Oct. 25, 1966 W. P. GOODMAN ETAL 3,281,086

THREAD WINDER

Filed Dec. 23, 1963 3 Sheets-Sheet 1

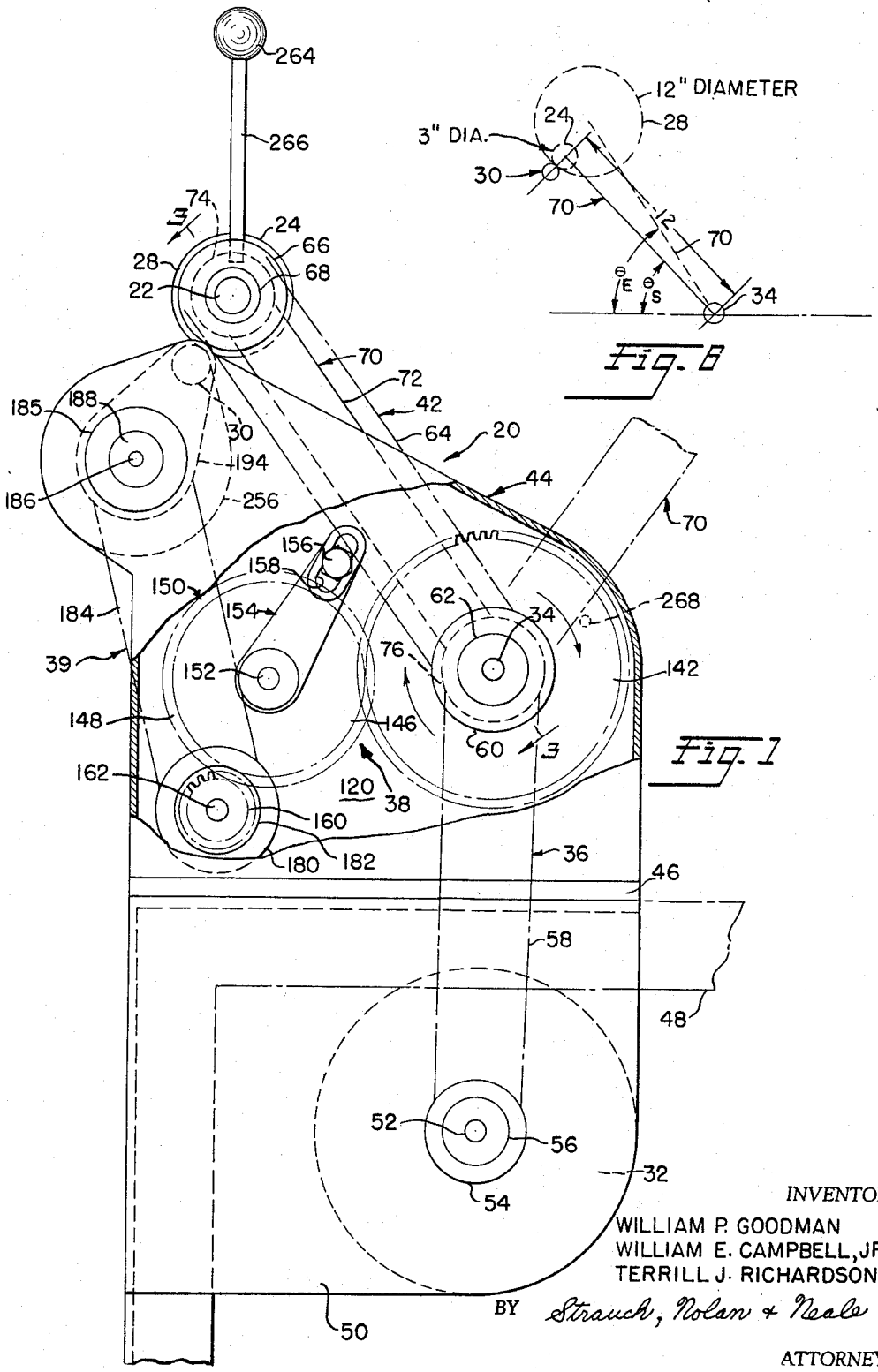


Fig. 6

Fig. 1

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THREAD WINDER

Filed Dec. 23, 1963 3 Sheets-Sheet 2

