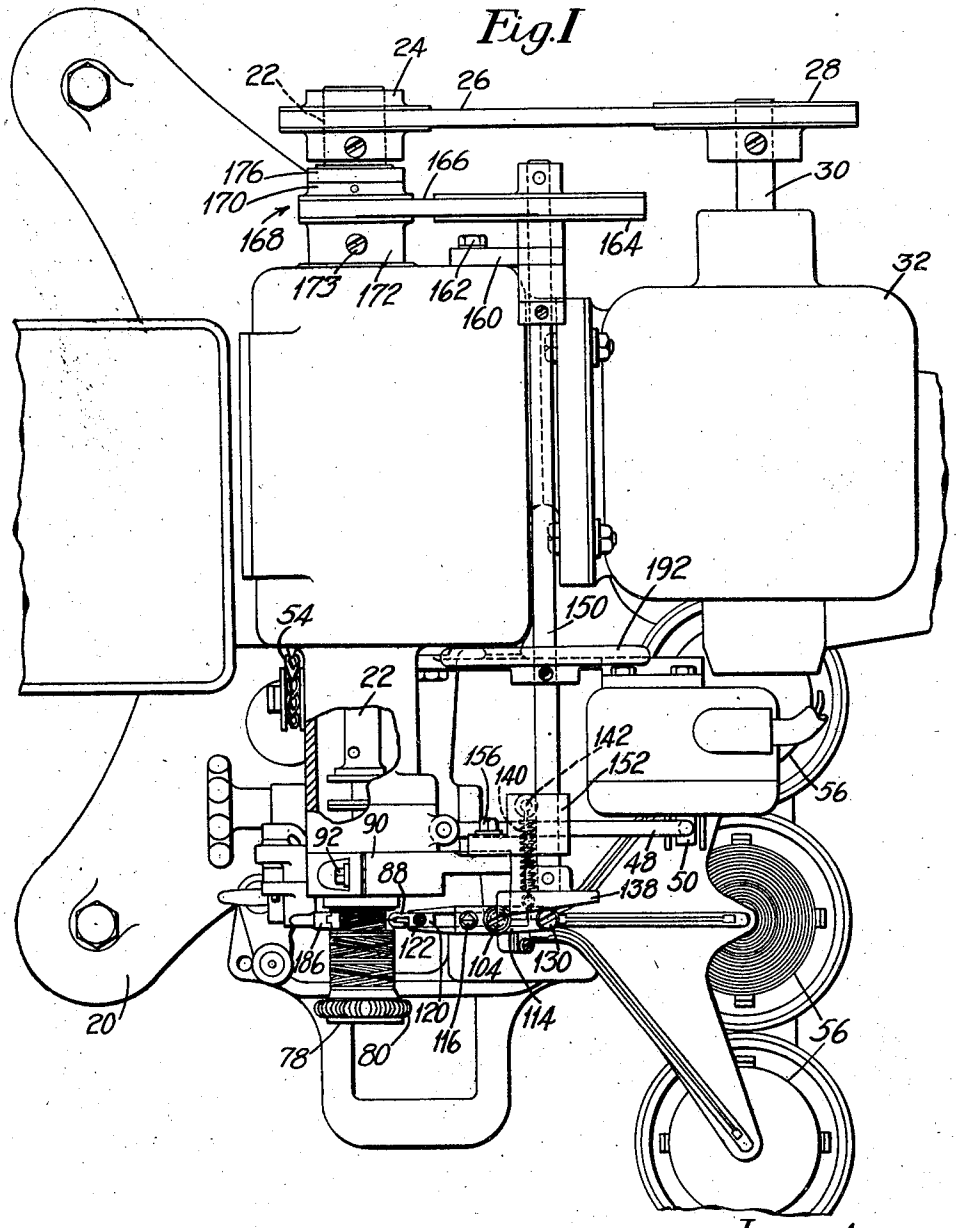
April 10, 1945. C. F. FITZGERALD 2,373,109

