F. S. RAND & G. N. TAYLOR.

WINDING MACHINE.

APPLICATION FILED JAN. 19, 1914.

1,234,388.

Patented July 24, 1917.

3 SHEETS—SHEET 1.

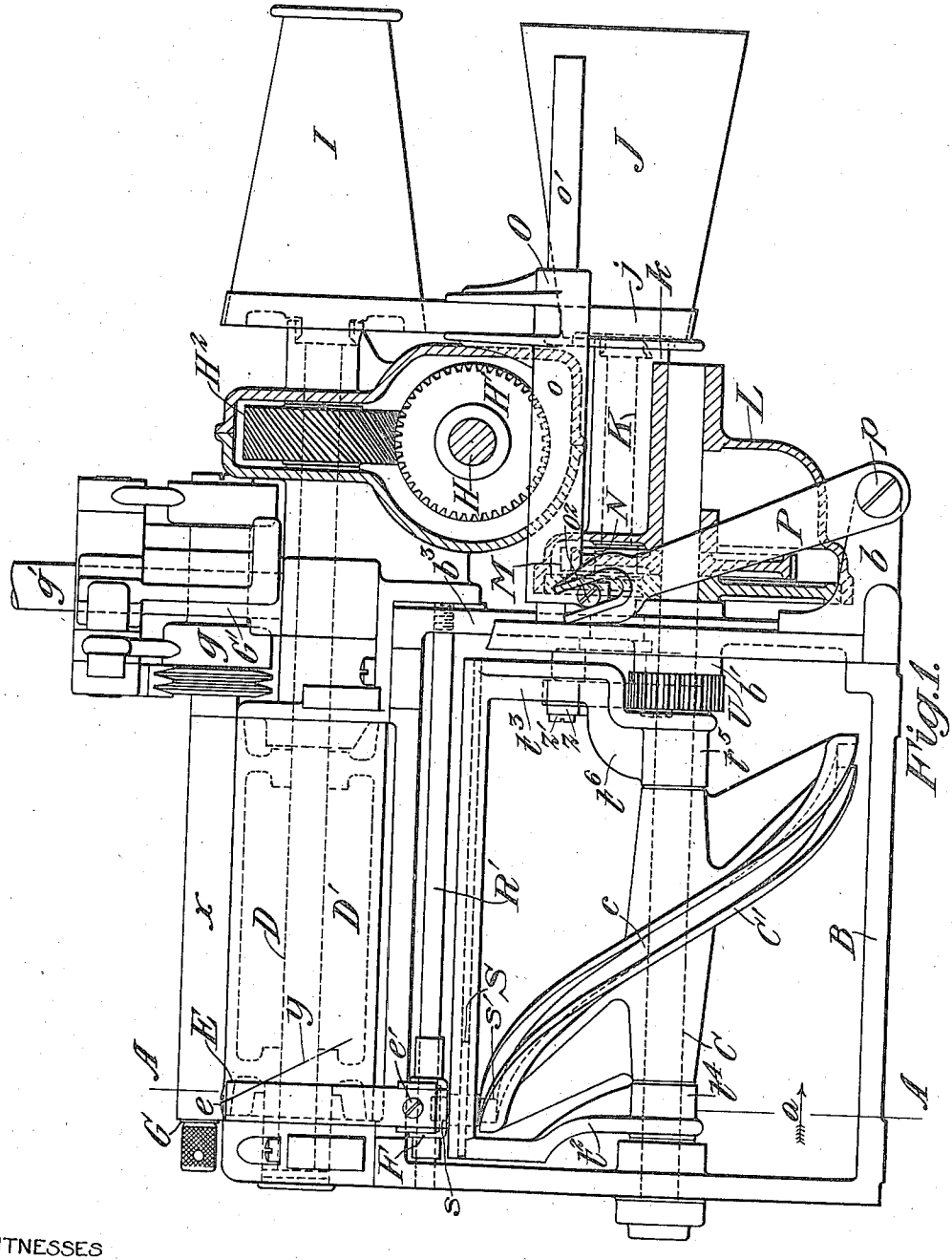


Fig. 1.