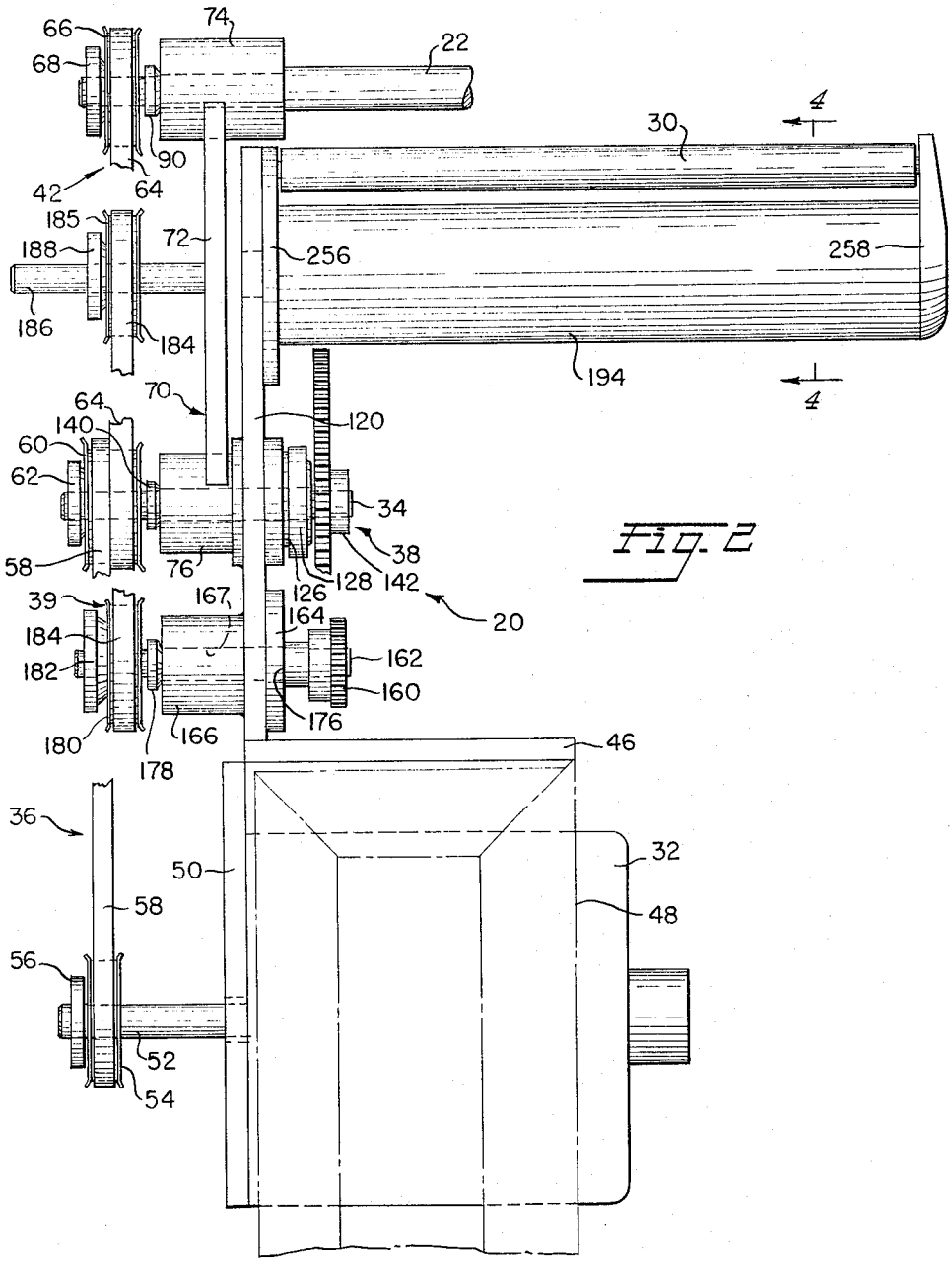


Fig. 2

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THREAD WINDER

Filed Dec. 23, 1963 3 Sheets-Sheet 3

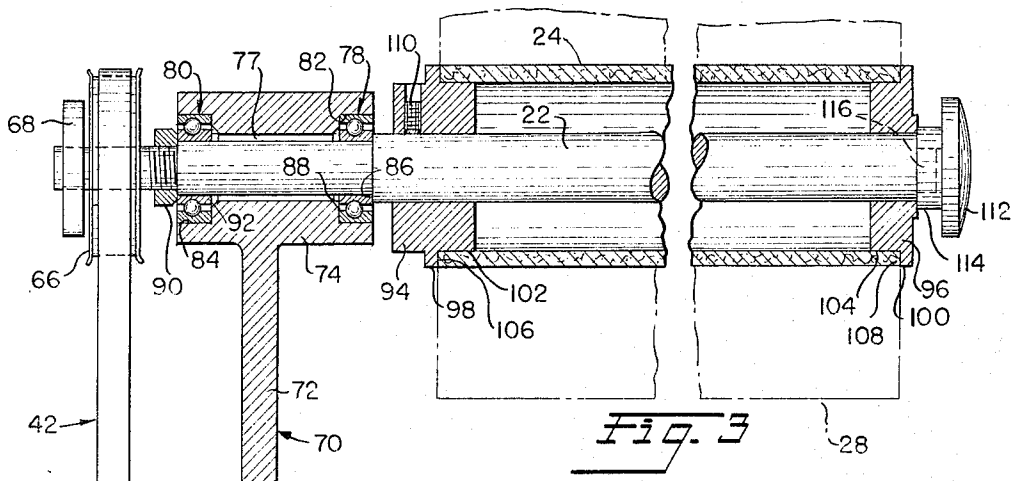
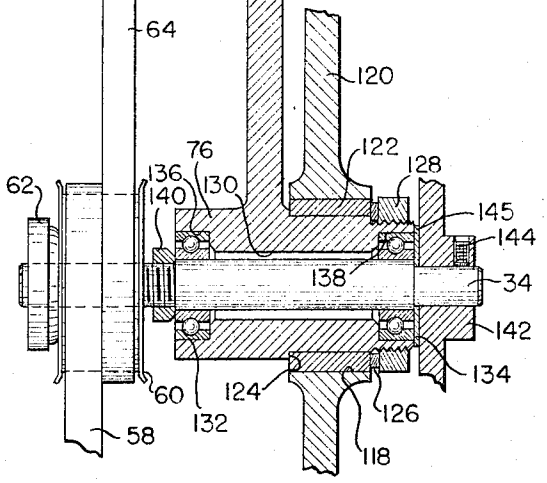