WINDING MACHINE

Filed Nov. 29, 1943 4 Sheets-Sheet 1

Fig. I



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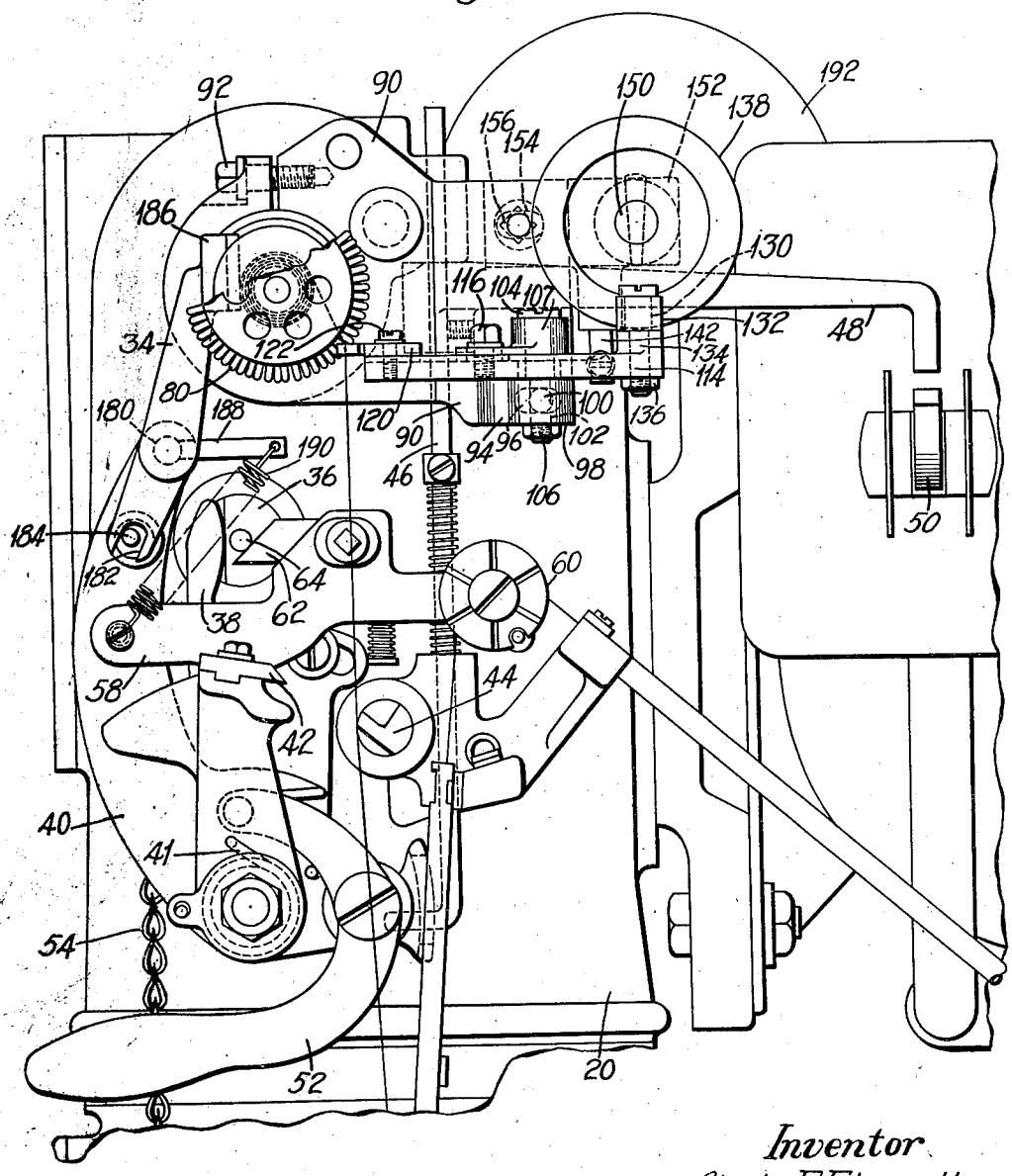
By his Attorney

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WINDING MACHINE

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Fig. 2



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WINDING MACHINE

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Fig. 3

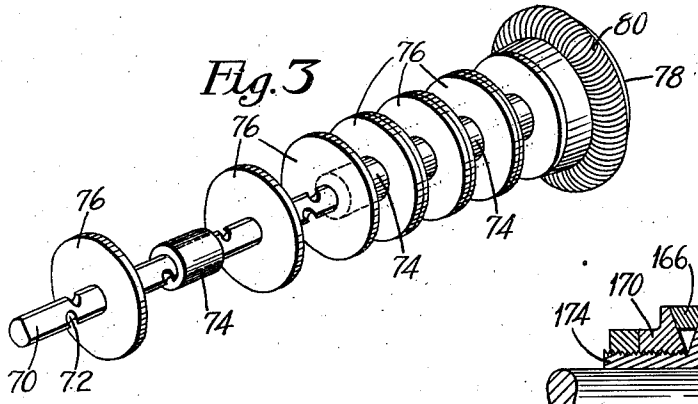


Fig. 4

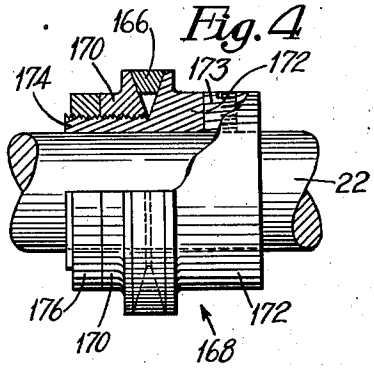
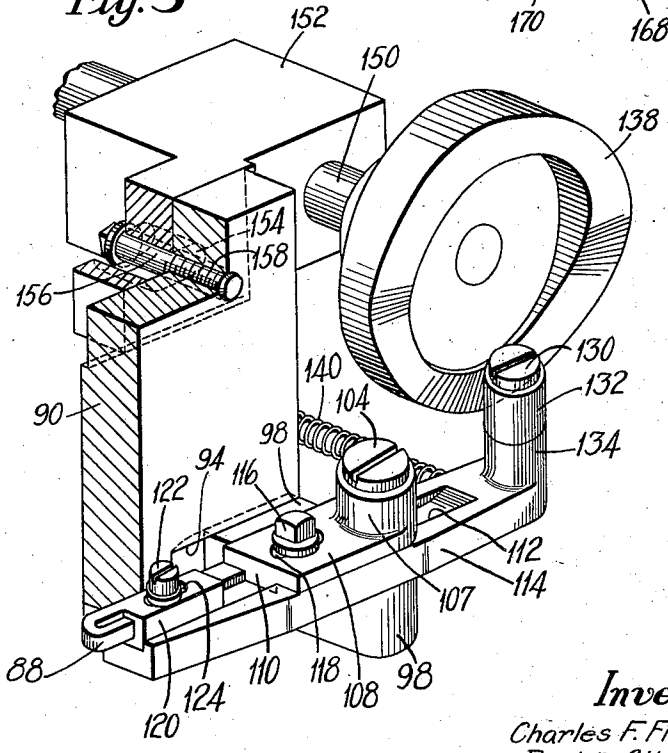