WITNESSES

S. C. McBride

G. C. Kenny.

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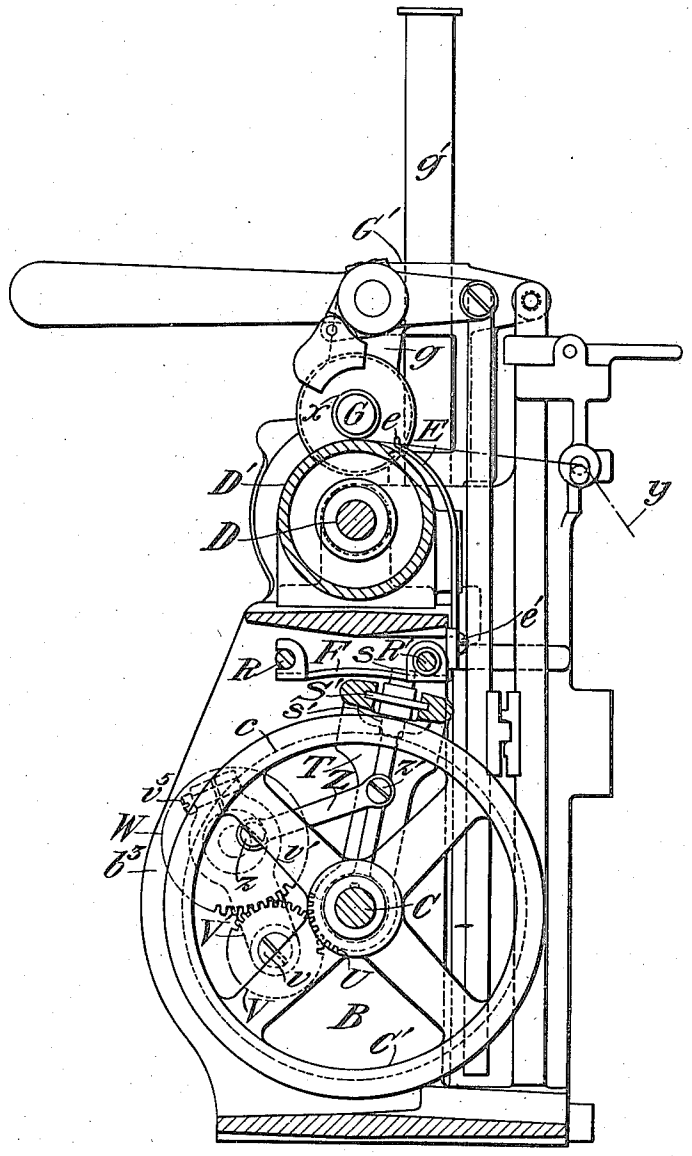


Fig. 2.

WITNESSES

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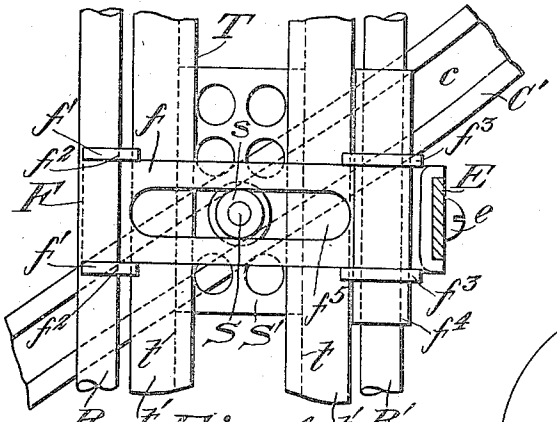


Fig. 4.

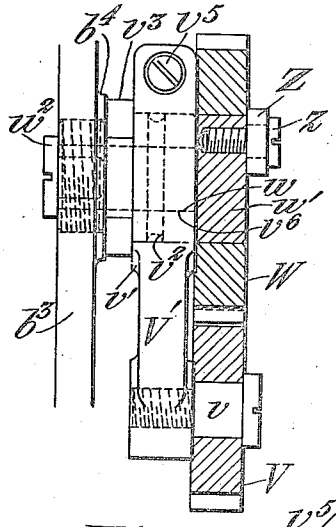


Fig. 5.

