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S. W. WARDWELL, Jr.

METHOD OF WINDING COPS OR BALLS.

No. 480,158. Patented Aug. 2, 1892.

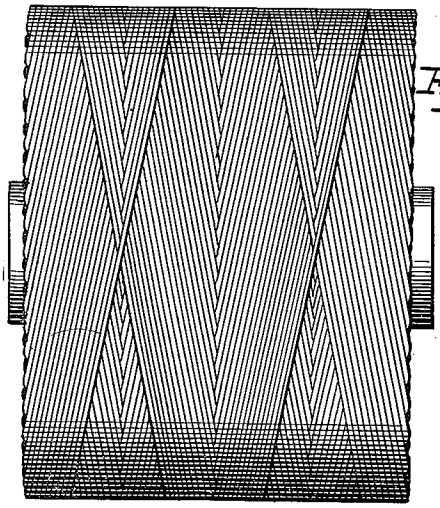


Fig. 5

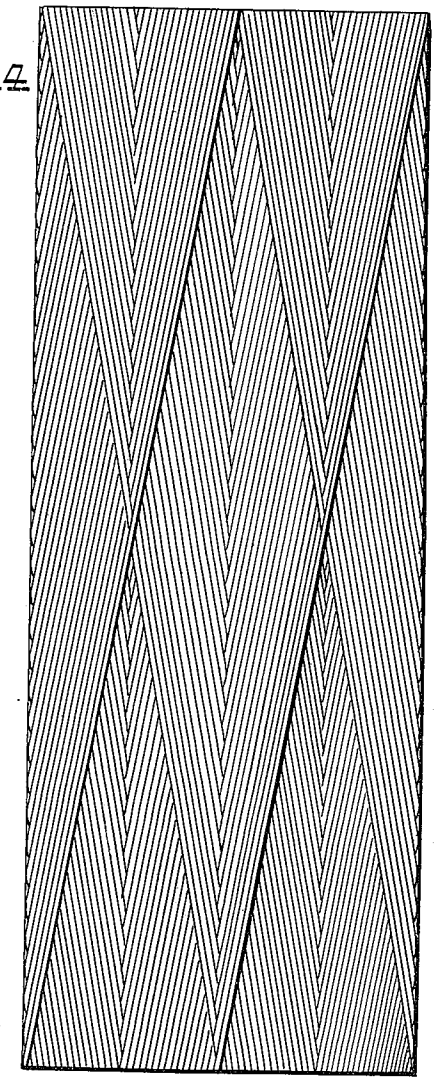


Fig. 4

Fig. 3.

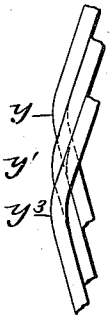


Fig. 1.

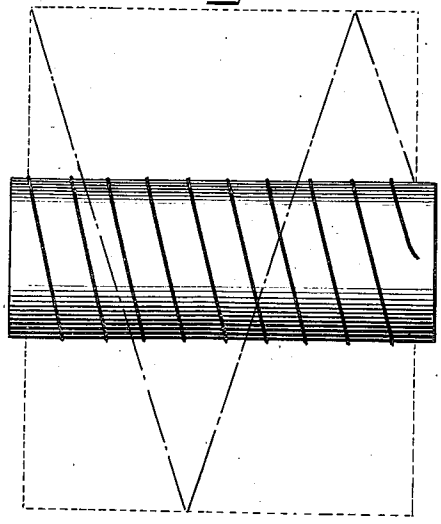
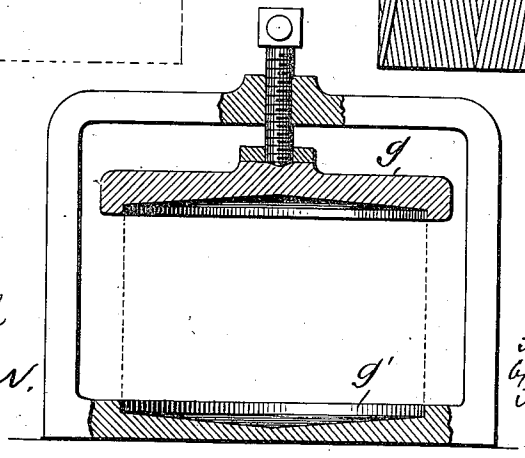


Fig. 6.