Fig. 5



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WINDING MACHINE

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Fig. 6

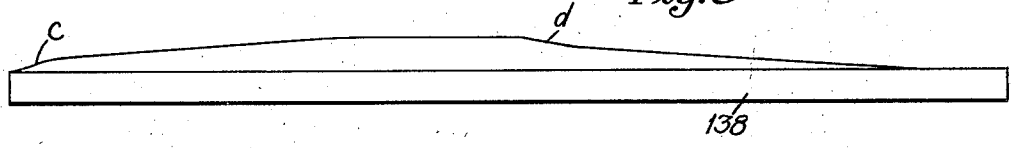


Fig. 8

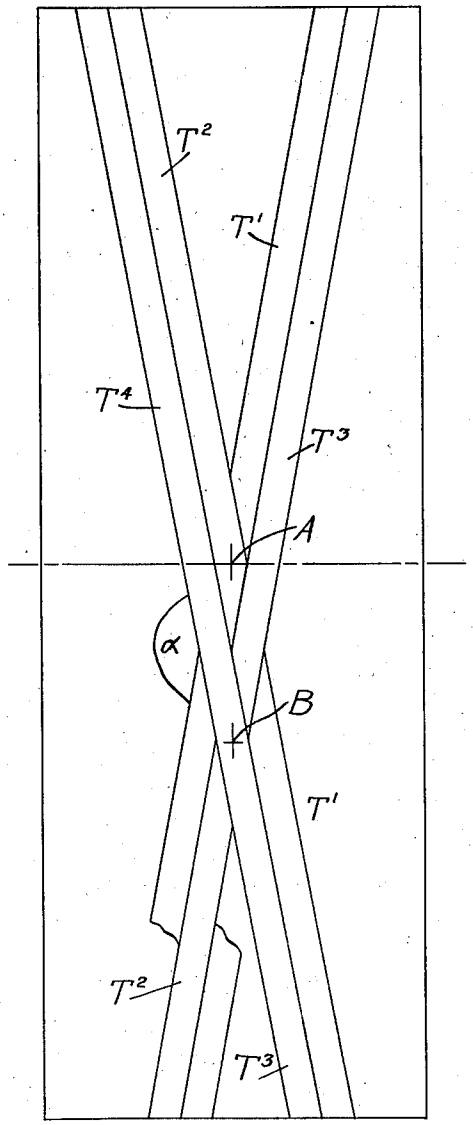
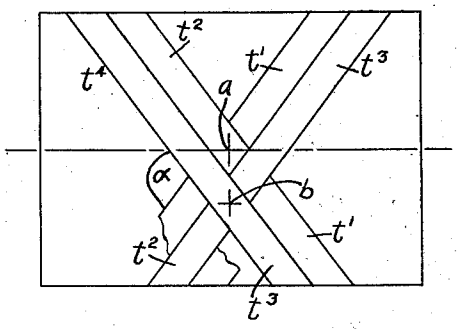


Fig. 7



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Patented Apr. 10, 1945 2,373,109

UNITED STATES PATENT OFFICE

2,373,109

WINDING MACHINE

Charles F. Fitzgerald, Beverly, Mass., assignor to United Shoe Machinery Corporation, Flemington, N. J., a corporation of New Jersey

Application November 29, 1943, Serial No. 512,159

8 Claims. (Cl. 242—20)

The invention relates to improvements in mechanism adapted to cross-wind bobbins or cops and is herein illustrated as embodied in an automatic multiple-bobbin winding machine of the type disclosed in Letters Patent of the United States No. 2,343,935, granted March 14, 1944, on an application filed in the name of Paul W. Senfleben. It is understood, however, that the invention is not limited in its utility to machines of the type disclosed in said patent but may be employed to equally good advantage in connection with non-automatic single-bobbin winding machines or machines for winding cops including self-sustaining cops.

In accordance with the disclosure of the aforementioned patent a series of bobbins, such as are used in heavy leather sewing machines, is automatically wound on the machine, each bobbin being wound in such a manner that each convolution of thread is located substantially at right angles to the axis of rotation of the bobbin or the winding shaft on which the bobbin is mounted. It has been found desirable to extend the usefulness of the machine disclosed in said patent to wind self-sustaining cops, and this may be accomplished most expediently by cross-winding. In cross-winding a cop the convolutions of the filament or thread are laid helically around the cop. Cross-winding requires a guiding member which presents the filament or thread to the winding shaft and which is caused to reciprocate in the direction of the axis of rotation of the winding shaft so as to produce a cross-winding effect. This thread-guiding member is commonly known as a traverse. The frequency of reciprocation of the traverse as compared with the speed of rotation of the winding shaft determines the cross-winding pattern.