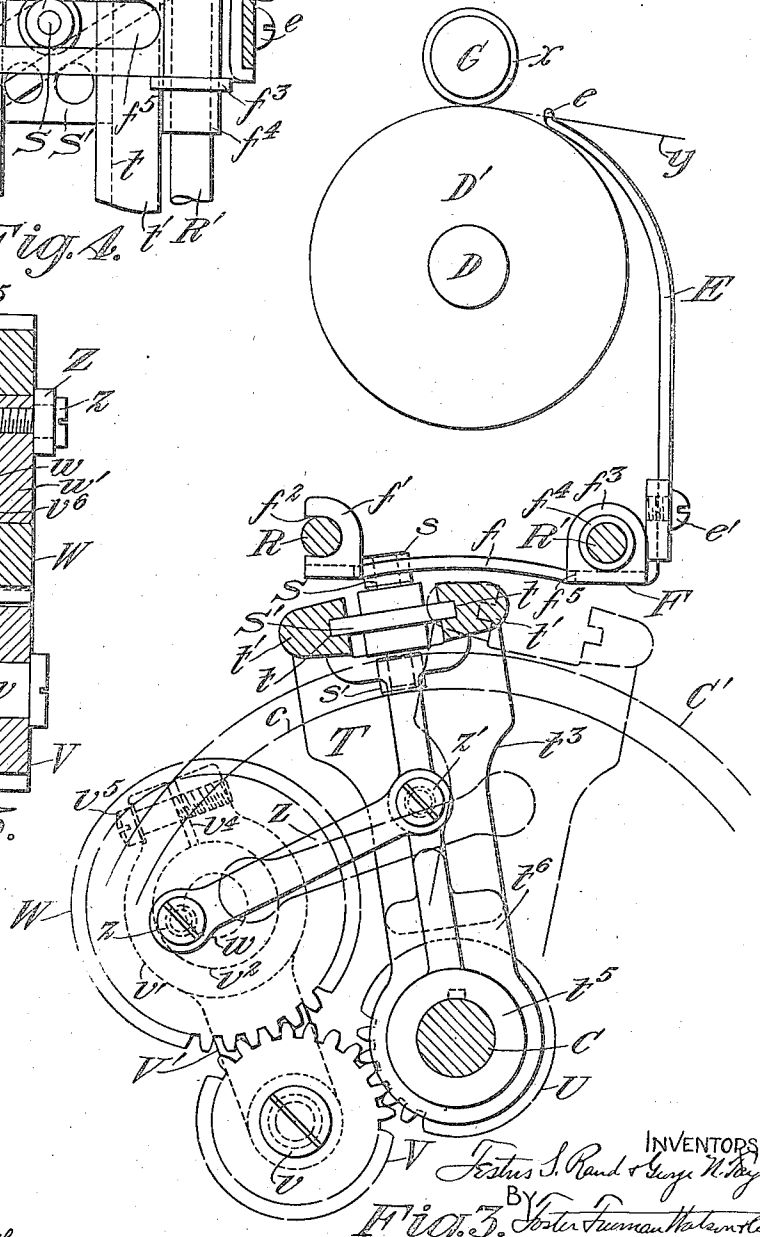


Fig. 3.

WITNESSES

S. C. McBride

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UNITED STATES PATENT OFFICE.

FESTUS S. RAND, OF PROVIDENCE, AND GEORGE N. TAYLOR, OF EAST PROVIDENCE, RHODE ISLAND, ASSIGNORS, BY MESNE ASSIGNMENTS, TO UNIVERSAL WINDING COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

WINDING-MACHINE.

1,234,388. Specification of Letters Patent. Patented July 24, 1917.

Application filed January 19, 1914. Serial No. 813,013.

To all whom it may concern:

Be it known that we, FESTUS S. RAND and GEORGE N. TAYLOR, citizens of the United States, residing at Providence and East Providence, respectively, in the county of Providence and State of Rhode Island, have jointly invented certain new and useful Improvements in Winding-Machines, of which the following is a specification.

Our invention consists of improvements in winding machines and relates particularly to machines of the type known as "friction" or "drum" winders. In machines of this style the thread-cop or yarn-package is rotated through frictional contact of its surface with the periphery of a "drive-roll" or "drum" and the thread or yarn is laid in place by means of a traversing thread-guide reciprocated in a path parallel with the face of the cop.

It is usual in drum-winders to maintain the speed of the drive-roll uniform throughout the winding of the whole cop and as the latter increases in diameter its angular velocity or speed of rotation will necessarily be gradually retarded due to the increasing disparity between its diameter and that of the drive-roll. This results in a constant change in ratio between the speed of rotation of the cop and the speed of reciprocation of the thread-guide and, consequently, there is a corresponding change in the "wind." The term "wind" is generally employed to designate the number of turns or coils which the yarn makes about the cop in traversing from one end to the other and, as before stated, in drum-wound packages the "wind" varies from start to finish of the package. For instance, if the winding is started with say eight or ten "winds" at the smallest diameter, as the cop increases in size and its speed of rotation is retarded the number of "winds" will be materially lessened by the time it reaches its full diameter; in some cases the yarn making only a half turn about the cop at this point.