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(No Model.) 4 Sheets—Sheet 2.

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Fig. 9.

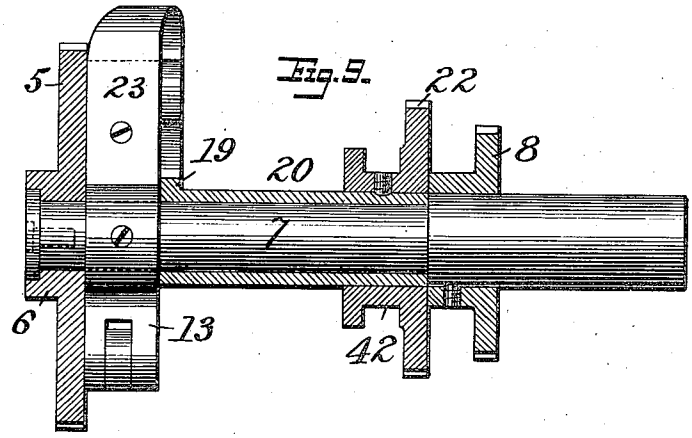

Fig. 2.

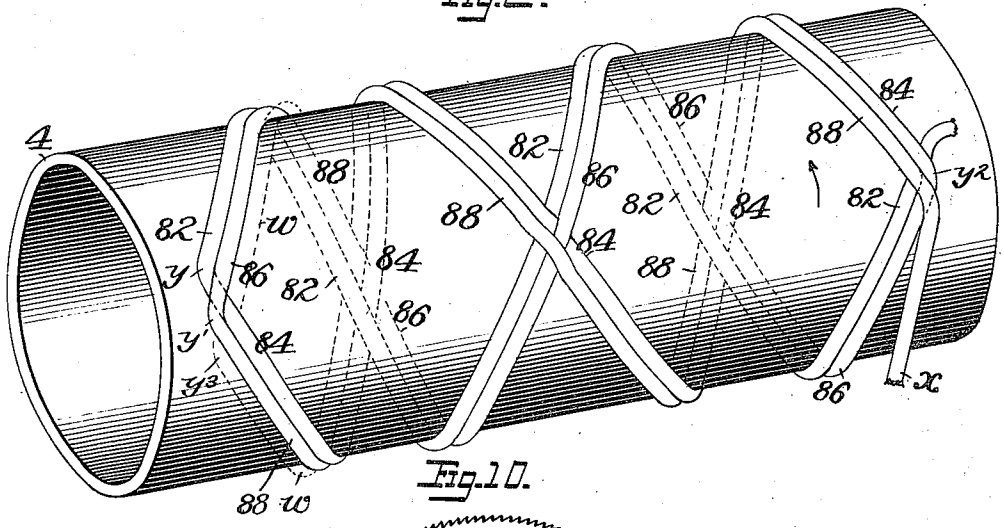

Fig. 10.

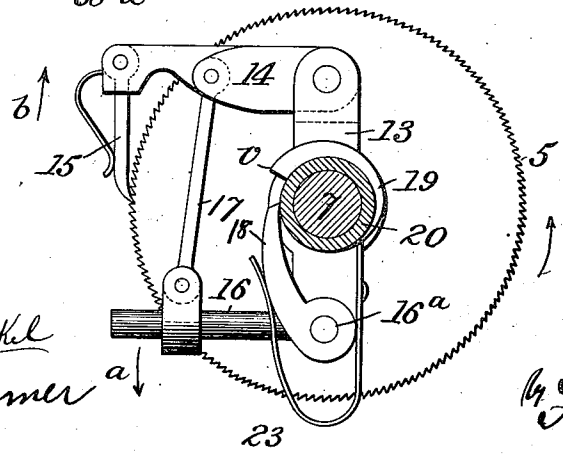

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Fig. 7.