If, for example, the traverse is caused to move during one revolution of the winding shaft a distance corresponding substantially to the length of the cop, that is, the distance between the two side or end faces of the cop (this movement hereinafter being referred to as a traversing movement), each convolution of thread, as measured from one side face to the other, extends helically around the cop and the following convolution of thread extends as an oppositely directed helix around the cop, crossing over the previous convolution at a point midway between the two end faces of the cop, and crossing over the convolution immediately ahead of the previous convolution at a point located in the perimeter of one end face of the cop.

Assuming the winding of the thread to be controlled by a traverse making at least one traversing movement during one revolution of the winding shaft and the winding to begin midway between the ends of the sleeve member or the like supporting the cop during the winding operation, each alternate convolution of thread which begins substantially at the same location as the convolution of thread immediately preceding the previous one would be laid on top (seen radially of the cop) of the said convolution immediately preceding the previous one rather than alongside said convolution, if the speed ratio between the traversing movements of the traverse and the revolutions of the winding shaft were 1 to 1, or 1 to an integer multiple of 1.

To obviate the undesirable condition just mentioned it has been necessary in prior winding machines adapted for cross-winding to resort to cumbersome transmissions of expensive manufacture to produce the necessary variation in the traverse movement with relation to the rotation of the winding shaft.

It is, therefore, an object of the invention to provide a simple and yet effective mechanism for cross-winding cops in the manner described, by means of which mechanism the cops are wound uniformly and tightly, and any possibility of piling alternate convolutions of thread on top of each other is precluded.

To this end an important feature of the invention resides in the provision of novel mechanism for actuating the traverse in such a manner that the winding of each alternate convolution of thread begins immediately adjacent (seen substantially in the general direction of the axis of rotation of the cop) to the convolution immediately preceding the previous one. Thus, the convolutions of thread are laid close to each other in the circumference of the cop. This is accomplished by providing a single actuating mechanism designed to impart to the driving means of the traverse a one-half revolution plus a fraction of a revolution during one revolution of the winding shaft, with the result that after two revolutions of the winding shaft the traverse has made a complete movement to and fro and has moved somewhat beyond the original starting point to begin the winding of a new convolution of thread.

In accordance with another feature of the invention, means is provided for adjusting the speed ratio between the winding shaft and the traverse-driving means within a range permissible to secure the desired proper cross-winding effect. This adjustment may be resorted to when chang-

ing from one size of thread to a substantially different size of thread.

These and other features of the invention will now be more fully described in the following specification with reference to the accompanying drawings and will be pointed out in the claims.

In the drawings,

Fig. 1 is a plan view of a thread-winding machine in which the invention is embodied;

Fig. 2 is a right-hand side elevation of a part of the upper portion of the machine illustrating the traverse mechanism;

Fig. 3 is an angular view of a mandrel carrying a series of disks and sleeves on which the cops are supported during the winding operation;

Fig. 4 is a front view, partly in section, of a pulley mounted on the winding shaft and serving to drive the traverse-actuating mechanism, the pulley being provided with a speed adjustment;

Fig. 5 is an angular view of the traverse mechanism and its immediate actuating members;

Fig. 6 is a development of the traverse-actuating cam; and,

Figs. 7 and 8 are diagrammatic views illustrating the cross-winding of the thread at the beginning and at the end of the winding operation on one cop.

The invention is illustrated as embodied in a machine of the type disclosed in the above-mentioned Letters Patent and accordingly only such features of the general organization as it is necessary to refer to for an understanding of the present invention will be described herein in detail. The machine, as illustrated herein, is especially adapted to cross-wind self-sustaining cops of thread, such as are used in heavy leather lockstitch sewing machines.

As in the machine disclosed in the above-mentioned Letters Patent, the machine illustrated herein includes a frame 20 (Figs. 1 and 2) in the upper portion of which is rotatably mounted in suitable bearings a shaft 22 (hereinafter referred to as the winding shaft) on which the bobbins or cops wound or to be wound are supported (see Fig. 1.) The winding shaft 22 is rotated at a uniform rate of speed and to this end there is mounted on its left hand extremity (as seen from the front of the machine) a pulley 24 which is connected by a belt 26 to a pulley 28 secured to the outer extremity of the rotor shaft 30 of a motor 32.