At the start of the winding the coils of yarn are laid in "open" or spaced-apart relation, but as the "wind" changes the spacing between the turns becomes less and the coils gradually close up and eventually pile one on another. This crowding or "piling" of the coils of winding takes place each time the "wind" changes from a greater to a lesser number of even turns and causes what is termed a "ribbon wind" on the surface of the cop. In a cop of standard size there may be as many as eight or ten occurrences of this "ribbon wind" in its make-up and it is a well recognized fact that the winding is defective at these points. That is to say, when the winding is crowded or "piled" the yarn is liable to be stretched and strained, and, furthermore, the coils will not hold in place as well as when spaced apart. When several coils are laid over each other in the "ribbon wind" they tend to slip and slide out of place and to roll on the surface of the cop. This acts to disturb the twist of the yarn and to otherwise weaken it so that its ultimate quality is impaired. Besides this, when the cop is unwound the yarn will not draw off freely where the coils are crowded or laid in a "ribbon" and therefore the commercial value of the product is materially lessened on this account.

The object of the present invention is to cure this defect in drum-wound packages by breaking up the "ribbon wind" and eliminating the "piling" of the coils. The means for accomplishing this purpose consists essentially of an arrangement of mechanism which acts automatically to interrupt or disturb the synchronism of movement between the thread-guide and the winding-spindle at frequently recurring intervals. Through this means the related operations of the guide and spindle are thrown out of consonance and the regularity of the winding is upset or disrupted so that the coils cannot crowd or pile one on another.

The manner and means for carrying out the improvement as above set forth are fully described in the following specification, illustrated by the accompanying drawings, in which like letters of reference designate like parts. In the drawings:—

Figure 1 is a front view of our improved winding machine showing a portion of the gear-casings in section to illustrate the driving connections inclosed thereby;

Fig. 2 is an end elevation of the same, part sectional on the line A—A of Fig. 1, looking in the direction indicated by the arrow *a;*

Fig. 3 is an enlarged, side elevation of the traverse-shifting mechanism as viewed in the same direction;

Figs. 4 and 5 are enlarged, detail views of the same.

Referring first to Figs. 1 and 2, B designates the frame of the winding machine which is provided with bearings for two horizontal shafts C and D. On the lower shaft C is fixedly mounted a usual form of traverse-cam C′ adapted to reciprocate the traversing thread-guide E, and held fast on the upper shaft D is the drive-roll D′. The winding-spindle G which is adapted to receive the cop-tube x, or other shell or holder on which the package is wound, is supported to rotate in an end bearing g which forms part of a sliding carriage G′. In Figs. 1 and 2, the spindle G is illustrated in position with the cop-tube x bearing on the periphery of the drive-roll D′ and it is to be noted that the carriage G′ is adapted to slide upwardly on a vertical supporting rod g' to allow the spindle to recede from the roll as the cop increases in diameter. Suitable weights, not here shown, are employed in connection with the carriage G′ to normally maintain the cop in contact with the drive-roll D′ to cause a friction between the two whereby the cop and its spindle is rotated from the roll.

It is the usual practice to arrange a plurality of winders in series or "gangs" all mounted on a common table or bed and for this reason we prefer to adapt the present machine to be driven from a single, main driving-shaft H extending between the shafts C and D at right-angles thereto, see Fig. 1. The shaft H may be connected to drive the shafts C and D in any suitable manner, but as here shown we employ a spiral gear H′ meshing with a similar gear H^2 on the shaft D. Mounted on the end of the shaft D, is a cone-pulley I from which rotation is transmitted to an oppositely-arranged cone-pulley J by means of the driving-belt j. The pulley J is mounted fast on a shaft K which rotates in a bearing k formed as a part of a gear-casing L. The casing L is mounted on the cam-shaft C and incloses a gear M fast on said shaft and arranged to mesh with a pinion N on the inner end of the pulley-shaft K. The main driving-shaft H drives the shaft D through the gears H′, H^2 and rotation is imparted by the pulley I to the pulley J through the belt j and transmitted thence through the shaft K and gears N and M to the shaft C.