Fig. 3



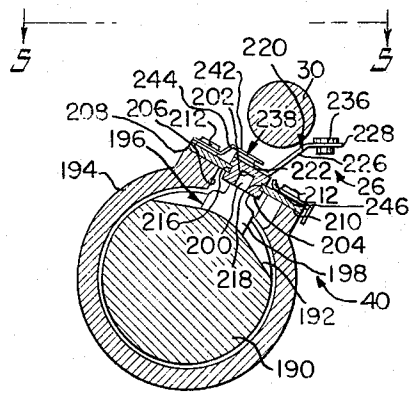


Fig. 4

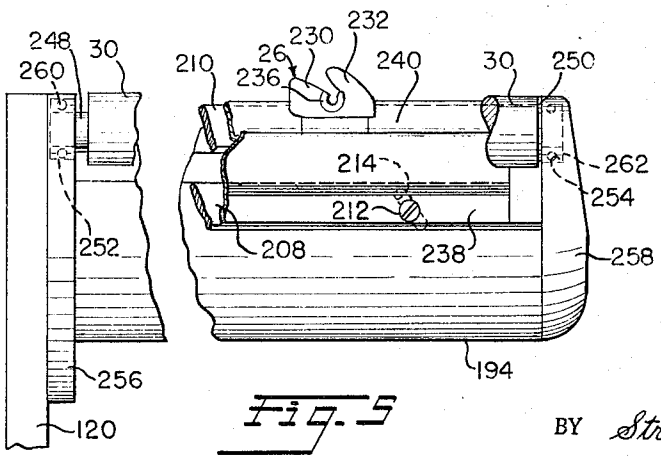


Fig. 5

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3,281,086

THREAD WINDER

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Filed Dec. 23, 1963, Ser. No. 332,448
6 Claims. (Cl. 242—18)

This invention relates to machines for winding thread, yarn, wire, and other strand material (hereafter generically referred to as thread) onto cops, cones, spools, tubes, and other packages, hereafter collectively referred to as bobbins. More specifically, this invention relates to winding machines having a winding spindle supporting a bobbin onto which thread is wound to form a thread package, a reciprocable guide for guiding the thread onto the bobbin, and a gainer mechanism for displacing successive wraps of thread to form a stable thread package.

The most modern and advanced winders of this type heretofore available are those disclosed and claimed in copending application No. 298,040 filed July 29, 1963, by Edward G. Mueller for Winder.

One important object of the present invention is the provision of novel improved winders of the same general type as, but having materially higher winding speeds than, those disclosed in the above copending application to thereby provide an increase in winding capability.

This and other objects of this invention are achieved by supporting the winding spindle for swinging or pivotal movement about an axis remote from and parallel to the spindle and so located that the package being wound rests against a rotatably supported roller or bail. This construction permits the thread guide to be assembled to the follower of the cam mechanism provided to reciprocate the guide, making the heretofore employed pivotal thread guide supporting traverse arm unnecessary.

Several important advantages are gained by this arrangement in addition to reductions in manufacturing and maintenance costs achieved by the elimination of the traverse arm and allied components. By eliminating the traverse arm, the mass of the components reciprocated by the winding machine cam is materially reduced, permitting a surprising increase in winding speed from 500 r.p.m. (the maximum speed attainable by winders of the type disclosed in application No. 298,040 and by other prior art winders of the type to which this invention pertains) to 2,000 r.p.m.

In addition, as pointed out in copending application No. 138,166 filed September 14, 1961, by August J. Hambach for Precision Winder, (now Patent No. 3,193,209) torque motors, which are the type employed in the winding machines of the present invention, react to externally applied forces to maintain the winding tension constant. Elimination of the traverse arm and associated components also reduces extraneous external drag, materially increasing the capability of the torque motor to maintain the winding tension uniform and at the desired value.