For the purpose of winding successively a plurality of bobbins or cops, the winding shaft 22 or at least a portion thereof, is also mounted for axial movement so as to present the bobbins or cops successively in winding position. The axial movement of the winding shaft is stepwise or intermittent and under the control of a so-called thread controller 34 (Fig. 2) and an escapement comprising a rack bar 36 and pawls cooperating therewith, one of the pawls being shown at 38 in Fig. 2. The thread controller 34 engages the coil of thread of the bobbin or cop in winding position and as this coil of thread increases in thickness during the winding operation the thread controller is moved outwardly of the machine. The outward movement of the thread controller ultimately initiates the next axial movement of the winding shaft, this movement taking place after the completion of the winding operation on one bobbin or cop and serving the purpose of presenting the next empty bobbin in winding position. The thread controller 34 and the pawls cooperating with the rack bar 36 are carried on a multi-armed lever 40 (Fig. 2) which is normally held inwardly of the machine by a strong spring 41 and is moved outwardly of the machine during and as a result of the outward movement of the thread controller 34. The rack bar 36 which also is mounted for axial movement in the machine frame causes, after the winding of the last bobbin, a thread severing knife 42, which is held in a cocked position, to be released so as to sever the thread in cooperation with a stationary cutting abutment 44. Moreover, the knife actuating mechanism controls a vertically movable bar 46 provided with a horizontally extending arm 48 the downwardly bent end of which serves to shut off the machine by throwing a switch 50. To cock the knife 42 after the severing of the thread and to perform other initial operations prior to the starting of a new winding operation, the machine is provided with a resetting lever 52. To move the winding shaft 22 and the rack bar 36 in their axial directions, a weighted chain 54 (Figs. 1 and 2) is provided, the chain engaging a link member (not shown) connecting the winding shaft with the rack bar.

The illustrated machine is provided, furthermore, with a plurality of thread supplies 56 (Fig. 1) for the purpose of having readily available in the machine threads of different characteristics. A selected thread is conducted from its supply 56 upwardly to a thread guide roll 60 (Fig. 2) provided on a release arm 58 in such a manner that upon occurrence of undue tension in the thread, for example, if a knot should become lodged in a thread guiding portion, the release arm 58 will be rocked to release the knife 42 to sever the thread and to shut off the machine by means of the bar 46. Normally, the thread passes around the guide roll 60, thence downwardly into and through a waxpot, thence upwardly to the winding shaft. The release arm 58 is provided with an inclined cam member 62 which, during the last stepwise axial movement of the rack bar 36 is engaged by a pin 64 carried in the extremity of the rack bar and thereby is actuated to release the knife 42 and to shut off the machine by throwing the switch 50.

The features of the machine so far described are substantially identical with those of the machine disclosed in the aforementioned Letters Patent. As in that machine, the winding shaft 22 is provided at its right hand end with an axially extending bore into which is inserted a mandrel 70 (Fig. 3) supporting the bobbins or in the present case supporting a series of members on which the cops are being wound. The mandrel is provided with helically extending grooves cooperating with inclined pins (not shown) located in the axial bore of the winding shaft for the purpose of securing the mandrel to the winding shaft in different predetermined positions. However, instead of a series of bobbins or spools the illustrated mandrel 70 carries a series of sleeves 74 loosely on it, the sleeves being separated by loosely mounted disks 76. Each sleeve 74 serves to support one cop during and after the winding operation in the machine, the cop being wound between the two disks 76 located at the ends of each sleeve 74 and acting as terminal flanges for the cop. After the winding operation the mandrel is removed from the winding shaft and the sleeves 74 and disks 76 are easily stripped off the mandrel 70 and the cops removed therefrom. The outer end of the mandrel 70 has secured to it a hand wheel 78 provided with a peripheral

groove in which is located a spiral spring 80 into the spirals of which the leading end of the thread to be wound is inserted.

For the purpose of cross-winding self-sustaining cops the illustrated machine is provided with a traverse 88 (Figs. 1, 2 and 5) serving to present the thread to the cop to be wound. The traverse 88 is caused to reciprocate in the direction of the axis of rotation of the cop so as to bring about cross-winding and the speed of its reciprocatory motion as compared with the speed of rotation of the cop determines the cross-winding pattern.

The traverse is constructed and mounted in the machine as follows: As illustrated best in Fig. 2 there is provided a plate 90 of substantial thickness, the plate being secured in suitable manner in the machine frame. One portion of the plate provides a bearing for the disks 76. For the purpose of adjustment, the bearing is split, it being held in adjusted position by a screw 92. The lower front portion of the plate 90 is rabbetted to provide a recess 94 (Figs. 2 and 5). A slot 96 (Fig. 2) is cut through the bottom of the recess 94. Fitted into the recess is a block 98 (Figs. 2 and 5) which is adjustable lengthwise of the recess (i. e. forwardly or rearwardly of the machine) and is held in adjusted position by means of a screw 100 extending from the rear face of the plate 90 (as seen in Fig. 2) through the slot 96 into a tapped bore provided in the block 98. The block 98 serves as a support for the traverse. The front end of the block 98 has a vertical bore 102 in which is received a screw bolt 104 held in place by a nut 106. The head of the screw bolt 104 engages a sleeve 107 surrounding the upper portion of the screw bolt and having a forwardly extending arm 108 (Fig. 5). On the lower face of the arm 108 is formed a ledge or tongue 110 which is in engagement with a groove 112 provided in a traverse actuating lever 114 which rests on the block 98 and is apertured for pivotal movement about the screw bolt 104. The lever 114 is adjustable with relation to the arm 108 and is held in adjusted position by a screw 116 extending through a slot 118 in the arm 108 and threaded into the lever 114.