The shaft C carries the cam C′ which reciprocates the thread-guide E and it has been determined that an improvement in the winding can be effected by varying the speed of the guide in relation to that of the drive-roll D′ throughout the building of the cop. The usual practice in machines of this class has been to maintain a constant ratio between the speed of the drive-roll and that of the thread-guide. With this arrangement, since the speed of rotation of the cop or package varies inversely with its diameter, as before described, a considerable change will take place in the ratio between the speed of the cop and that of the guide. In other words, the cop will be rotated with a relatively large number of turns during each traverse of the guide at the beginning of the winding and generally only a fraction of a turn to one traverse of the guide at the finish of the winding. This results in a considerable disparity between the number of the winds at the beginning and completion of the cop, and it is a well known fact that such a condition has inherent disadvantages which result in defects in the winding and cause irregularities in the delivery of the yarn when the cop is unwound. When the yarn is wound from end to end of the cop with a relatively large number of turns it will hold its place better than when wound with only a few turns. The coils are less liable to slip and become displaced when wound with a relatively slight pitch or lead; while, on the other hand, if the pitch or angle of the coils is made too great there will be a tendency for the yarn to pull in from the ends of the cop and this will cause irregularities on its surface, developing into ridges or bunches and finally resulting in a malformed package. Furthermore, when the yarn has too quick a traverse across the cop at each revolution, the laying of the coils at the ends of traverse can not be controlled so precisely and the yarn is liable to roll over the edges and draw across the ends, making what are technically called "cobwebs." It is well known that these defects of "cobwebs" and other malformations in drum-wound cops are highly objectionable since they prevent free delivery of the yarn in unwinding and otherwise lessen the commercial value of the package. As before stated, they are usually caused by the rapid decrease in the number of "winds" from start to finish of the cop and it has been demonstrated that if the reduction in the number of "winds" is made less pronounced the cop is greatly improved. We have found that if the winding is started with say five and one-half or approximately that number of "winds" and reduced to not less than about two and one-half "winds," a much more perfect cop can be produced. To effect this lessening of the disparity between the number of "winds" at the start and finish of the cop and secure the preferred rate of change above specified we employ a mechanism for obtaining a differential ratio between the speeds of the drive-roll and thread-guide arranged as follows:

As before explained, the cam-shaft C is driven from the shaft D through the medium

of the cone-pulleys I and J connected by the belt j. The belt j is engaged by a shipper-fork O which is formed with an elongated bearing o adapted to slide on a rod o' which projects from the side of the frame B. At the inner end of the bearing o is a stud o^2 which is engaged by the forked end of a lever P, the latter being pivoted at p on an extension b of the frame B. The lever P is connected to the carriage G' by means of a suitable operating-device which, for the sake of simplification, is not here shown. The carriage G' carries the winding-spindle G and it will suffice to explain that as the latter rises with the growth in diameter of the cop the lever P is rocked slowly to the right to shift the belt j toward the outer ends of the pulleys I and J. As the belt j moves to the right, as viewed in Fig. 1, the diameter of the driving-pulley I decreases and the diameter of the driven-pulley J increases so that the speed of the cam-shaft C is gradually retarded. This causes a corresponding retardation in the speed of reciprocation of the thread-guide E and consequently the reduction in the number of "winds" in the package is less pronounced than when a constant rate of speed is maintained between the drive-roll and thread-guide.

The arrangement of the thread-guide E and its reciprocating and traverse-shifting mechanism for breaking up the "ribbon wind" will now be described: Referring to Fig. 3, the guide E is preferably constructed of sheet-metal with its upper portion curved inwardly around the surface of the drive-roll D' so that its notched or slotted extremity e lies in proximity to the point of contact of the cop-tube x on the roll. Its lower end is attached to a carriage or slide F by means of the screw e'. The slide F is formed with a sheet-metal bridge-piece or plate f reaching between two parallel rods R, R' which extend horizontally between the sides of the frame B, see Figs. 1, 3 and 4. The plate f is preferably formed with ears f', f' at one end bent up at right-angles thereto and having openings f^2, f^2 engaging the rod R, see Fig. 3. At its opposite end the plate f is formed with ears f^3, f^3 in which is secured a sleeve or bushing f^4 adapted to slide on the rod R'. Extending longitudinally of the plate f is a slot f^5 which engages a roll s rotatably mounted on the end of a stud S which latter is secured in a plate or slide S'. On the lower end of the stud S is a roll s' which engages the groove c in the cam C'. The slide-member S' is fitted to slide in grooves t, t formed in the parallel sides t', t' of a traverse-frame T. The frame T has two depending legs t^2, t^3, see Fig. 1, which straddle the cam C and terminate in hubs t^4, t^5 having bearings pivotally mounted on the cam-shaft C. The right-hand leg t^3 is offset at t^6 to provide a space between the hub t^5 and the shaft-bearing b' of the frame B and within this space is a pinion or gear U mounted fast on the cam-shaft C.

The gear U meshes with a similar gear V mounted rotatably on a stud v which projects from an arm V' secured to the inside of the frame B, see Figs. 3 and 5. The arm V' is preferably formed with a hub v' mounted on a bushing v^2 having a shouldered portion v^3 screwed against a boss b^4 on the frame member b^3. The hub v' of the arm V' is split at v^4 and a binder-screw v^5 serves to clamp the arm to the bushing while allowing adjustment of its lower end to provide for setting the gear V in relation to the gear U, or for disconnecting the two gears when desired. The bushing v^2 is formed with an axial bore v^6 in which is rotatably mounted a stud w formed with a head w'. The head w' of the stud w abuts one end of the bushing v^2 and a screw w^2 in the opposite end of the stud engages the other end of the bushing to hold the stud in place. Forced on to the head w' of the stud w, or otherwise secured thereto, is a gear W arranged to mesh with the gear V. The head w' of the stud w carries an eccentrically-disposed stud or crank-pin z on which is mounted the end of a connecting-rod or link Z. The opposite end of the link Z is connected to the leg t^3 of the traverse-frame T by a stud z'. Having now described the arrangement of the various mechanisms of the complete machine its method of operation will next be explained.