A further novel feature of the present invention is that the bail supporting the thread package exerts a continuous pressure on the package, and this pressure can be maintained substantially constant or decreased slightly as the diameter of the thread package increases by properly locating the winding spindle pivot axis. Such constant or slightly decreasing pressure on the package results in the formation of a materially better and more stable package.

The innovation just described, like the elimination of traverse arm, is a significant advance over the winders disclosed in application No. 298,040, which make no provision for exerting pressure on the thread package, and those commercially available winders which do make provision for maintaining pressure on the package. The

mechanisms used in the latter employ complex spring biased systems which are so complicated as to be generally unacceptable for commercial applications.

From the foregoing, it will be apparent that another important object of this invention resides in the provision of novel improved thread winders of the type disclosed in the copending application, but which are capable of winding better packages than the earlier disclosed winders.

In conjunction with the foregoing object, it is a further specific object of the present invention to provide winders having a novel and simplified mechanism for maintaining a fairly constant or slightly decreasing pressure on the thread package being wound as the diameter of the package increases.

It is another object of the present invention to provide novel improved winders of the type disclosed in the copending application, but which are capable of providing more accurate and uniform tension control.

A further object of this invention is the provision of novel improved winders having all the advantages of those disclosed in the copending application, but which are simpler and less expensive to construct.

Another specific object of the present invention is the provision of novel improved thread winding machines in which the pivotally mounted thread guide bearing traverse arms of the prior art winders are eliminated.

Other objects and further novel features of the present invention, as exemplified in the novel winder construction discussed above, will become more fully apparent from the appended claims and as the ensuing detailed description and discussion proceeds in conjunction with the accompanying drawing, in which:

FIGURE 1 is a partially diagrammatic side elevation of a thread winding machine constructed in accordance with the principles of the present invention;

FIGURE 2 is a front elevation of the thread winding machine illustrated in FIGURE 1, with the major portion of the winder's gainer mechanism housing removed;

FIGURE 3 is a section through the winding spindle, its support, and the winding spindle drive, taken substantially along line 3—3 of FIGURE 1;

FIGURE 4 is a section through the thread guide and thread guide reciprocating mechanism, taken substantially along line 4—4 of FIGURE 2;

FIGURE 5 is a view of the thread guide and the thread guide reciprocating mechanism, looking generally in the direction of arrows 5—5 of FIGURE 4; and

FIGURE 6 is a diagram depicting certain parameters involved in determining the magnitude of the arc through which the winding spindle is preferably designed to swing as the thread package is wound to insure the production of thread packages of optimum quality.

Referring now to FIGURES 1 and 2, thread winding machine **20**, constructed in accordance with the principles of the present invention, includes a swingably mounted, rotatable winding spindle **22** on which a thread bobbin **24** (see FIGURE 3) is supported. Thread is guided onto bobbin **24** by a reciprocating thread guide assembly **26** (see FIGURES 4 and 5) to form a thread package indicated generally in FIGURE 1 by reference character **28**. A rotatably supported, free wheeling bail **30** exerts a constant and substantially uniform or slightly decreasing pressure on bobbin **24** as the thread package is wound, which results in the formation of a better, more stable thread package.

Winding spindle **22** and thread guide assembly **26** are driven by a motor **32** drive-connected to a rotatably supported intermediate drive shaft **34** by a belt drive **36**. Drive shaft **34** is drive-connected through a gear type gainer mechanism **38** and a belt drive **39** to cam-type thread guide operating mechanism **40** (see FIGURE 4) by which thread guide assembly **26** is reciprocated. Shaft

34 is also drive-connected to winding spindle 22 by a belt drive 42.

Winding spindle 22 and thread guide reciprocating mechanism 40 are supported from a casting 44 in which the gainer mechanism 38 is housed and which will be referred to hereinafter as the gainer housing. The gainer housing is provided with a base 46 for supporting the housing on a stand shown diagrammatically and identified generally by reference character 48.

Motor 32 is mounted on a plate-like support 50 fixed to stand 48 subjacent the gainer housing base 46. The details of support 50 are not critical in the practice of the present invention and may be varied as desired for particular installations.

Winding machine motor 32 is an especially designed single phase or polyphase electric motor which automatically slows down as the diameter of the thread package increases to maintain uniform tension and winding speed. Suitable motors having the foregoing characteristics are manufactured by the B. A. Wesche Electric Company of Cincinnati, Ohio. The performance characteristics of these motors are discussed in an article entitled "Torque Motors And Brakes" printed in the April 1957 issue of Product Engineering and in the copending Hambach application referred to above.

Turning now to FIGURE 2, thread winding machine motor 32 has a single output shaft 52 to which the drive pulley 54 of belt drive 36 is fixed as by a key (not shown) and a retainer 56 on the outboard end of the shaft. A flexible drive belt 58 extends around pulley 54 and around a driven pulley 60 rotatably fixed to intermediate drive shaft 34 as by a key (not shown) and a retainer 62 on the end of the shaft.