As will be noted the traverse supporting block 98 is adjustable forwardly and rearwardly of the machine and the lever 114 is adjustable relatively to the block 98 forwardly and rearwardly of the machine. These adjustments serve the purpose of changing the timing and extent of the traverse movement, either by changing the effective length of the lever 114 or the position of the lever with relation to its driving elements.

Seated in the front end of the groove 112 is a block 120 (Fig. 5) which has at its forward end a hook-shaped extension serving to guide the thread and being the traverse 88 proper. The block 120 is adjustable along the groove 112 and is held in adjusted position by a screw 122 extending through a slot 124 in the block 120 and threaded into the lever 114. The adjustment of the block 120 with relation to the lever 114 also serves to lengthen or shorten the effective length of that lever and thereby to lengthen or shorten the movement of the traverse, as well as to change the position of the traverse with relation to the winding shaft without changing the position of the lever.

To impart an oscillatory motion to the traverse carrying and actuating lever 114 so as to cause th traverse 88 substantially to reciprocate in a direction parallel to the winding shaft the rear end of the lever 114 has an apertured boss 134 in which is received a vertical screw bolt 130 (Figs. 2 and 5). The head of the bolt 130 engages a hardened sleeve-like cam follower 132 which is seated on the boss 134, the member 132 being held in place by a nut 136 threaded onto the lower end of the screw bolt 130 projecting from the lower face of the lever 114. The cam follower 132 is held in engagement with a rotary open face cam 138 (Fig. 5) by a spring 140. One end of the spring is secured to the rearward portion of the lever 114 and the other end of the spring is secured to a fixed vertical pin 142 (Figs. 1 and 2).

It will be noted from the above that an adjustment of the block 98 causes an adjustment of the position of the lever 114 with relation to the cam 138 without adjusting the effective length of the lever. An adjustment of the lever 114 relatively to the block 98 serves to adjust both the relative position and the effective length of the lever.

The contour of the operating face of the cam 138 is best illustrated in the development of the cam in Fig. 6. The cam has one high portion and one low portion and the changes from one portion to the other are initially rather abrupt as indicated at *c* and *d*.

As a result of the rotation of the cam 138 oscillatory movements are imparted to the lever 114 to cause the traverse 88 to reciprocate in front of a cop to be wound. The reversal of the traverse at the end of each traverse movement is abrupt in view of the particular configuration of the operating face of the cam 138 so that after the completion of one thread helix the following reverse thread helix is started immediately and accordingly no substantial amount of thread is laid along the perimeter of either end face of the cop.

For the purpose of rotating the cam 138 it is secured to the free end of a shaft 150 (Figs. 1 and 5). The right hand portion of the shaft 150 is rotatably mounted in a bearing block 152 which is adjustably secured to the plate 90. To this end a forwardly projecting portion of the block 152 is provided with a slot 154 (Figs. 2 and 5) through which extends a screw bolt 156 threaded into a tapped bore 158 in the plate 90 and normally clamping the block 152 to the plate 90. Thus, the shaft 150 and bearing block 152 are adjustable to an extent limited by the length of the slot 154 with relation to the plate 90. The purpose of this adjustment will be presently explained.

The left hand end of the shaft 150 is mounted in a bearing 160 (Fig. 1) which is adjustably secured by means of a screw bolt 162 to a portion of the machine frame. The adjustment provided by the screw bolt 162 is in direction and extent substantially the same as that provided by the screw bolt 156. The left hand extremity of the shaft 150 carries a pulley 164 connected by a belt 166 to a pulley 168 on the winding shaft 22. As illustrated in Fig. 4 of the drawings, the pulley 168 is adjustable to vary the velocity of the belt engaging portion of the pulley. The adjustment of the velocity of the pulley 168 is made to accommodate different sizes or thicknesses of thread to be wound. An adjustment of the pulley 168 either to increase or to decrease the velocity of its belt engaging portion is followed up by an adjustment of the bearings 152 and 160 of the shaft 150 so as to keep the belt 166 sufficiently taut.

In order to provide for an adjustment of the pulley 168 it comprises two principal parts, namely, a left hand part 170 (Fig. 4) and a right hand part 172, the latter part being secured to the shaft 22 by a set screw 173. The left hand part 170 is annular and has an internal threaded portion which is in threaded engagement with a threaded portion on a sleeve-like extension 174 of the right hand part 172. A rotation of the left hand part 170 with relation to the right hand part 172 changes the peripheral velocity of the belt engaging portion of the pulley that portion being adjusted radially of the pulley when such an adjustment is effected. The two parts 170 and 172 of the pulley 168 are maintained in adjusted relation by a nut 176 which is threaded on the sleeve-like extension 174 and abuts the left hand part 170.

As will be noted from the above the winding shaft 22 serves to rotate the traverse actuating cam 138 by means of the train of mechanism comprising the pulley 168, the pulley 164 and the shaft 150.