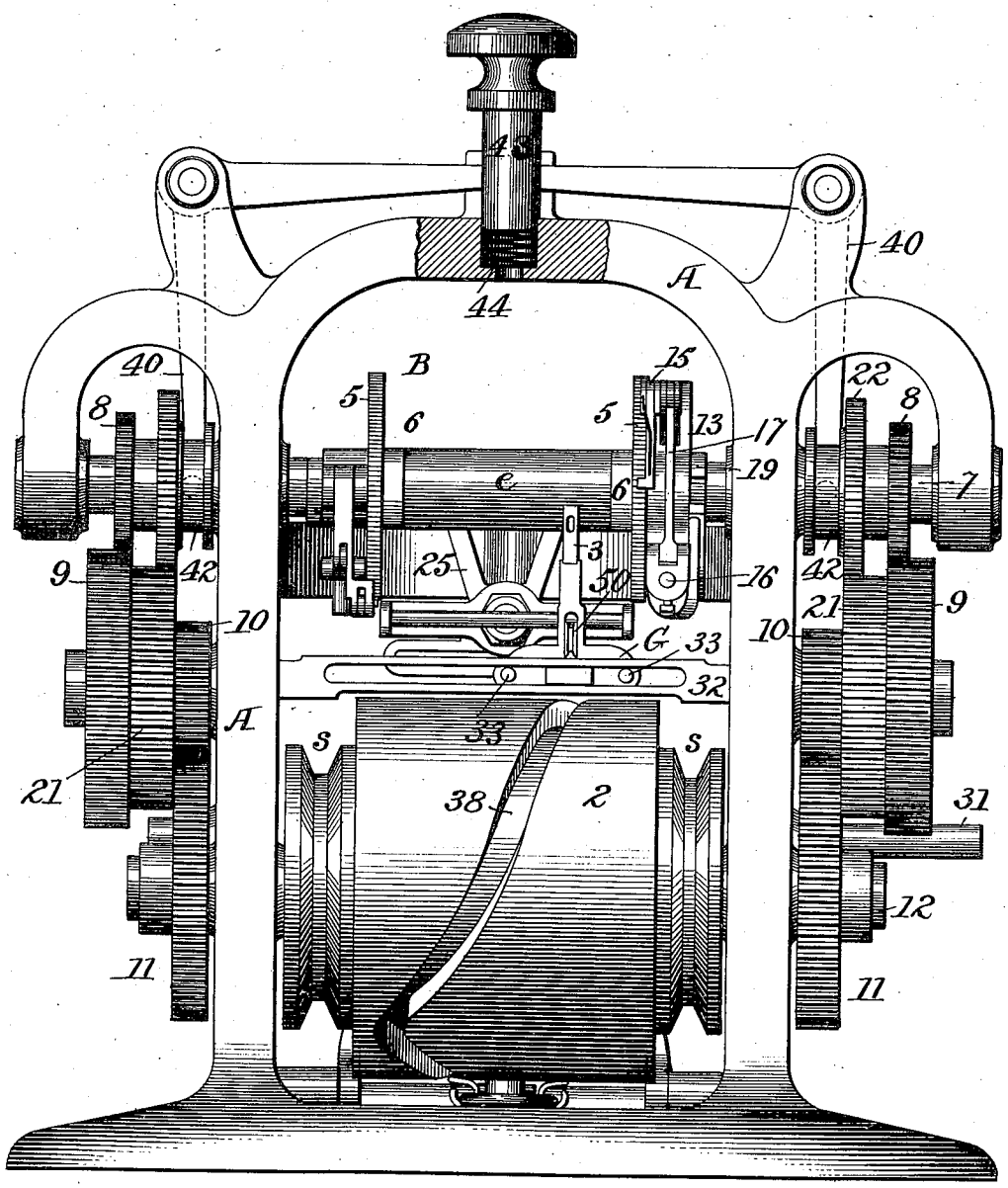

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