As indicated above, intermediate drive shaft 34 is drive-connected to winding spindle 22 by a belt drive 42 which includes a flexible drive belt 64 extending around the pulley 60 fixed to intermediate shaft 34 adjacent drive belt 58. Drive belt 64 also extends around a driven pulley 66 rotatably fixed to winding spindle 22 as by a key (not shown) and a retainer 68 on the end of the winding spindle.

Winding spindle 22 is rotatably supported by a winding spindle support arm 70 which, as the diameter of the thread package wound on bobbin 24 increases, permits winding spindle 22 to swing in an arc away from thread guide assembly 26 and bail 30 to maintain a substantially constant distance between the thread guide assembly and the outermost wrap of thread on bobbin 24. This eliminates the necessity, which obtained heretofore, of mounting the thread guide assembly on a pivotable arm or other pivotable support to provide the proper spacing between the thread package and the thread guide. As a result, several important advantages are obtained such as a great increase in winding speed, more accurate control of winding tension, and simplification of the winding machine mechanism, permitting it to be more economically manufactured and maintained.

As shown in FIGURE 3, winding spindle support arm 70 has a rectangular sectioned, elongated midsection 72 and cylindrical bosses 74 and 76 at the upper and lower ends of the midsection, respectively. Winding spindle 22 extends through an aperture 77 in the upper boss 74 from which it is supported by a pair of rolling element type bearings such as ball bearings 78 and 80. Ball bearings 78 and 80 are disposed in annular recesses 82 and 84 which are concentric with aperture 77 and are located at the opposite ends of boss 74. Winding spindle 22 is retained in boss 74 by an annular shoulder 86 on the spindle which engages the inner race 88 of ball bearing 80 and by a lock nut 90 threaded on the winding spindle and engaging the inner race 92 of ball bearing 78.

Referring still to FIGURE 3, cylindrical bobbin supports 94 and 96 are mounted on winding spindle 22 adjacent support arm 70 and adjacent the outboard end of the winding spindle, respectively, to support bobbin 24 which, as illustrated, is a cylindrical cardboard tube although any desired type of bobbin may be used. Radial flanges 98 and 100 on bobbin supports 94 and 96, respectively, provide axially extending, circular projections 102 and 104 which maintain bobbin 24 concentric with winding spindle 22 and annular projections 106 and 108 which maintain the bobbin in a fixed axial relation with the winding spindle.

The inboard bobbin support 94 is fixed to winding spindle 22 as by a setscrew 110. Outboard bobbin support 96 is removably retained in place by a knurled knob 112 provided with a drilled and tapped shank 114 into which the outboard end portion 116 of the winding spindle is threaded. By unscrewing knob 112, outboard bobbin support 96 may be removed, permitting bobbin 24 to be doffed from the winding spindle.

Support arm 70 is pivotably supported from gainer mechanism housing 44 by the boss 76 at the lower, supported end of the spindle support arm which extends through a circular aperture 118 in gainer housing vertical wall member 120 in which a sleeve type bearing 122 of bronze or other bearing metal is disposed to rotatably support boss 76. Bearing 122 may be retained in aperture 118 in any desired manner such as by press fitting. Boss 76 is retained in place by an annular shoulder 124 on the boss, which engages one side of bearing 122, and by a friction disc 126, preferably of fiber or bronze, surrounding boss 76 and abutting the opposite side of bearing 122. Friction disc 126 is maintained in abutting relationship with bearing 122 by a lock nut 128 threaded on boss 76.

Boss 76 has a central aperture 130 through which the intermediate drive shaft 34 described above extends. Shaft 34 is rotatably supported in aperture 130 by rolling element type bearings such as the illustrated ball bearings 132 and 134. Ball bearings 132 and 134 are mounted in annular recesses 136 and 138 which are concentric with aperture 130 and are located at the opposite ends of boss 76. Intermediate drive shaft 34 is retained in boss 76 by a lock nut 140 threaded on shaft 34 which engages ball bearing 132 and by a spur gear 142 (see also FIGURE 1) fixed to intermediate shaft 34 as by a setscrew 144. A spacer or washer 145 on shaft 34 between bearing 134 and spur gear 142 prevents longitudinal movement of shaft 34 relative to boss 76 without impeding rotation of the shaft.

From the foregoing, it will be apparent that winding spindle 22 is pivotably or swingably supported by spindle support arm 70 for movement in an arcuate path about an axis which is coincidental with the axis of rotation of intermediate drive shaft 34. This permits spindle 22 to move or swing away from thread guide assembly 26 and bail 30 as the diameter of thread package 28 increases to maintain a constant distance between the outer wrap of thread on the package and thread guide assembly 26. Since the last-mentioned axis is also the axis of revolution of pulley 60, the center-to-center distance between the axes of rotation of pulleys 60 and 66 remains constant, despite the movement of spindle support arm 70, and the tension in the belt 64 of belt drive 42 therefore also remains constant.