Referring first to Figs. 1, 2 and 3, the thread or yarn y is led from its source of supply through the notched extremity e of the thread-guide E and its end secured to the cop-tube x. When power is applied to the driving-shaft H the drive-roll D' is rotated to turn the winding-spindle G to wind the yarn on to the tube x while it is being traversed by the guide E. Reciprocation is imparted to the guide E by the cam C' to which rotation is transmitted through the cone-pulleys I and J, as before explained. As the cop increases in diameter from the addition of layer on layer the spindle G recedes from the drive-roll D' and the carriage G' rides upwardly on the rod g'. This action causes the belt j to be shifted on the pulleys I and J to gradually retard the speed of the cam C' and the connected thread-guide E and in this way the ratio of speed between the guide and the cop is controlled to regulate the change in the "wind." With the differential speed-controlling mechanism operating as described the variation in the "wind" from start to finish of the winding will not be so great as in drum-winders of the usual style, still a limited degree of change will take place and this is of advantage rather than being objectionable. During the change from one even

"wind" to another there will still be a tendency for the coils to pile and form the "ribbon" and to counteract this the traverse-shifting mechanism operates as follows:

The cam C′ operates the thread-guide E through engagement with the roll s' mounted on the stud S. The stud S is fast in the slide S′, which slides in the frame T, and carries the roll s which engages the slot f^5 in the sliding carriage F. Now, during the rotation of the cam C′, the gear U on the shaft C turns the gear V and this latter in turn rotates the gear W. As the gear W is rotated its crank-pin z imparts movement through the link Z to the frame T and a limited oscillating motion is therefore communicated to said frame. The limits of oscillation of the frame T are illustrated in Fig. 3, in which the full lines show the frame at one extreme of its movement and the dash lines at the other. The oscillation of the frame T causes the roll s to slide back and forth in the guide-carriage F and during this movement the cam-roll s' is shifted back and forth in the groove c of the cam C′. Referring particularly to Figs. 1 and 4, it will be noted that the cam-groove c extends at a more or less acute angle to the slot f^5 in the carriage F and hence as the roll s' slides back and forth in said groove it will necessarily displace the slide S′ longitudinally of the frame T. During this movement of the roll s' in the cam-groove c the roll s will play back and forth in the groove f^5 of the plate f and the latter will be shifted back and forth on the rods R, R′. This staggering movement of the carriage F, which is independent of its prime movement of reciprocation under the normal influence of the cam C′, is communicated directly to the thread-guide E mounted on the plate f. It will therefore be seen that during the operation of the machine the guide E will be constantly displaced axially of the cop relative to its normal movement of reciprocation, first in one direction and then in the other. In other words, the thread-guide will have an intermittent increment and decrement of movement with respect to its normal reciprocatory motion and hence the regularity of its traverse will be broken up or disrupted.

It will be noted that the two gears U and V of the traverse-shifting mechanism are of equal size while the gear W is of somewhat greater diameter. This provides that the motion of the crank-pin z and the consequent oscillation of the frame T will be timed at a different rate of speed from that of the cam C′. The object of this is to prevent a synchronism of movement between the cam C′ and the frame T. It is not essential that the timing of these two elements be in strict accordance with the ratio herein proposed, but we have demonstrated by experiment that a ratio between the gears V and W of about two to three-and-a-slight-fraction gives very satisfactory results. For instance, the gear V is preferably constructed with forty teeth while the gear W has sixty-one. The odd tooth in the gear W will cause what might be termed a continuous gain or differential ratio in the movement of the cam over that of the crank-pin z and in this way the harmony of movement between the cam C′ and the frame T will be entirely disrupted. In the same way, the movement of the thread-guide E is thrown out of consonance with the movement of the drive-roll D′ and therefore it will be impossible for the guide to have its movement of traverse in synchrony with the rotation of the cop during any portion of the winding. For this reason the guide will be prevented from following the same course over the face of the cop during several continuous rotations of the latter and hence the coils of yarn will be kept from crowding or "piling." It will therefore be seen that with this new arrangement of mechanism applied to the transverse-operating means the defects of "ribbon winding" are entirely obviated and thereby a much improved cop is produced.