Referring to Fig. 1, it will be noted that the diameter of the driven pulley 164 is larger than the diameter of the driving pulley 168, thus indicating that the pulley 164 as well as the shaft 150 and cam 138 are rotated at a lesser rate of speed than the pulley 168 and the winding shaft 22. If the speed ratio between the pulleys 164 and 168 were 1 to 1 the cam 138 would impart to the traverse 88 a complete to and fro movement during one revolution of the winding shaft 22. Assuming the traverse to start at one end or side face of the cop (as determined by the disk 76) it would, during this one revolution of the winding shaft 22, move to the other side face of the cop and then back again to its starting position. If the speed ratio between the pulleys 164 and 168 were 1 to 2, that is to say, if the driven pulley 164 were making one half of a revolution during one revolution of the driving pulley 168, the traverse 88 would move from one side face of the cop to the other. In either case, the inevitable result would be that alternate convolutions or helices of thread would be piled on top of each other, thus making a proper winding of cops impossible.

To assure a proper cross-winding of cops on the illustrated machine the dimensions of the two pulleys 164 and 168 are so selected that the radius of the pulley 164 is larger than the radius of the pulley 168 but smaller than the diameter of the last mentioned pulley. The result is that during one revolution of the driving pulley 168 the driven pulley 164 makes less than one revolution but more than one half revolution. Consequently, the traverse 88 is caused to make one complete traversing movement (from one end face to the other of the cop or if the winding started in the middle between two disks 76 from that middle to one disk and back again to the middle) plus an additional increment of movement. In the illustrated example the speed of the pulley 164 is 1.038/2 during and as compared with one revolution of the pulley 168.

As has been explained, in cross-winding filaments with the aid of a traverse making at least one traversing movement during one revolution of the winding shaft, each alternate helix of filament or thread is laid on the periphery of the cop parallel to the adjacent helix of thread. If the speed ratio between the traverse actuating shaft 150 and the winding shaft 22 were exactly 1 to 2 or 1 to any other integer multiple of one the traverse would, after laying one forward and one reverse helix of thread, be located again in its initial position (assumed before laying the forward helix) and thus would begin laying each alternate thread helix exactly on the same spot where it began laying the helix immediately preceding the previous helix. This would result in piling alternate helices of thread on top of each other. To avoid this, the speed ratio between the winding shaft 22 and the traverse actuating shaft 150 is so selected that it can be expressed only in fractional numbers thus assuring that the traverse is always moved, even though at a uniform rate of speed, somewhat beyond the point where it began laying the adjacent helix of thread.

The question may be raised whether or not during the continued winding operation the successive advancements of the traverse 88 beyond its previous starting positions by the additional increments of movement imparted to it may not adversely affect the proper placing of the thread crossing points in the middle between the two end faces of the cop. These thread crossings should always be in a plane at right angles to the axis of rotation of the cop and located midway between the two end faces of the cop. The answer is that the increase in the diameter of the cop and in the length of thread required to wind a helix of thread around the cop is concomitant with the increase of the angle α of the crossing threads, as will be noted by an inspection of the diagrammatic views of Figs. 7 and 8. The outline of Fig. 7 constitutes an elevation of a sleeve 74 on which a cop winding operation has just been started. Fig. 8 is an elevation of the completely wound cop. Referring to Fig. 7 it will be seen that the winding is assumed to begin substantially in the middle of the sleeve. The first convolution of thread is indicated at t^1 and the succeeding convolutions of thread are marked t^2, t^3, and t^4. Similarly, in Fig. 8 the last wound and in this instance final convolution of thread is marked T^4, and the preceding convolutions are indicated at T^3, T^2, and T^1, it being understood that convolution T^1 is preceded by many other convolutions of thread. The increase of the angle α of the crossing threads at the same time results in an increase of the distance between adjacent thread crossing points a and b (Fig. 7) in the same peripheral surface of the cop (compare the distances between a and b in Fig. 7 and between A and B in Fig. 8). It has been found that any moving ahead of the traverse as a result of the additional movements imparted to it is compensated by the increase in the distance between the crossing points a and b of adjacent threads as the thread coil of the cop increases in thickness during the continued winding operation.

It is understood that the above described adjustment of the driving pulley 168 is not such as to disturb the necessary fractional speed ratio between the shafts 22 and 150 but is made merely to accommodate threads of different thicknesses.

As previously mentioned, the illustrated machine has a thread controller 34 (Fig. 2) which is moved outwardly of the machine as a result of the increasing thickness of the cop. This controls the step by step movement of the portion of the winding shaft 22 supporting the cops. While in the machine disclosed in the above mentioned Letters Patent, the thread controller is not in contact with the coils of thread from the very beginning of the winding operation the