As pointed out previously, intermediate shaft 34 also drives the gainer mechanism 38 which, through operating mechanism 40, reciprocates thread assembly 26. The spur gear 142 described above and fixed to intermediate drive shaft 34 is the input gear of gainer mechanism 38.

Referring now to FIGURE 1, input gear 142 meshes with a spur gear 146 which, together with a spur gear 148, forms an intermediate gear assembly 150. Intermediate gears 146 and 148 are fixed together for concomitant rotation and are rotatably supported by a stub shaft 152.

Stub shaft 152 extends normally from and is fixed to an intermediate gear assembly support bracket 154

fixed to gainer mechanism housing wall member **120** by a cap screw **156** which extends through an elongated, slotted aperture **158** in bracket **154** into threaded engagement with the housing wall member. The elongated slot **158** permits universal movement of support bracket **154** in a plane parallel to the gainer mechanism gears, permitting gears of varying diameter to be mounted on stub shaft **152** and moved into meshing engagement with the cooperating gears of the gainer mechanism. Bracket **154** is retained in the position to which it is adjusted by tightening cap screw **156**.

Gear **148** of intermediate gear assembly **150** meshes with a spur gear **160** fixed to the end of an intermediate drive shaft **162** (see also FIGURE 2). The rotation of shaft **162**, acting through operating mechanism **40**, effects reciprocation of thread guide assembly **26** axially of winding spindle **22** to guide the thread onto bobbin **24**. The gainer mechanism so relates the simultaneous rotation of bobbin **24** and reciprocation of thread guide assembly **26** that one wrap of the thread guided onto the bobbin will not be laid exactly on top of the preceding wrap as this would produce a highly unstable package. The functions of gainer mechanisms and the manner in which they operate are described in detail in the copending Hambach application identified above to which reference may be had if deemed necessary for an understanding of the present invention.

Referring now to FIGURE 2, gainer mechanism housing wall member **120** is formed with integral bosses **164** and **166** extending, respectively, inwardly and outwardly from the wall member. Shaft **162** is rotatably supported in an aperture **167** extending through the wall member and bosses **164** and **166** by rolling element type bearings such as ball bearings (not shown) located in recesses at the exposed ends of bosses **164** and **166**, respectively. Shaft **162** is retained in aperture **167** by an annular shoulder **176** of the shaft and by a lock nut **178** threaded on the shaft.

Supported on intermediate drive shaft **162** adjacent lock nut **178** is the drive pulley **180** of belt drive **39** which is rotatably fixed to the shaft as by a key (not shown) and a retainer **182**. A flexible drive belt **184** extends over pulley **180** and around a driven pulley **185** fixed to a cam shaft **186** as by a key (not shown) and a retainer **188**.

Referring now to FIGURES 2 and 4, cam shaft **186** is fixed to the inboard end of an elongated, cylindrical cam **190** in the surface of which a closed, helical groove or cam track **192** is formed. Cam **190** is rotatably supported in a housing **194** supported in cantilever fashion from gainer mechanism housing wall member **120** in parallel, spaced, side-by-side relation to winding spindle **22** as by cap screws (not shown) or other appropriate fasteners. The details of cam **190**, the manner in which it is mounted in housing **194**, and the manner in which the latter is attached to the gainer mechanism housing are not critical in the practice of the present invention and are disclosed in detail in copending application No. 298,040, referred to above. Further elaboration of these details is therefore not deemed necessary herein.

The rotation of cylindrical cam **190** moves a cam follower **196** rectilinearly along a path parallel to the cam's axis of rotation and parallel to the longitudinal axes of winding spindle **22** and bail **30**. Cam follower **196** includes a uniformly thick, enlarged width lower portion **198** which depends into cam track **192** and an upwardly directed stem **200**. Stem **200** extends into a downwardly opening, cylindrical, blind aperture **202** in a captured slide block **204**, which is preferably formed from Nylon or other material having a low coefficient of friction. Cam follower **196** and slide block **204** are thus fixed for concomitant movement, but the cam follower may pivot relative to slide block **204** to follow cam track **192**.

As shown in FIGURE 4, slide block **204** is disposed in an elongated slot or opening **206** formed in the top of and extending the length of cam housing **194**. The movement of slide block **204** is guided by adjustable slide plates **208** and **210** fixed to cam housing **194** on opposite sides of aperture **206** by screws **212**. Screws **212** extend through elongated slots **214** in the slide plates (which permits adjustment of the slide plates) into threaded engagement with housing **194** (see FIGURE 5). The opposite edges of slide plates **208** and **210** extend into cooperating recesses **216** and **218** formed in the opposite sides of slide block **204** to confine the movement of the slide block to a rectilinear path.

