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S. W. WARDWELL, Jr.

APPARATUS FOR WINDING COPS OR BALLS.

No. 480,157. Patented Aug. 2, 1892.

Fig. 1.

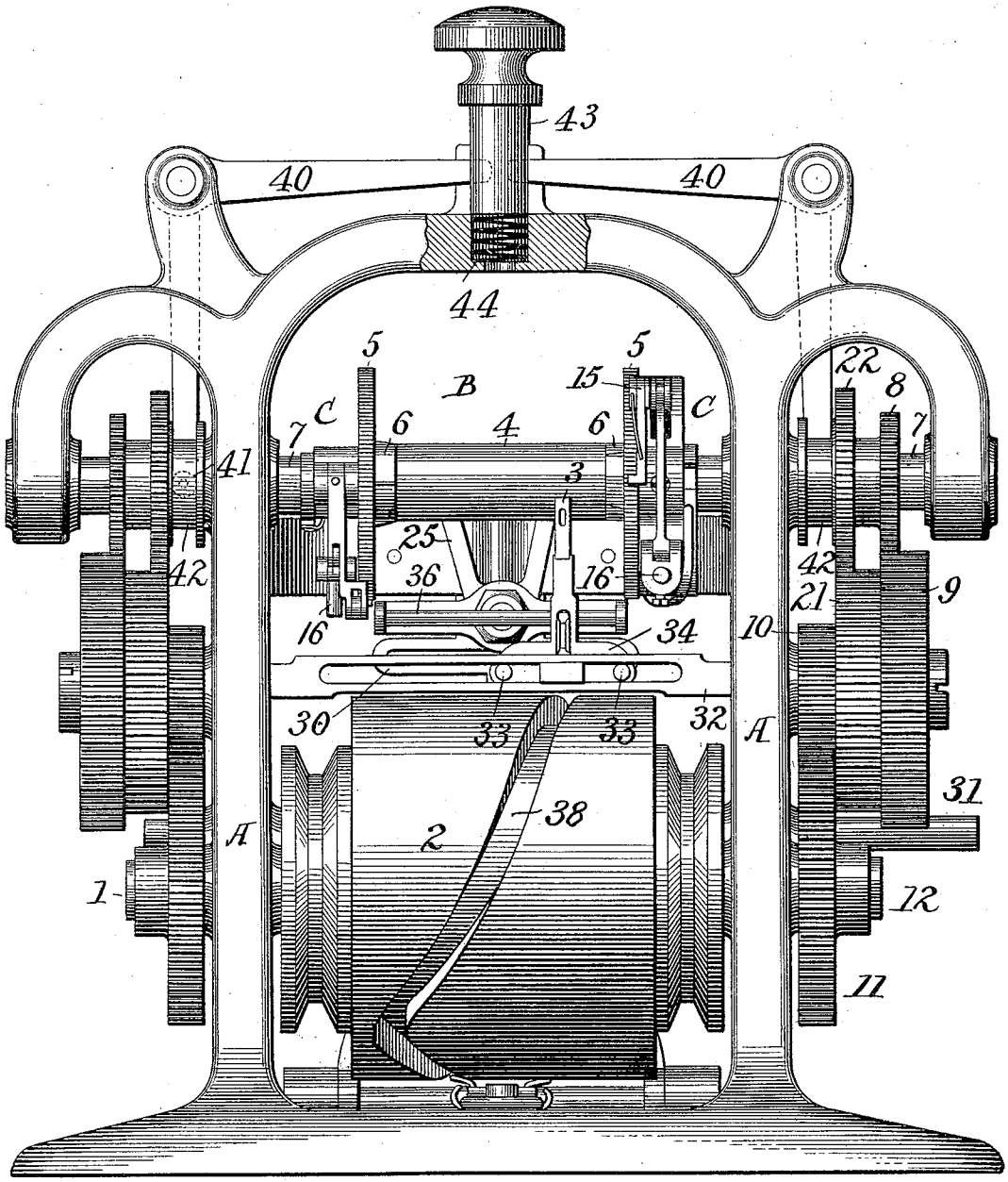

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Fig. 2.