thread controller 34 of the illustrated machine is maintained in firm contact with the thread coil beginning with the first layer of thread wound and this is done for the purpose of pressing and ironing the convolutions of thread as they are being laid. To this end the thread controller 34 is in the form of a two-armed lever secured on a stub shaft 180 (Fig. 2) rotatably mounted in the upper end of the right hand arm of the lever 40. The lower arm of the thread controller 34 has an open ended slot 182 which is engaged by an eccentrically mounted adjustable pin 184. The pin determines the extent of movement of the thread controller with relation to its supporting lever 40, as will be explained. The thread controller 34 carries at its upper end a thread engaging and ironing member 186 which is held in firm contact with the convolutions of thread of the cop from the very beginning of the winding operation, and to this end there is secured to the shaft 180 a rearwardly extending pin 188 which is biased by a spring 190 connecting the pin 188 to the lever 40. The eccentric pin 184 is so set that one side of the slot 182 abuts the pin 184 with the result that the ironing member 186 can move deeply into the space provided between the two disks 76 determining the lateral dimensions of the cop so as to press the convolutions of thread from the beginning of the winding operation. As the cop increases in thickness the thread controller 34 is moved outwardly with relation to the lever 40 until the other side of the slot 182 abuts the eccentric pin 184 and thus terminates the movement of the thread controller 34 with relation to the lever 40. The continued increase of the thread coil in thickness now causes a movement of the thread controller 34 and the lever 40 as a unit until the rack bar 36 is released to terminate the winding operation of this particular cop and to initiate the winding operation of the next cop which, in the meantime, has been moved into winding position. After movement of the wound cop out of winding position and movement of the adjacent sleeve 74 and disks 76 into winding position the lever 40 is again moved inwardly to its original position and the ironing member 186 enters the space between the disks 76 in winding position. As a result of the action of the spring 190 on the pin 188 the final portion of this movement of the ironing member 186 and the threaded controller 34 is again with relation to the lever 40.

To insure that during the mounting and removal of the mandrels 70 the winding shaft may conveniently be held stationary, the traverse actuating shaft 150 is provided with a hand wheel 192 (Figs. 1 and 2) by means of which the rotary parts of the illustrated machine may be temporarily immobilized.

Having now described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A winding machine adapted for cross-winding filaments having, in combination, a rotary winding shaft the rotation of which produces a filament coil, a traverse for presenting the filament to the coil and controlling the cross-winding of the filament, driving means for said traverse rotating at a constant speed of more than one revolution and less than two revolutions during two revolutions of the winding shaft, and means for adjusting the speed ratio between the winding shaft and the traverse-driving means.

2. A winding machine adapted for cross-winding filaments having, in combination, a rotary winding shaft the rotation of which produces a filament coil, an oscillating traverse for presenting the filament to the coil and controlling the cross-winding of the filament, a rotary cam for oscillating the traverse, and means for rotating the cam at a constant speed of more than one revolution and less than two revolutions during two revolutions of the winding shaft to cause each alternate convolution of filament to be placed in juxtaposition to the adjacent convolution as seen in the axial direction of the winding shaft.

3. A winding machine adapted for cross-winding filaments having, in combination, a rotary winding shaft the rotation of which produces a filament coil, an oscillating traverse for presenting the filament to the coil and controlling the cross-winding of the filament, a rotary cam for oscillating the traverse, and means for rotating the cam at a constant speed of more than one revolution and less than two revolutions during two revolutions of the winding shaft to cause each alternate convolution of filament to be placed in juxtaposition to the adjacent convolution as seen in the axial direction of the winding shaft, the cam being so shaped that its pitch changes abruptly to cause an abrupt reversal of movement of the traverse whenever one side face of the coil has been reached.

4. A winding machine adapted for cross-winding filaments having, in combination, a rotary winding shaft the rotation of which produces a filament coil, a traverse for presenting the filament to the coil and controlling the cross-winding of the filament, a fulcrum stud about which the traverse oscillates, means for adjusting said fulcrum stud to adjust the timing of the traverse, and means for varying the throw of the traverse.

5. A winding machine adapted for cross-winding filaments having, in combination, a rotary winding shaft the rotation of which produces a filament coil, an oscillating traverse for presenting the filament to the coil and controlling the cross-winding of the filament, a cam for oscillating the traverse, a rotary shaft carrying said cam, a pulley on said cam shaft, and a pulley on the winding shaft for driving the pulley on the cam shaft by means of a belt, the diameter of the winding shaft pulley being more than the radius but less than the diameter of the cam shaft pulley.

6. A winding machine adapted for cross-winding filaments having, in combination, a rotary winding shaft the rotation of which produces a filament coil, an oscillating traverse for presenting the filament to the coil and controlling the cross-winding of the filament, a cam for oscillating the traverse, a rotary shaft carrying said cam, a pulley on said cam shaft, a pulley on the winding shaft for driving the pulley on the cam shaft by means of a belt, the diameter of the winding shaft pulley being more than the radius but less than the diameter of the cam shaft pulley, and means for adjusting the speed of the belt-engaging portion of one of the pulleys.

7. A winding machine adapted for cross-winding filaments having, in combination, a rotary winding shaft the rotation of which produces a filament coil, a traverse for presenting the filament to the coil and controlling the cross-winding of the filament, driving means for said traverse rotating at a constant speed of more than one revolution and less than two revolutions during two revolutions of the winding shaft, and a

yielding member engaging the surface of the filament coil to press the convolutions of the filament as they are being wound.

8. A thread-winding machine having, in combination, a rotary winding shaft supporting a plurality of sleeves and terminal flanges sustaining a plurality of thread cops during their winding, a thread controller acting between the flanges of one cop at a time to cause the winding operation on each cop to be terminated and the winding operation on another cop to be started, a support for the thread controller, said controller being mounted for limited movement relatively to its support, and yielding means acting on said controller to insure its engagement with the thread on the cop from the start of the winding operation thereon.

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