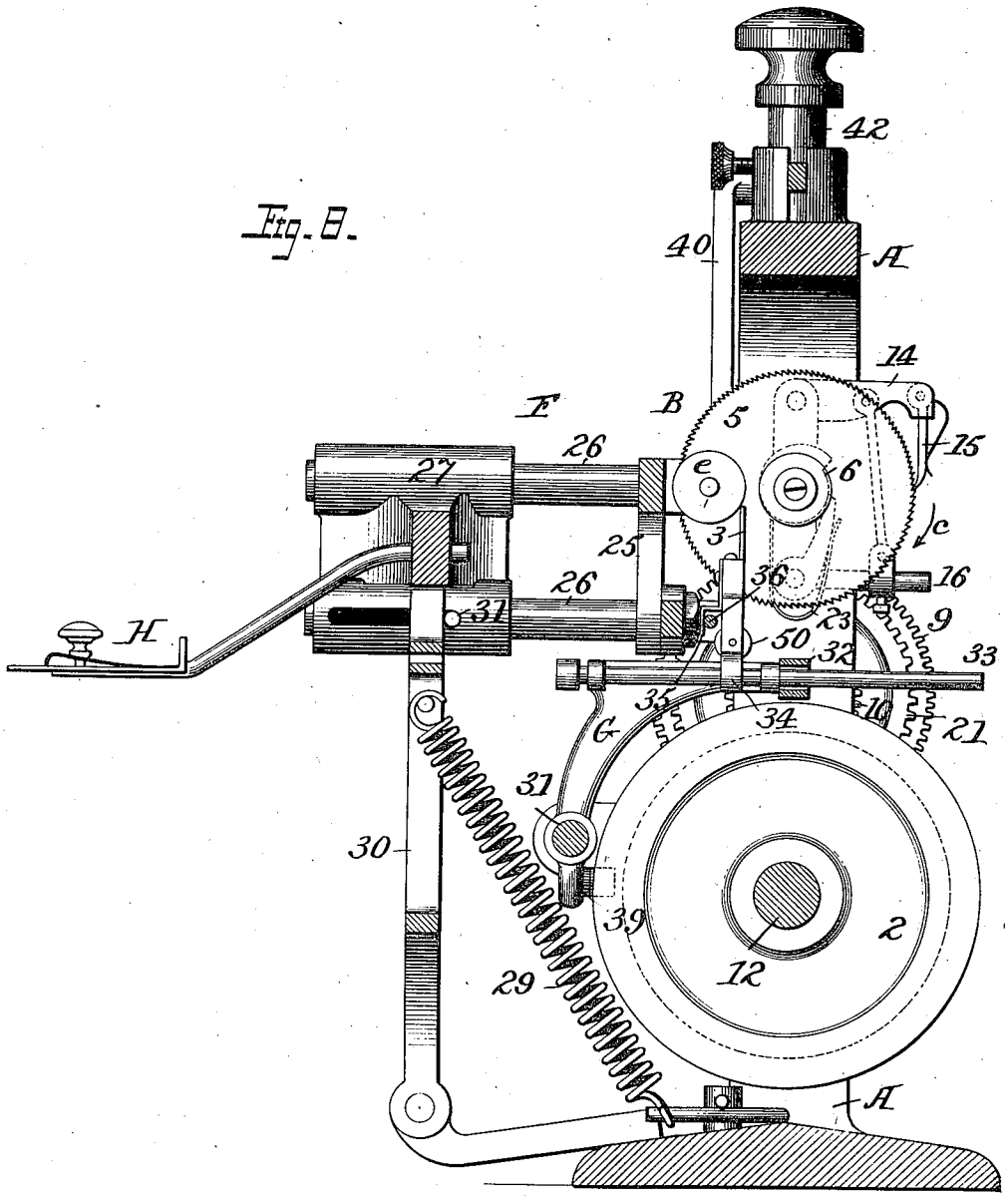
Fig. 8.