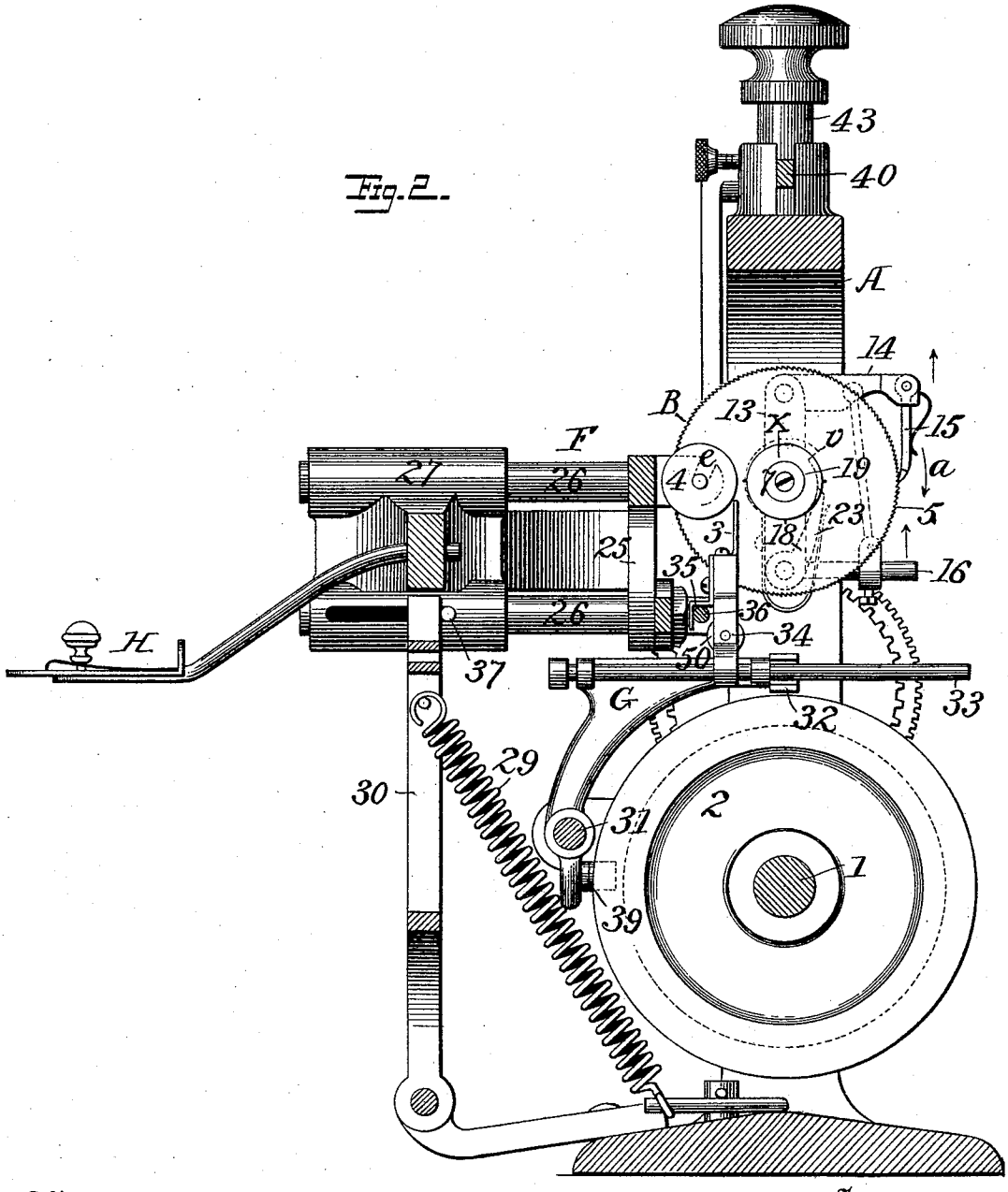

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Fig. 3.

