2, this drive is communicated to a double sprocket 40 keyed to shaft 21. A chain 41 on another part of sprocket 40 engages a sprocket 42 on shaft 19 to drive it in the same direction as shaft 21, and chain 41 also passes under a double sprocket 43 on shaft 20 to drive it oppositely to shafts 21 and 19. Sprocket wheel 43 on shaft 20 also connects, through a chain 44 with a sprocket wheel 46 on shaft 18 to drive it in the same direction as shaft 20. Thus, the alternate shafts have opposite directions of rotation and all the shafts and their drums 17 are rotated at the same speed.

The traverse mechanism cam, which drives the level-wind mechanism, is shown at 47 in Fig. 1. This cam is keyed to a shaft 48, journaled in standards 49, 50 carried on table 12. A cam follower 51 is carried on an arm 52 secured to a vertical rock shaft 53, rotatable in upper and lower journal housings 54, 56, bolted to extensions on the machine framework. An upper arm 57, extending from rock shaft 53 carries an upright 58, from which a tie rod 59 connects with an upright bar 61 carrying a cross bar 62 of channel form, to which the ends of traverse rods 26 are bolted. As cam 47 rotates, shaft 53 is rocked and arm 57 thereof carries tie rod 59 and framework 61, 62 in reciprocating motion to slide the rods 26 back and forth in their bearings and thus reciprocate the thread guides along the spools. A pair of crossed brace members 63 give lateral support against bending to the rods 26.

Power to drive the cam 47 is derived from the motor 38 through one of the spool rotating shafts. In the drawings this is the shaft 19. A sprocket chain 64 engages a sprocket wheel 65 on shaft 19 and a sprocket wheel 66 rotatable on a shaft 67 journaled in uprights 68, 69 on table 12. Driving torque is delivered to the shaft 67 through a slip clutch 71, adjustable by a spring 72 and nut 73, to a sprocket wheel 74, and from thence to a set of gears 76, 77, 78 of varying size through a sprocket chain 79 and a sprocket wheel 80, which latter is mounted on the same shaft 81 which mounts the gears. A roller 82, mounted to swing about shaft 67, rests upon the chain 79 to take up the slack. Shaft 81 is journaled in a framework having three sides 83, 84, 85. Sides 83 and 84 are pivoted on the center line of shaft 67 and the gear system is movable upward about the axis 67 by means of a handle extension 86 on side 83. This permits movement of a driven gear 87 along a keyway 88 of shaft 48 and selective engagement with any of the gears for changing the gear ratio. The frame is fixed in selected position by a bolt 89 in a bracket 90 fixed to the table 12 and passing through a slot 91 in an arm 92 pivoted to handle 86.

The purpose of the several gears 76–78 is to vary the rate at which the traversing device moves back and forth across the several spools. This is to permit the machine to operate on varying widths of material and still lay the material evenly over the spool. The machine is adapted to wind any widths of material from small gauge threads to narrow tape, and this mechanism permits the machine to be adjusted to its varying requirements.

The carrying power of slip clutch 71 is sufficient to activate the entire traverse mechanism at the commencement of winding when the speed of the spools is at a maximum. By the arrangement now to be described, the clutch is caused to slip by means of an auxiliary drive, which is responsive to the reduction in speed of the spools as the diameter of the material on the spools increases, to subtract from the speed input to the traverse cam.

Pairs of follower wheels 93, 94 and 96, 97, located at the left hand end of the machine as shown in Fig. 3, are keyed on shafts 98, 99, respectively, journaled in the outer ends of pairs of arms 101, 102 and 103, 104, rotatably mounted on shafts 105, 106 journaled in arms 107, 108 rising from brackets 110 secured to the upper edges of the plates 22.

The rollers 93–97 rest in their lowered position on the flanges 111 of the windup spools located beneath them. To insure against slippage between the rollers and the spool flanges, the rollers are forced into engagement with the flange by a toggle mechanism comprising arms 112, 113, keyed on shafts 105, 106, and rods 114, 116, articulated to arms 112, 113, as at 117, 118, and slidable through openings 119, 121 in plates 22 against the pressure of springs 122, 123 surrounding the rods 114, 116 and abutting adjustable collars 124, 126 on the rods. This linkage serves a double purpose: When either pivot, such as 117, is in its uppermost position, the follower wheels 93, 94 are urged downward by spring 122 against flanges 111 of the spools; but when the pivot 117 passes downwardly of dead center position, or past alignment of rods 112, 114, the spring 122 serves to urge friction wheels 93, 94 upwardly and hold them in such raised position to facilitate removal and replacement of the spools.