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UNITED STATES PATENT OFFICE.

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METHOD OF WINDING COPS OR BALLS.

SPECIFICATION forming part of Letters Patent No. 480,158, dated August 2, 1892.

Application filed January 2, 1892. Serial No. 416,848. (No model.)

To all whom it may concern:

Be it known that I, SIMON W. WARDWELL, Jr., a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Methods of Winding Cops or Balls, of which the following is a specification.

My invention relates to the formation of cops or balls of yarn, thread, or cord of fibrous or other material; and it consists in a method, fully set forth hereinafter, of laying the thread in the winding of the cop or ball, so as to secure a solid cop which is not readily crushed or broken, insure the delivery of the thread in unwinding without tangling, reduce the dimensions of the cop or ball, facilitating packing, storage, and transportation, and obtain other advantages, hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a diagrammatic view illustrating the disposition of the thread in ordinary modes of winding. Fig. 2 is a perspective view, enlarged, showing the manner in which the thread is laid in starting the winding of my improved cop. Fig. 3 is an enlarged view illustrating the disposition of the threads at the end of the cop. Fig. 4 is a view showing the surface of one of the improved cops as flattened out to a plane and illustrating the disposition of the threads. Fig. 5 is a view illustrating the improved cop; Fig. 6, a sectional view of the cop-press; Fig. 7, a front elevation of the winding-machine; Fig. 8, a transverse elevation; Figs. 9 and 10, detached views of parts of the machine.

Heretofore in winding balls or cops of yarn, thread, cord, or rope the thread is conducted to a revolving cylinder or tube and carried transversely first to one end and then to the other of the latter, laying coils in successive layers until the cop is built up to the proper size. Such operations have heretofore been so performed that the number of coils of thread in each layer gradually decreases as the size of the cop increases, so that while there may be six or eight coils or windings of the thread directly upon the tube in the first layer, as in full lines, Fig. 1, there will be but one or two windings in each portion of thread extending from one edge to the other of the cop in the last or external layer, as in dotted lines, Fig. 1, and the winding is consequently irregular, the threads are not parallel in the successive coils, the cop is soft and yielding and readily crushed and broken, resulting in entangling the thread, and in unwinding, the thread is apt to slip across the end of the cop, causing friction, and sometimes resulting in the breaking of the thread. To overcome these objections, I so wind the thread upon the cylinder or tube that each portion of thread extending between the two ends of the cop shall have substantially the same number of coils or turns in each layer of the winding—that is, if the thread laid directly upon the surface of the cylinder or tube is coiled round the latter twice or makes two turns in extending from one end of the cop to the other, every portion of thread extending from end to end in every layer of the cop will also make two two turns, or substantially two turns—exactitude in this respect being desirable, although a difference of a fraction of a turn (more or less) may be permitted.

As illustrating the manner in which the thread is laid upon the tube or cylinder and thereafter in each layer of the cop, I refer to the diagrams Figs. 2, 3, and 4, Fig. 2 showing two turns of the thread within the limits of the length of the cop. 82 represents the first coil of the thread x, the end of which is secured in any suitable manner, which coil winds or turns twice in traversing the length of the cop toward one end and then twice in returning to the first end, and 84, 86, and 88 represent the succeeding coils. Assuming that the cylinder is turning in the direction of the arrow, the thread x, in laying the coils 86 and 88 before it reaches the bend or turn y^2 where the coil 82 reverses its direction, will be laid upon the inside of the thread of the coil 82 and then upon reaching the bend y^2 will be carried over and across the coil 84 at a point beyond the bend y^2 in the periphery of the cop and will then be bent back, forming a bend or turn, and upon the further revolution of the tube the thread will be laid on the outside of the thread of the coil 84 and will follow said thread throughout its convolutions to the opposite end of the cop and then back and will be finally laid on the right-hand side of the thread of the coil 86 at the