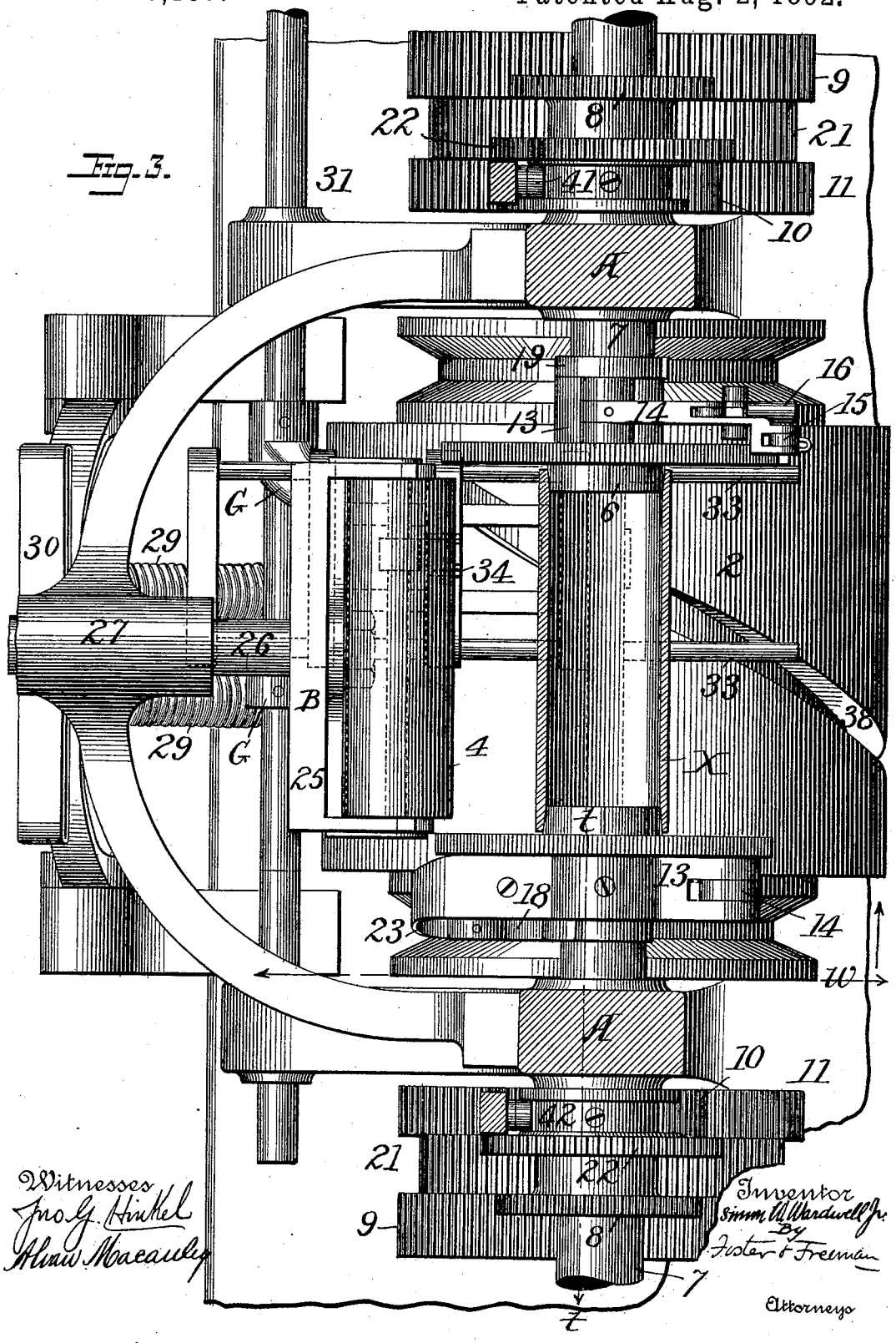

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Fig. 4.