Slide block **204** supports thread guide assembly **26** which includes a sheet metal guide member **220** with a bottom flange **222** fixed to the top surface of slide block **204**. Guide member **220** also includes an intermediate portion **226** extending at substantially a right angle to bottom mounting flange **222** and a bifurcated upper guide portion **228** extending upwardly at an angle from intermediate portion **226**. The two bifurcations **230** and **232** of guide member upper portion **228** guide the thread being wound into an eyelet **236**, fastened to guide member **220**, through which the thread being wound runs as it is wound onto bobbin **24**. Eyelet **236** is preferably formed from a ceramic or other wear resistant material to extend its useful life.

As shown in FIGURE 5, upper and lower dust shields **238** and **240**, which are sheet metal members extending the length of cam housing **194**, are mounted on slide plates **208** and **210** and fastened to the cam housing by the same screws **212** employed to fix the slide plates to the housing. Upper dust shield **238** has an integral shielding portion **242** which spans opening **206** in housing **194** and terminates in an edge adjacent the intermediate portion **226** of guide member **220**. This shield also has a vertically extending shielding portion **244** forming a seal between shielding portion **242** and the cam housing on the side of aperture **206** on which slide plate **208** is mounted.

Lower dust shield **240** has an upstanding shielding portion **246** which forms a seal between slide plate **210** on the opposite side of aperture **206** from upper shield **238** and the intermediate portion **226** of guide member **220**.

It will be apparent, from the foregoing, that the two shields cooperate to substantially span the gaps between the opposite sides of guide member **220** and the housing portions on the opposite sides of aperture **206**, minimizing the entry of foreign matter through aperture **206** into the interior of cam housing **194**.

The thread guide assembly described above is an important feature of the present invention since it has no pivotable traverse arm as was heretofore employed to support the thread guide assembly in order to properly guide the thread being wound onto the bobbin. As a result and as discussed in more detail above, this permits substantially higher winding speeds, increases the accuracy with which the desired winding tension may be maintained, and results in a simpler and more economical thread winding machine.

Referring now to FIGURES 2 and 5, another extremely important feature of the present invention is the rotatable bail **30** provided to exert a constant and substantially uniform pressure on the thread being wound onto bobbin **24**. Rotatable bail **30** is a cylindrical member (see FIGURE 4) supported in parallel spaced relationship to cam **190** and winding spindle **22** by reduced diameter end portions **248** and **250** which extend into apertures **252** and **254** in, respectively, cam housing end wall **256** and an end plate **258** attached to the outboard end of the housing. Ball or other rolling element type bearings **260** and **262** are disposed in apertures **252** and **254** around the bail's reduced diameter end portions **248** and **250** to minimize frictional resistance to rotation of the bail.

As shown in FIGURE 1, the outermost wrap of the thread package **28** being wound on bobbin **24** rests on

bail **30**. The weight of spindle support arm **70**, spindle **22**, bobbin supports **94** and **96**, bobbin **24**, and the thread being wound thereon exert a substantial force on bail **30**. The bail, in turn, exerts an equal and opposite force on the thread package **28** being wound on the bobbin, producing a more stable and better package than is possible in those winding machines where no force is exerted on the thread package and in a much simpler manner than has heretofore been possible in those machines which have made provision for exerting force on the package.

Preferably, winding machine **20** is so designed that, as the winding proceeds and spindle **22** swings away from bail **30**, the force exerted by the bail on thread package **28** remains substantially constant or decreases slightly. This is done by designing the thread winding machine so that, as the package is wound, spindle **22** moves through an arc of predetermined magnitude such that the decreasing proportion of the dead weight exerted as a force on bail **30** is offset by an increase in total dead weight due to the constantly increasing weight of the thread. Referring now to FIGURE 6, the manner in which the magnitude of this arc is determined is as follows:

To solve for $P\theta_s=P\theta_e$ with $C^*=15$ lbs:

Symbols:

θ_s=Arm angle at start of winding operation (bobbin **24** resting on bail **30**).

θ_e=Arm angle at end of winding operation (thread package **28** wound to maximum desired diameter).

C=Dead weight. Includes:

(a) Weight of spindle **22** and bobbin **24**.

(b) Weight of spindle support arm **70**.

(c) Friction load of snubbing device **263**.**

P=Pressure force on package.

Constants:

20 lbs. assumed as final package weight.

12 inches assumed as distance between longitudinal axes of winding spindle **22** and intermediate shaft **34**.

3 inches assumed as diameter of bobbin **24**.

12 inches assumed as maximum diameter of thread package **28**.

Assume:

$$P\theta_s=P\theta_e$$

Then,

$$P\theta_s=C\cos\theta_s$$

and

$$P\theta_e=C\cos\theta_e+20\cos\theta_e$$

To determine θ_s and θ_e:

$$\sin \tfrac{1}{2}(\theta_e-\theta_s)=2.25/12$$
$$\sin \tfrac{1}{2}(\theta_e-\theta_s)=0.188$$

and

$$\sin^{-1}0.188=10°50'$$

Thus

$$\theta_e-\theta_s=21°40'$$

If $\theta_s=53°$, then $\theta_e=75°$, $P\theta_s=10.4$ lbs., and $P\theta_e=9.1$ lbs.