left hand of the cop, as indicated by the dotted line w, and beyond the bend y^2 will cross the threads of the coils 86 and 88 and then be bent back, forming a bend y^3, and will be laid against the outside of the preceding coil 88 and follow the convolutions of the latter back to the opposite end. This is the course of each coil of thread in each layer of the cop, so that each coil in each layer lies parallel throughout its length to the thread of a previous coil, and at each end of the cop the thread of each coil crosses over the extreme thread of a previous coil at that end and is then bent to change its course, the bend of the thread of each coil being a short distance in the periphery of the cop beyond the bend of the coil previously laid, as shown in Fig. 3. The cop thus formed with two coils in each length of thread between the ends of the cop is illustrated in Fig. 5 and in arrangement of threads at the surface is illustrated in Fig. 4.

While it is not absolutely necessary, it is in many cases preferable that the thread of each coil shall be in actual contact with, as well as parallel to, the threads of the preceding coil, so as to bring the windings into close proximity and secure a cop of minimum size and maximum density. In some instances where it is desired to secure absolute uniformity in the dimensions of successively-wound cops the same may be wound with the succeeding coils parallel, but not absolutely in contact, and the cops may then be subjected to end pressure between dies g g', Fig. 6, whereby the separated threads of the succeeding coils are brought together to the desired extent. By using dies of the proper form the ends of the cop may be made slightly convex or conical, if desired. It will be evident that as the threads of the loosely-wound cop were uniformly and regularly laid the pressure upon the ends moves the parallel coils closer together and thereby compacts the cop by this means, and not as when an irregularly-wound cop is compressed by forcing one thread into another and compressing and condensing the threads themselves, which results in crushing and breaking the fibers.

It will be seen that in order to properly dispose the thread in the cop, as above described, it is necessary after the thread of each coil is brought to one end of the cop to delay the action in returning the thread toward the opposite end, or else to continue the revolution of the cop until the thread that is being laid is carried over and across the previously-laid thread, so that in the actual operation of winding the cylinder not only completes the revolution or revolutions necessary to wind each coil of thread the proper number of times between the ends, but also must have an additional movement (or what is the equivalent, a delay in its movement) of an extent equal to the distance necessary to carry the thread, being laid to the outside of the thread previously laid, so that the successive bends of the successively-laid coils are not one above the other, but are one beyond the other in the periphery of the cop, as shown at y y' y^2 y^3, Figs. 2 and 3.

While it would be practicable to direct the thread by hand to build up the cop, I prefer to employ mechanisms, one form of which (shown in Figs. 7 to 10,) I will now describe. The frame A of the machine is suitably constructed to support the operating parts, hereinafter described, among which are a tube or cylinder holder B, and a thread-guide 3, and means for rotating said cylinder-holder and imparting a reciprocating motion to the guide in a line parallel to the axis of the cylinder-holder. These parts are so constructed that a cylinder or tube 4 may be applied to and supported by the holder B, and rotated therewith, and that the thread x is supported and carried to the eye of the guide 3, and means are employed whereby the holder is rotated, so that as the thread is brought to either end of the cop the rotation will continue at an increased speed, or such an increased or decreased movement is otherwise imparted to the holder as will insure that the coil last laid shall be completed with the bend y at a point beyond that of the previous coil, or that, if the rotation of the holder is uniform, the change of direction of the coil of thread being laid shall be delayed by delaying the reversing movement of the guide until said thread being laid has crossed the thread of the preceding coil. Different means may be employed for causing such a relative variation of movement as will affect the above-described result. Thus in the construction shown in Figs. 7 to 10, the holder B consists of two disks 5 5 capable of being separated to receive between them the tube 4, into the open ends of which enter hubs 6 upon the disks, each of which turns loosely upon the end of a short shaft 7, Figs. 7, 8, and 9, which is driven at a uniform speed by means of a pinion 8 and gear-wheel 9, driven through the medium of gears 10 and 11 from the driving-shaft 12, on which are grooved pulleys s. To the shaft 7 is secured fixedly near each disk, a cross-arm 13, carrying a lever 14, to the outer end of which is pivoted a spring-pawl 15, that engages teeth upon the periphery of the adjacent disk 5, so that as the shaft 7 revolves in the direction of its arrow c, Fig. 8, the disk will be carried by and with said shaft. At the opposite end of the arm 13 is a rock-shaft 16^a, carrying arms 16 and 18, the arm 16 being connected by a rod 17 with the lever 14, and the arm 18 extending over a cam 19 upon a sleeve 20, turning upon the shaft 7, and driven from the shaft 12, through the medium of the gears 11, 10, 21, and 22. The shaft 7 and the sleeves 20 turn in the same direction, but the revolution of one—for instance, the sleeve 20—is retarded so that periodically the end of the arm 18, which is pressed down by a spring 23, will escape from the projecting portion v of the cam 19, thereby rocking the shaft 16^a and throwing the arm