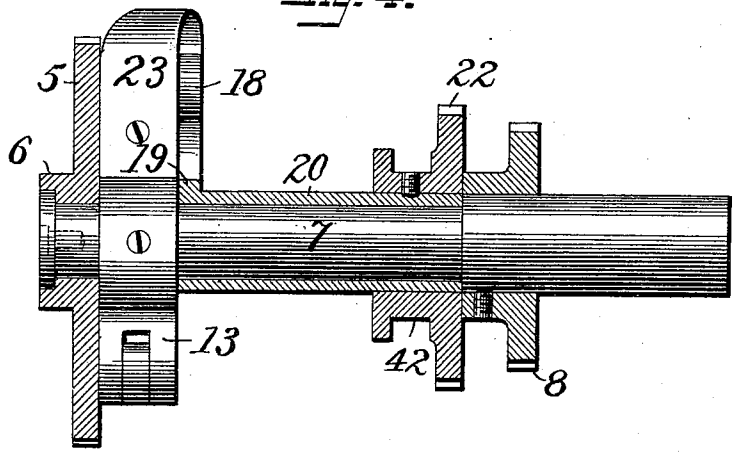


Fig. 8.

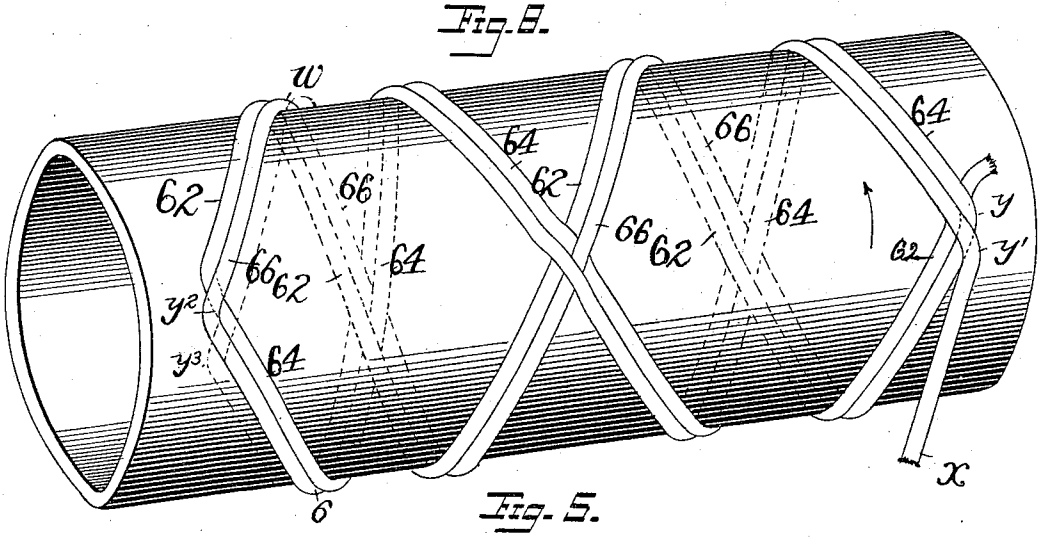
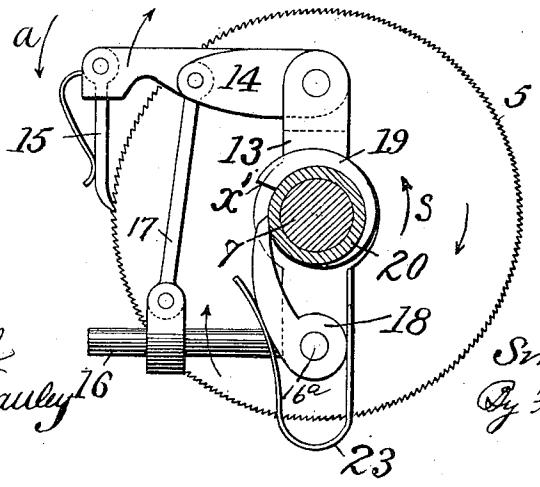


Fig. 5.