*Determined by experiment for each winding application.
**Required to keep thread package 28 from bouncing at the high winding speeds attainable by the winding machines provided by the present invention.

Depending upon the type of thread being wound, for example, the force exerted by bail **30** on thread package **28** must be varied in order to produce thread packages of optimum quality and stability. This is accomplished by threading lock nut **128** (see FIGURE 3) along intermediate shaft **34** to thereby vary the normal pressure between sleeve bearing **122** and friction disc **126** and between friction disc **126** and lock nut **128**, which elements collectively constitute a snubbing device **263**. This varies the frictional force opposing the pivotal movement of package support arm **70**. As is apparent from the equations derived above, by varying the friction load of snubbing device **263**, the dead weight C and, therefore, the pressure P exerted on thread package **28** is altered by varying the foregoing frictional force since this force is a component of the dead weight parameter C. Depending on the particular thread being wound, a bronze or fiber friction disc **126** is employed to provide the proper frictional load.

Thread winding machine **20** is also provided with an operating knob **264** fixed to the upper end of a lever arm **266** threaded into the upper winding spindle supporting boss **74** of winding spindle support arm **70**. Operating knob **264** permits the thread winding machine operator to swing winding spindle support arm **70** and, therefore, thread package **28** from the running position shown in full lines in FIGURE 1 to the alternate position shown in phantom lines in which thread package **28** may more readily be doffed. A stop **268**, threaded into gainer mechanism housing wall member **120**, supports arm **70** and thread package **28** when the latter are in the alternate position. After the thread package **28** is doffed and a new bobbin **24** mounted on winding spindle **22**, operating knob **264** may be employed to pivot winding spindle support arm **70** in the counterclockwise direction (as viewed in FIGURE 1) to return the mechanism to the running position with bobbin **24** resting on bail **30**.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by Letters Patent is:

1. A thread winding machine, comprising:

(a) a bobbin supporting winding spindle;

(b) a winding machine housing;

(c) means supporting said spindle from said housing including a spindle supporting arm and means at the lower end of said arm mounting said arm for unrestrained rotation relative to said housing, said winding spindle being rotatably journalled by said arm at the upper end thereof; and

(d) a thread guide traverse assembly fixed to and extending from said housing, said assembly including a rotatably mounted spindle supporting bail disposed below and extending parallel to said winding spindle, said bail being fixed relative to said housing and the axis of rotation of said arm being so located relative to said bail and the length of said arm being such that, as the diameter of the package of thread wound on the bobbin supported by said spindle increases and the winding spindle moves upwardly away from said bail, the increasing weight of the thread provides a force offsetting the decrease in the force exerted on the bail by the winding spindle to thereby maintain the force exerted on the thread package by the bail substantially constant.

2. The thread winding machine as defined in claim **1**, together with means for rotating said winding spindle, comprising a motor, an intermediate drive shaft rotatably supported in a bore through the lower end of the spindle supporting arm and first and second drive belts trained over a pulley fixed to said shaft, one of said belts drive-connecting said motor to said shaft and the other drive-connecting said shaft to said winding spindle.

3. The thread winding machine as defined in claim **1**:

(a) wherein said thread guide traverse assembly further includes a thread guide traversing cam and a reciprocable thread guide operatively connected to said cam for reciprocation thereby; and

(b) including a gainer mechanism having its output member operatively connected to said thread guide traversing cam;

(c) a motor; and

(d) a belt drive including at least one rotatably supported intermediate drive shaft drive-connecting said motor and said winding spindle, the input member of said gainer mechanism being fixed to said intermediate shaft.

4. A thread winding machine, comprising:

(a) a winding machine housing with a wall member having an apertured boss;

(b) a winding spindle;

(c) means supporting said winding spindle for pivotal movement relative to said housing including a spindle supporting member journalled at one end in the aperture through said boss, said member rotatably supporting said winding spindle at the opposite end thereof; and

(d) selectively adjustable snubbing means for varying the frictional force between said boss and the end of the spindle supporting member journalled therein;

(e) said spindle supporting member terminating in a boss extending through the aperture through the winding machine housing and having an annular shoulder abutting one side of said wall member; and

(f) said snubbing means comprising a retainer threaded on said boss on the opposite side of said wall member from said shoulder and a friction disk surrounding said boss and disposed between said wall member and said retainer.

5. The thread winding machine as defined in claim 3, wherein:

(a) the input and output members of said gainer mechanism are spur gears rotatable about fixed centers and said gainer mechanism further comprises:

(b) a pair of intermediate gears of dissimilar pitch diameters fixed for concomitant rotation and meshing, respectively, with said input and said output gears, and means mounting said intermediate gears for selectively adjustable displacement in a plane normal to the axes of rotation of said gears.

6. The thread winding machine as defined in claim 3, together with a belt drive drive-connecting the output member of the gainer mechanism to the thread guide traversing cam.

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