16, lever 14, and pawl 15 in the direction of their arrows, Fig. 8, so that as the revolution of the shaft 7 and cross-bar 13 is continued the arm 18 will ride up, the cam gradually drawing back the arm 16 and lever 14 and carrying the pawl 15 in the direction of the arrow *a*, Fig. 10, until the end of the arm 18 again escapes from the projection *c*, when the parts swing back, carrying the pawl in the direction of the arrow *b*. The pawl therefore derives its motion from two sources—first, from the rotation of the shaft and the cross-arm carried by the shaft, which would give to the pawl and to the disk the same rate of rotation as the shaft; second, from the cam, which imparts to the pawl a forward traveling movement in excess of that derived from the shaft, so that at the completion of each revolution of the shaft the pawl and the disk will have traveled not only the extent of a complete revolution, but to an additional extent corresponding to the movement imparted to the pawl by the cam. As a result of this combination and operation, while the guide is brought to one end or the the other of the holder B at the completion of each revolution of the holder (when there are two turns or more to a length of the cop at the completion of each definite number of revolutions) the holder itself is moved to a slight extent beyond a complete revolution before the guide begins its return movement, so that the thread held by the guide is not started on its return winding until it has been laid over onto the outer side of the thread of the previous coil.

While it will be seen that the action of the cam is gradual and moves the disks constantly during the entire revolution at a speed slightly in excess of that derived from the shaft 7, this action might be instantaneous, if desired.

It will be evident that the movement imparted to the periphery of the cop by the reciprocation of the pawl, as above described, will be less when the cop is an inch in diameter than when the cop is four inches in diameter, and as a result the movement when the cop is small in diameter is only sufficient to carry the thread across that of the previous coil, and the movement when the cop is four inches in diameter would, if all the conditions were the same, be excessive. It is a fact, however, that when the cop is small in diameter the threads are laid upon the same at a more acute angle to the axis than the angle upon which they are laid upon the larger surface of the cop as it increases, and consequently a greater length of thread is required to cross the thread previously laid at the periphery of the full-sized cop than is required to cross the threads laid upon the layers nearer the center of the cop. I have found in practice that this change in the angles of the threads laid upon the successive layers in forming the cop is such as will coincide with the increased throw or movement of the surface of the cop as the latter increases in diameter, so that practically it is not necessary to make use of any appliances for compensating for this difference in action, but that, on the contrary, said difference avoids the necessity of making special provision for a greater travel in consequence of the greater distance across the threads, as their angle to the axis increases with the increased diameter of the cop.

As the cop is clamped between the two disks, the above-described movements might be imparted to one of them only; but in order to secure certainty of operation I prefer to drive each of the disks through the medium of the appliances described.