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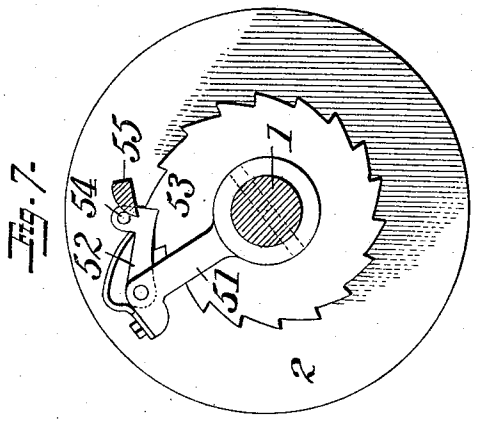

Fig. 7.

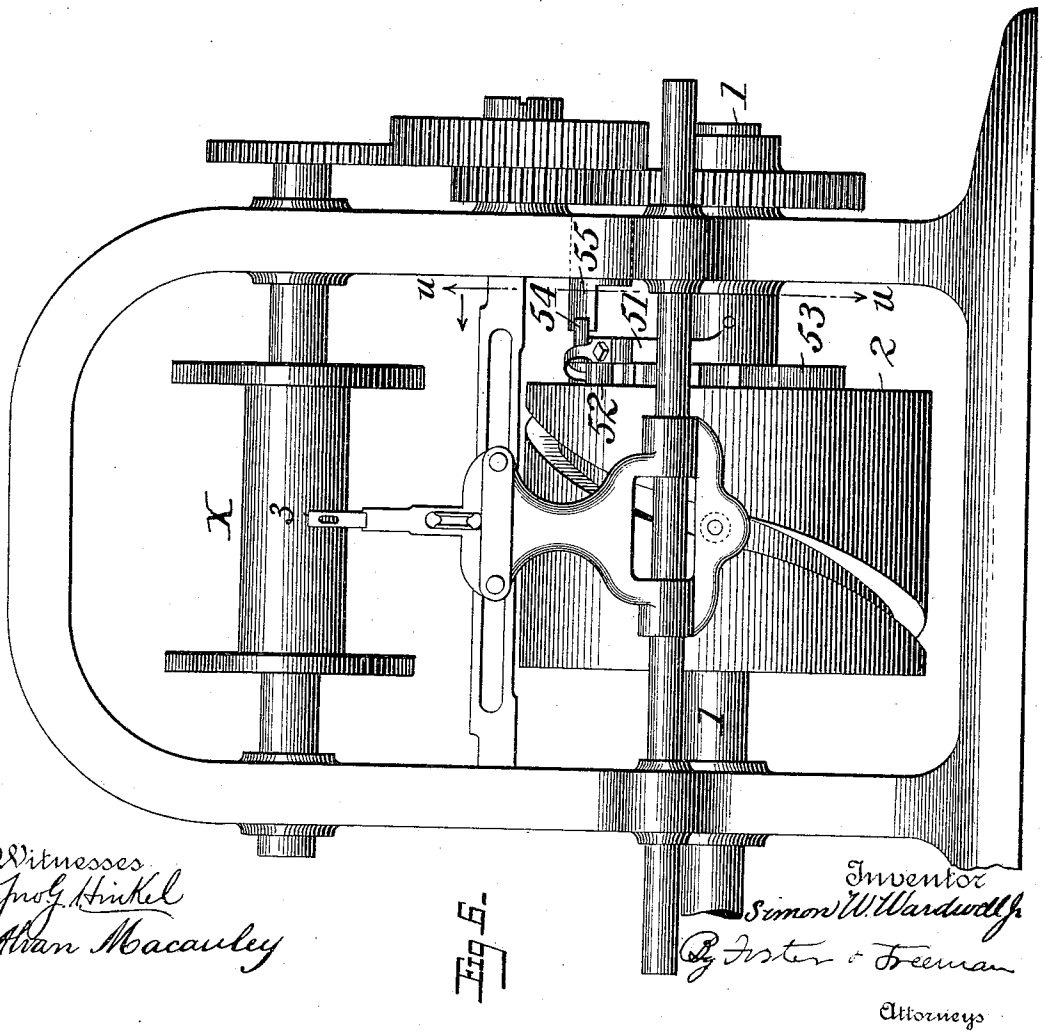

Fig. 5.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR WINDING COPS OR BALLS.