The rotation of follower wheels 96, 97 is imparted through a sprocket wheel 127, keyed on an extension of shaft 99, and a chain 128 to a pair of coaxial sprocket wheels 129, 130, attached together and freely rotatable on an extension of shaft 106. Similarly, the rotation of the opposite pair of friction wheels 93, 94 is communicated by a keyed sprocket wheel 131 and chain 132 to a connected pair of sprocket wheels 133, 134 rotatable on an extension of shaft 105. A sprocket chain 136 passes over wheel 130 around wheel 134, around an idler sprocket wheel 137 journaled in a plate 138 secured to the framework, and around a sprocket wheel 139 which is keyed to the shaft 67. The interconnection between the several follower rolls will tend to correct any variations in spool travel and cause all of the spools to rotate at the same speed. The connection from these several follower rolls to the sprocket 139 determines the speed at which the shaft 67 may rotate, the power for driving

the shaft, however, being delivered through the slipping clutch 71.

The sprockets are so arranged that the drive to the traverse cam 47 originating at chain 64 imparts to shaft 67 a direction of rotation similar to that applied to the shaft 67 by chains 136, reflecting the drive of the follower wheels 93, 94, 96, 97. The drive from the follower wheels to the cam is correctly designed for traverse in proper relation to the rotation of the spools. However, as the threads build up on the spools, the constant linear velocity, due to the surface drive on the wound thread, entails a steady reduction in the angular velocity of the spools due to the increasing radius. Thus, although there is a constant power drive to the cam from chain 64, the chain system from the follower wheels is the determining factor in setting the angular speed of the cam and, the friction on the follower wheels being greater than that in the slip clutch, the angular velocity of the cam is gradually reduced while shaft 67 continues to rotate at constant angular velocity, the difference in the two velocities being possible due to slippage in the clutch.

Thus, the apparatus fulfills two vitally important conditions: Constancy of linear feed of material and a constant relation between traverse speed and angular velocity of the spool.

While a certain preferred embodiment of the invention has been shown and described, the invention is not limited thereby since changes in the size, shape and arrangement, for instance, of the various parts may be made without, however, departing from the spirit or scope of the appended claims.

What is claimed is:

1. A windup apparatus comprising a frame having means to receive the spindle of a windup spool having end flanges, a power-driven drum mounted so as to fit between the flanges of a mounted spool to drive the spool by contact with the outer surface of material being wound thereon and the spool being adapted to recede from the drum as the diameter of its wound portion increases, a roller adapted to rest on a flange of a mounted spool to be driven in rotation thereby, traverse means for distributing the material along the length of the spool during winding, said traverse means having a power drive with rotating parts having a slip connection, and means communicating the rotation of said roller means to said rotating parts in a direction similar to that occasioned by said power drive.

2. A windup apparatus comprising mounting means for a spool to be wound, drive means for the spool adapted to communicate rotation thereto by contact with the outer surface of the material being wound on the spool, traverse means to distribute material being wound on the spool along the length thereof, means to communicate drive from the said drive means to the traverse means, said latter means including a slip connection, roller means adapted to engage a circumference of fixed radius on the spool to be driven thereby, and means communicating a drive from said roller means to said traverse means whereby the linear speed of the traverse means is slowed in proportion to the reduction of angular velocity of the spool consequent upon the increasing diameter of the wound material.

3. A device as in claim 2, said roller means being mounted for swinging motion to and from the spool.

4. A device as in claim 2, a mounting for said roller means adapted for swinging motion to and from the spool, and a spring-urged toggle means urging said latter mounting to working position or idle position, selectively, on either side of dead center of the toggle means.

5. A windup apparatus comprising mounting means for a spool to be wound, drive means for the spool adapted to communicate rotation thereto by contact with the outer surface of material being wound on the spool, said mounting means comprising guides in which the spool is free to move away from said drive means as the spool diameter increases, traverse means having a thread guide, a cam for reciprocating the traverse means, rotating means to drive the cam to distribute material being wound on the spool along the length thereof, drive means for said rotating means, including a slip connection, and drive means acting conjointly with the second-mentioned drive means to provide an additional drive for the cam and responsive to reduction in angular velocity of the spool being wound, consequent upon its increasing diameter, to impart a retarding force to said latter drive means through said slip connection whereby a constant relation between angular velocity of the spool and rate of travel of said traverse means is maintained.