To hold the thread in position upon the cop after it is laid thereon, I make use of a presser-roller *e*, carried by a frame F, consisting of a yoke-piece 25 and two parallel bars 26 26, sliding in a yoke 27, extending from and constituting part of the main frame A, the frame F, with its roller, being carried inward by means of a spring 29, connected with a lever 30 and holding the latter against a pin 31, extending from one of the bars 26. As the cop increases in diameter the roller and the frame are forced outward. The said spring presser-roller, however, may be supported with a yielding pressure against the cop in any other suitable manner.

The guide 3 is supported and reciprocated and maintained in its relation to the periphery of the cop as the latter increases by means of any suitable appliances. As shown, the said guide is supported by a carrier G, a cross-bar 31 of which slides in bearings upon the opposite side frame, while a projection at the forward end of the carrier slides in a transverse slot in a cross-bar 32. The carrier is provided with bearings for two slide-rods 33 33, upon which is a cross-piece 34, supporting the guide, and a hook 35 at the back of the cross-piece 34 extends back of a cross-bar 36 upon the frame F, so that as the frame F is pushed back by the increasing diameter of the cop the guide is carried outward to the same extent without interfering with the free travel of the guide back and forth across the face of the cop as the reciprocating motion is imparted to the carrier.

One means of imparting the reciprocating movement to the carrier is a cylinder-cam 2, secured to a shaft 1, and having a cam-slot 38, receiving a stud 39, projecting from the carrier.

In order to permit the tubes 4 to be inserted between the disks 5 5 and the cop to be withdrawn, I so mount the shafts 7 that they can slide longitudinally in their bearings, the gear-wheels being of sufficient width to permit this movement without disengagement, and I provide means whereby said shafts may be separated to receive the tube or allow the cop to be withdrawn and brought together to clasp the tube. Different means may be employed for sliding each of said shafts. As shown, a bell-crank lever 40, pivoted to the frame of the machine, has at

one end a stud 41, extending into a groove 42 in the hub of one of the wheels upon the shaft at one side of the machine, while a similar bell-crank lever is similarly arranged on the other side of the machine, and the horizontal arms of both levers extend into slots in a push-bar 43, sliding in a cross-piece of the frame and bearing upon a spring 44, which tends to lift the push-bar and throw in the shafts and bring the disks to bear upon the tube. By pushing down the bar the spring is compressed and both shafts are thrown outward. If desired, however, one of the shafts can revolve in its bearings without sliding, the movement of the other in many cases being sufficient to permit the tube to be inserted and the cop withdrawn. The thread is conducted to the guide through a suitable tension device H and round a guide-pulley 50.

As before set forth, the action is the same, whether the rotating cop gains sufficient at each revolution to carry the thread being laid across that previously laid at the end of the cop, or the cop rotates uniformly without gain, and the guide as it reaches each end of the cop is held for a longer time than is necessary for the cop to complete its rotation.

I do not here claim the mechanism or product herein shown and described, as the same constitute subjects of separate applications for Letters Patent, Serial Nos. 416,230 and 416,229.

Without limiting myself to the use of any special mechanism, I claim—

1. The within-described mode of winding cops, consisting in winding the thread spirally upon a tube or cylinder in successive coils with substantially the same number of coils in each layer, and in carrying the thread of each coil at each end of the cop across the thread of a previous coil, and bending the last laid portion with an abrupt bend at a point beyond that where the previously-laid portion is bent to form a cop with a substantially flat end, substantially as described.

2. The improvement in the art of winding cops, consisting in winding the thread in successive coils, laying each thread at the end of the coil across and over that previously laid and there bending the thread back at a point adjacent to the previous bend, and winding it in a course parallel with that of a previously-laid coil to form a cop with a substantially flat end, substantially as described.

3. The process of manufacturing cops, which consists in winding the thread in successive coils, each coil parallel to but not in contact with the thread of a preceding coil, and then subjecting the cop to end pressure to bring the thread of the adjacent coils together, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

SIMON W. WARDWELL, JR.

Witnesses:
CHARLES E. FOSTER,
MYER COHEN.