Various modifications might be made in the form and arrangement of our new mechanism without departing from the spirit or scope of the invention; therefore, without limiting ourselves to the exact construction shown and described, what we claim is:—

1. In a winding machine, the combination with the winding-spindle on which the cop is wound, of means to rotate said spindle, a thread-guide for traversing the yarn longitudinally of the spindle, a traverse cam for reciprocating said guide between fixed limits with a constant length of traverse, and means for displacing the guide longitudinally of its traverse with respect to the cam to cause an intermittent increment and decrement in the velocity of movement of the guide at irregular intervals during its traverse by the reciprocating-means without variation in the length or position of its traverse.

2. In a winding machine, the combination with a winding-spindle for receiving the cop to be wound thereon, of a drive-roll for rotating the cop through frictional contact with its surface, means to rotate the drive-roll at a constant rate of speed throughout the operation of the machine, a thread-guide for traversing the yarn on the cop, a traverse cam for reciprocating the guide between fixed limits with a constant length of traverse, and means for displacing the guide longitudinally of its traverse with respect to the cam to effect an intermittent incre-

ment and decrement in the velocity of movement of the guide at irregular intervals during its traverse without variation in the length or position of the traverse of the guide.

3. In a winding machine, the combination with a winding-spindle, of means to rotate said spindle, a thread-guide, means to reciprocate the guide between fixed limits with a constant length of throw including a traverse-cam, means connected with the guide and engaging the cam, and means to continuously shift said connecting-means to vary its point of engagement with the cam to effect an intermittent increment and decrement in the velocity of movement of the guide whereby its synchronism of movement with respect to the rotation of the winding-spindle is disrupted at irregular intervals during the winding, but without changing the position of the traverse with relation to its fixed limits.

4. In a winding machine, the combination with a winding-spindle, of means to rotate the spindle to wind the yarn thereon, a thread-guide, a cam for reciprocating the guide to traverse the yarn on the spindle with a constant length of traverse between fixed limits, means connecting the guide with the cam, and means to continuously shift said connecting-means circumferentially of the cam to cause an intermittent increment and decrement in the velocity of movement of the guide whereby the synchronism of its movement with respect to the rotation of the cop is disrupted at irregular intervals during the winding without variation in the length or position of the traverse of the guide.

5. In a winding machine, the combination with a winding-spindle, of means to rotate the spindle to wind the yarn thereon, a thread-guide for traversing the yarn on the spindle, a cylindrical cam having a helical cam-face for reciprocating the guide, means connecting the guide with the cam, and means to cause an angular displacement of said connecting-means with respect to the axis of the cam during recurring intervals of the winding to disrupt the normal synchronism of movement between the reciprocation of the guide and the rotation of the cop.

6. In a winding machine, the combination with a winding-spindle, of means to rotate said spindle, a thread-guide for traversing the yarn on the spindle, a cylindrical cam having a helical cam face for reciprocating the guide, means connecting the guide with the cam, and means for oscillating said connecting-means back and forth around the circumference of the cam to break up the synchronism of movement between the thread-guide and the winding-spindle and prevent the coils of winding from being crowded together on the surface of the cop.

7. In a winding machine, the combination with a winding-spindle, of means to rotate said spindle, a thread-guide, a cam for reciprocating the guide, a traverse-frame pivoted on the axis of the cam, a slide in said frame, means connecting said slide with the thread-guide, means connecting said slide to be reciprocated from the cam, and means to oscillate the traverse-frame during the reciprocation of the slide to shift the point of engagement of the connecting-means with the cam whereby the synchronism of movement of the thread-guide with respect to the rotation of the winding-spindle is continuously interrupted.

8. In a winding machine, the combination with a rotating winding-spindle, of means to rotate said spindle, a thread-guide, means to reciprocate said guide including a helical cam formed with an angularly-disposed circumferential groove, a roll connected to the thread-guide and engaging the groove in the cam, and means to intermittently displace said roll circumferentially of the cam-groove to disrupt the synchronism of movement between the thread-guide and winding-spindle.

9. In a winding machine, the combination with a rotating winding-spindle, of means to rotate said spindle, a thread-guide, means to reciprocate said guide including a helical cam having circumferential cam-faces, means connected to the guide and adapted to engage the cam-faces, and means to oscillate said connecting-means about the axis of the cam to vary its point of engagement with the cam-faces to intermittently impart an increment and decrement of movement to the guide whereby its synchronism of movement with respect to the winding-spindle is disrupted.

10. In a winding machine, the combination with a winding-spindle, of means to rotate said spindle, a thread-guide, means to reciprocate said guide including a traverse-cam, a traverse-frame adapted to oscillate about the axis of the cam, traverse-means carried by said frame and engaging the cam, means connecting the traverse-means with the guide, and means to continuously oscillate the traverse-frame to shift the traverse-means to vary its point of engagement with the cam and disrupt the synchronism of movement between the guide and the winding-spindle.