6. A windup apparatus comprising mounting means for a spool to be wound, drive means for the spool adapted to communicate rotation thereto by contact with the outer surface of material being wound on the spool, traverse means, a cam to reciprocate the traverse means to distribute material being wound on the spool along the length thereof, drive means for said cam, including a slip connection, and drive means acting conjointly with the second-mentioned drive means to provide an additional drive for the cam and responsive to reduction in angular velocity of the spool being wound, consequent upon its increasing diameter, to impart a retarding force to said latter drive means through said slip connection whereby a constant relation between angular velocity of the spool and rate of travel of said traverse means is maintained.

7. A windup apparatus comprising mounting means for a spool to be wound, drive means for the spool adapted to communicate rotation thereto by contact with the outer surface of material being wound on the spool, traverse means, a cam to reciprocate the traverse means to distribute material being wound on the spool along the length thereof, constant speed drive means for said cam, and drive means acting conjointly with the second-mentioned drive means to provide an additional drive for the cam and responsive to reduction in angular velocity of the spool being wound, consequent upon its increasing diameter, to retard the speed of said cam whereby a constant relation between angular velocity of the spool and rate of travel of said traverse means is maintained.

8. A windup apparatus comprising mounting means for a spool to be wound, drive means for the spool adapted to communicate rotation thereto by contact with the outer surface of material being wound on the spool, traverse means to distribute material being wound on the spool along the length thereof, contant speed drive means for said traverse means, and drive means acting conjointly with the second-mentioned drive means to provide an additional drive for the cam and responsive to reduction in angular

velocity of the spool being wound to retard the rotational speed of said cam in proportion to reduction in rotational speed of said spools whereby a constant relation between angular velocity of the spool and rate of travel of said traverse means is maintained.

9. A windup apparatus comprising mounting means for a spool to be wound, drive means for the spool adapted to communicate rotation thereto by contact with the outer surface of material being wound on the spool, traverse means, a cam, means to rotate the cam from the spool driving means and connections from the cam to the traverse means to distribute material being wound on the spool along the length thereof, a slip connection in said cam rotating means, a roller adapted to engage a circumference of fixed radius on the spool, and means to communicate motion from said roller to said cam whereby reduction in speed of the spool results in reduction in speed of said cam.

10. A windup apparatus comprising mounting means for a spool to be wound, a first drive means adapted to contact the outer surface of material being wound on the spool to rotate the spool, traverse means to distribute the material being wound on the spool along the length thereof, a second drive means powered by rotation of said spool and arranged to operate said traverse means, and a third drive means of constant speed also operating said traverse means, said second drive means controlling the rate of operation of said traverse means.

11. A windup apparatus comprising mounting means for a spool to be wound, a first drive means adapted to contact the outer surface of material being wound on the spool to rotate the spool, traverse means to distribute the material being wound on the spool along the length thereof, a second drive means powered by rotation of said spool and arranged to operate said traverse means, and a third drive means of constant speed also operating said traverse means, and means

governing the rate of operation of said traverse means in accordance with the rate of speed of said second drive means.

12. Winding mechanism for a spool comprising a power operated shaft, a drum on said shaft, means for supporting the spool so that it rests upon the drum by its outer periphery, a reciprocable traversing mechanism movable along the shaft, a cam to reciprocate said traversing mechanism, means to actuate the cam, said last named means including a slipping connection from the power operated shaft, and a regulating device for controlling the speed of the cam in timed relation to the speed of rotation of the spool, said regulating device comprising a roller maintained in contact with the spool and driving connections from the roller to the cam.

13. Winding mechanism for a spool comprising a power operated shaft, a drum on said shaft, means for supporting the spool so that it rests upon the drum by its outer periphery, a reciprocable traversing mechanism movable along the shaft, a cam to reciprocate said traversing mechanism, means to actuate the cam, said last named means including a slipping connection from the power operated shaft, and a regulating device for controlling the speed of the cam in timed relation to the speed of rotation of the spool, said regulating device being driven by the spool and having a driving connection with the cam.

EDWIN N. BRODEN.

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