SPECIFICATION forming part of Letters Patent No. 480,157, dated August 2, 1892.

Application filed December 26, 1891. Serial No. 416,230. (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 Apparatus for Winding Cops or Balls, of which the following is a specification.

My invention relates to machines for winding cops and balls of thread, yarn, &c.; and it consists of certain mechanism fully set forth hereinafter, and illustrated in the accompanying drawings, in which—

Figure 1 is an elevation in part section of a machine embodying my improvement. Fig. 2 is a transverse sectional elevation. Fig. 3 is a sectional plan on an enlarged scale. Fig. 4 is a section on the line *t t*, Fig. 3. Fig. 5 is a section on the line *w*, Fig. 3, looking in the direction of the arrow. Fig. 6 is an elevation illustrating a modification. Fig. 7 is a section on the line *u*, Fig. 6, looking in the direction of the arrow. Fig. 8 is a perspective view illustrating the manner in which the thread is laid upon the tube in forming the cop.

In the method heretofore used 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 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 external layer, 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 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 in starting and thereafter in each layer of the cop, I refer to the diagram Fig. 8, showing two turns of the thread within the limits of the length of the cop 62, representing 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 64 and 66 represent succeeding coils. Assuming that the cylinder is turning in the direction of the arrow, the thread *x*, before it reaches the bend or turn *y*, where the coil 62 reversed its direction, will be laid upon the inside of the coil 64, and then upon reaching the bend *y* will be carried over and across the coil 64 at a point beyond the bend *y* in the periphery of the cop and will then be bent back, forming a bend or turn *y'*, and upon the further revolution of the tube the thread will be laid on the outside of the thread of the coil 66 and will follow said thread throughout its convolutions to the opposite end of the cop and will be finally laid on the right-hand side of the thread of the coil 66 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 64 and 66 and then be bent back, forming a bend y^3, and will be laid against the outside of the preceding coil 6 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 from the bend of the coil previously laid. 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 thread of the preceding coil, so as to bring the windings into close proximity and secure a cop of medium size and maximum density.

It will seen that in order to properly dispose the thread in the cop, as above described, it is necessary to support the thread close to the periphery of the cop and after the thread of each coil is brought to one end of the cop employing feed devices of a character to delay the action in returning the thread-guide toward the opposite end, or else to continue the revolution of the cop-holder 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 or progressive 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 $y\ y'\ y^2\ y^3$, Fig. 8.

To mechanically build up the cop, I prefer to employ mechanism which 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 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 and for carrying back the guide as the size of the cop increases. These parts are so constructed that a cylinder or tube X may be applied to and supported by the holder B and rotated therewith and that the yarn x is supported and carried to the eye of the guide 3, arranged to deliver the thread at a point close to the periphery of the cop, 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 the delaying of 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 effect the above-described result. Thus in the construction shown in Figs. 1 to 5 the holder B consists of two disks 5 5, capable of being separated to receive between them the tube X, into the open ends of which enter conical hubs 6 upon the disks, each of which turns loosely upon the end of a short shaft 7, Figs. 1 and 4, 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. To the shaft 7 is secured fixedly 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 arrows, Fig. 5, 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, connected by a rod 17 with the lever 14 and the arm 18, extends 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 sleeve 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 x' 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. 5, so that as the further 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. 5, until the end of the arm 18 again escapes from the projection x'. 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 progressive or forward traveling movement in excess of that derived from the shaft, so that at the completion of each revolution of the shaft or upon each successive reversal of the movement of the guide the pawl and the disk will have traveled not only the extent of a complete revolution, (or a complete fraction or multiplication of a revolution), but will also have moved an additional extent corresponding to the movement imparted to the pawl by the cam. As a result of this operation, the reversal of the movement of the guide takes place not upon the completion of a rotation (or fraction or multiple of a rotation) of the holder, but after and only after the holder has reached a point in its revolution beyond that necessary to complete such movement and beyond that point which it occupied at the time the guide was reversed upon its preceding re-

versal of 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 previous coil. While it will be seen that the action of the cam is gradual and moves the disk constantly during the entire revolution at a speed slightly in excess of that derived from the shaft 7, this action might be momentary by substituting a radial pin for the cam, which pin would lift and drop the arm 18 in a fraction of a revolution.