11. In a winding machine, the combination with the winding-spindle, of means to rotate the spindle, a thread-guide, a cam-shaft, means to drive said shaft, a cam on said shaft, traverse-means engaging said cam to reciprocate the thread-guide, a frame for slidably supporting said traverse-means,

and means driven from the cam-shaft to oscillate the frame to shift the traverse-means and continuously vary its point of engagement with the cam in the manner and for the purpose described.

12. In a winding machine, the combination with the winding-spindle, of a drive-roll for rotating the cop supported on the spindle, means to drive said roll, a thread-guide, a helical cam for reciprocating the guide, traverse-means connected to the guide and engaging the cam, means to shift said traverse-means to vary its point of engagement with the cam, and differential gearing for actuating said means to disrupt the synchronism of movement between the thread-guide and winding-spindle.

13. In a winding machine, the combination with the winding-spindle, of means to rotate the spindle, a thread-guide, means to reciprocate the guide including a rotating traverse-cam formed with a helical groove, traverse-means connected to the guide and engaging the groove in the cam, means to intermittently shift said traverse-means to vary its point of engagement with the cam, and differential gearing for operating said means to vary the ratio between the shifting movement of the traverse-means and the rotation of the cam.

14. In a winding machine. the combination with the winding-spindle, of means to rotate the spindle, a traverse-guide, a traverse-slide connected to the guide, a cam, a roll on the traverse-slide engaging the cam, a traverse-frame for supporting the slide to be reciprocated thereon, a crank, means for rotating the crank, and means connecting the crank to oscillate the traverse-frame to intermittently shift the point of engagement of the traverse-roll with the cam.

15. In a winding machine, the combination with the winding-spindle, of a thread-guide, a traverse-cam, traverse-means connecting said guide to be reciprocated from the cam, a frame for supporting the traverse-means, means to oscillate said frame about the axis of the cam including a gear, a crank-pin on said gear, a link connecting the crank-pin with the frame, and means to rotate said gear with a differential rate of speed with respect to the speed of rotation of the cam.

16. In a winding machine, the combination with the winding-spindle, of a thread-guide, a traverse-cam, traverse-means connected to the thread-guide and engaging the cam, a frame for supporting said traverse-means concentric with the cam to adapt it to be oscillated upon the axis of the latter, a train of differential gearing, means to drive the same, and means on one of the gears to oscillate the traverse-frame therefrom to intermittently vary the point of connection of the traverse-means with the cam.

17. In a winding machine, the combination with a winding-spindle and cam-shaft, of means to drive the same, a cam mounted on the cam-shaft, a thread-guide, a traverse-slide connecting the guide to be reciprocated from the cam, a frame for supporting the slide to adapt it to oscillate about the axis of the cam, a gear on the cam-shaft, a gear driven therefrom, a crank-pin on the last named gear, and a connecting rod connecting the crank-pin with the traverse-frame to oscillate the latter during the rotation of the cam.

18. In a winding machine, the combination with the winding-spindle, of a thread-guide, a carriage connected with the guide to reciprocate the latter, a slide connected with the carriage to adapt it to be moved back and forth across the path of reciprocation of the latter, a cam for reciprocating the slide, and means to oscillate the slide with respect to the axis of the cam during its reciprocation thereby.

19. In a winding machine, the combination with the winding-spindle, of a carriage adapted to be reciprocated longitudinally of the spindle, a thread-guide connected with said carriage, a slide adapted to be oscillated back and forth across the path of reciprocation of the carriage, means connecting the slide with the carriage, a cam for reciprocating the slide, a frame on which the slide is reciprocated, and means for oscillating said frame with respect to the axis of the cam.

20. In a winding machine, the combination with the winding-spindle, of rods extending parallel therewith, a carriage mounted to slide on the rods and formed with a slot arranged at right-angles thereto, a thread-guide connected with the carriage, a rotating traverse-cam formed with a groove, a traverse-frame pivoted on the axis of the cam, a slide adapted to be reciprocated in guideways on the traverse-frame, a stud in said slide, a roll on said stud engaging the groove in the carriage, a second roll on the stud engaging the groove in the cam, and means to oscillate the traverse-frame about the axis of the cam during the reciprocation of the slide and carriage thereby.

In testimony whereof we affix our signatures in presence of two witnesses.

FESTUS S. RAND.
GEORGE N. TAYLOR.

Witnesses:
ARTHUR A. ARMINGTON,
HERBERT K. ALLARD.