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 if the movement when the cop is small in diameter is only sufficient to carry the thread across that of the previous coil 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 at 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 thread 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 pratically 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, and also to so set the parts that both shall not change their movements at the same instant.

To hold thread in position upon the cop after it is laid thereon, I make use of a presser-roller 4, 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 37, extending from one of the bars 26. The guide 3 bears on the periphery of the cop, and 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 frames, 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 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 X to be inserted between the disks 5 5 and the cops 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 springs are 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. A means of so operating the guide is fully illustrated in Figs. 6 and 7, in which the cam 2 is mounted loosely on the shaft 1, which is provided with an arm 51, carrying a spring-pawl 52, that engages a ratchet-wheel 53, secured to the cam 2, and a pin 54, projecting from the pawl, engages with a stationary cam 55 at one point in the revolution of the shaft 1 for a sufficient time for the said pawl to be lifted and then drop and engage the succeeding tooth of the ratchet 53. The cam 55 is so arranged that this lifting occurs at the time when under the action of the cam the guide is at the limit of its motion in either direction, so that the said cam is momentarily held stationary until the cop, rotating uniformly, has been carried sufficiently beyond its complete revolution to cause the thread being laid to be carried across that previously laid, as desired.

While I have referred to the movement of the holder and guide as one in which the holder in effect advances beyond a point it would reach upon each completed movement if there were no such progressive movement, substantially the like result would be obtained if the progression was backward.

I do not here claim the method described of laying the thread to build up a cop with a flat end, as the same constitutes the subject of application, Serial No. 415,648, filed December 19, 1891.

Without limiting myself to the precise construction and arrangement of parts herein set forth, I claim as my invention—

1. In a cop-winding machine, the combination, with a revolving holder for suporting the cop and with a reciprocating thread-guide supported to move in a course parallel to the axis of the cop, of mechanism adapted to give the holder an increment of movement at each rotation, for the purpose set forth.

2. A machine for winding cops, provided with a holder for the cop, and a reciprocating guide for the thread supported to move parallel to the axis of the cop and outward as the cop increases in diameter, and means for turning the holder and for reciprocating the guide, and mechanism for varying the relative movements of the holder and guide to insure an increment of movement to the holder at each rotation, whereby each reversal of the movement of the guide takes place after the holder has turned beyond the point of its revolution occupied at the moment of the preceding reversal of the movement of the guide, substantially as set forth.

3. A machine for winding cops, provided with a revolving holder for supporting the cops and with a reciprocating thread-guide and means for varying the relative movements of the thread-holder and guide, constructed substantially as described, to secure each successive reversal of the movement of the guide at the outer end of the holder after and only after the holder in its rotation has reached a point beyond the point reached at the moment of the preceding reversal of the movement of the guide at such end, substantially as set forth.

4. In a cop-winding machine, the combination of a guide and means for imparting to the same a regular reciprocating movement parallel to the cop, and a holder for supporting the cop, and means for imparting to the same a progressive rotary movement at each rotation, substantially as set forth.

5. The combination, in a cop-winding machine, of a reciprocating thread-guide for guiding the thread parallel to the holder, a cop-holder, a shaft for imparting motion to said holder, and means for imparting an increment of movement to the holder at each rotation of said shaft, substantially as set forth.

6. The combination of the cop-holder, rotating shaft for driving the holder, a cam operating independently of said shaft, and devices between the cam and the holder to rotate the latter independently of the shaft, substantially as set forth.

7. The combination of the holder consisting of disks carried by rotating shafts, pawls for engaging teeth upon said disks, cams, and means for moving the same independently of the disks, and devices between each cam and each pawl, whereby the latter is moved by the cam to impart additional movement to the adjoining disk independently of the movement of the shaft, 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:

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MYER COHEN.