No. 881,211. PATENTED MAR. 10, 1908.

S. W. WARDWELL.

WINDING MACHINE.

APPLICATION FILED JULY 19, 1906.

3 SHEETS—SHEET 1.

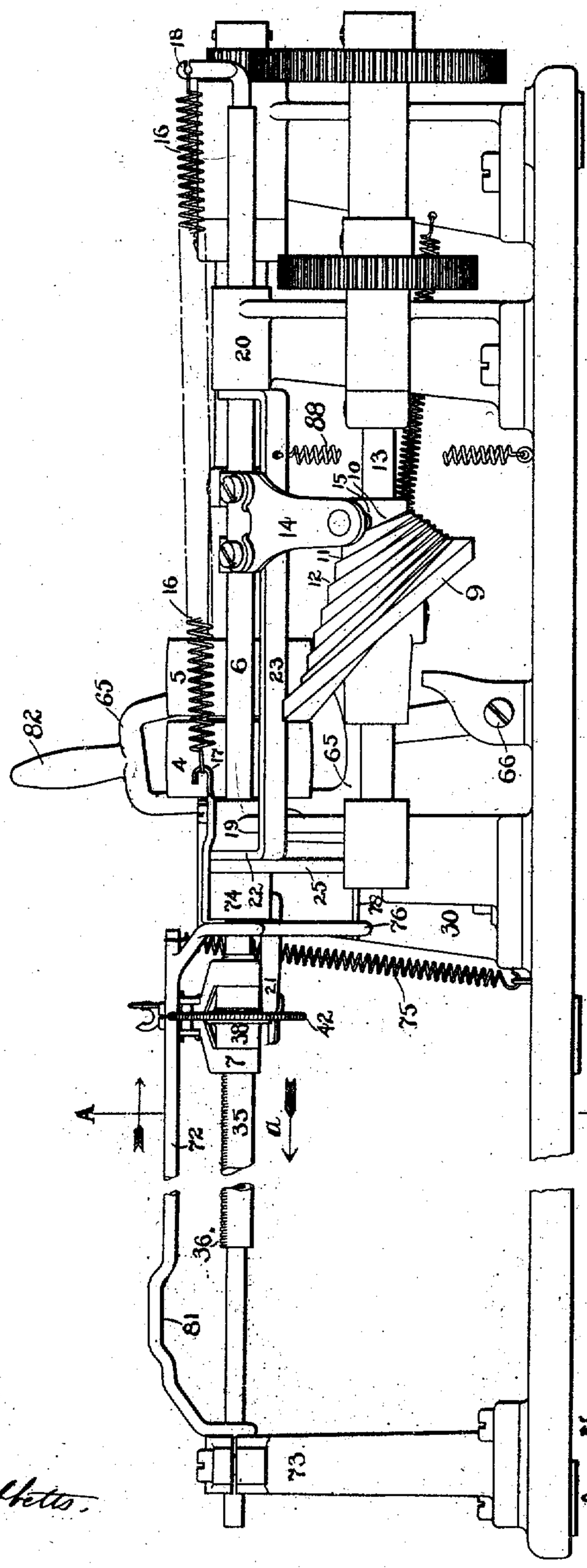

Fig. 1.

WITNESSES.
J. J. McCarthy
Milton Tibbetts.

INVENTOR
S. W. Wardwell
BY
Foster Freeman Watson
ATTORNEYS.

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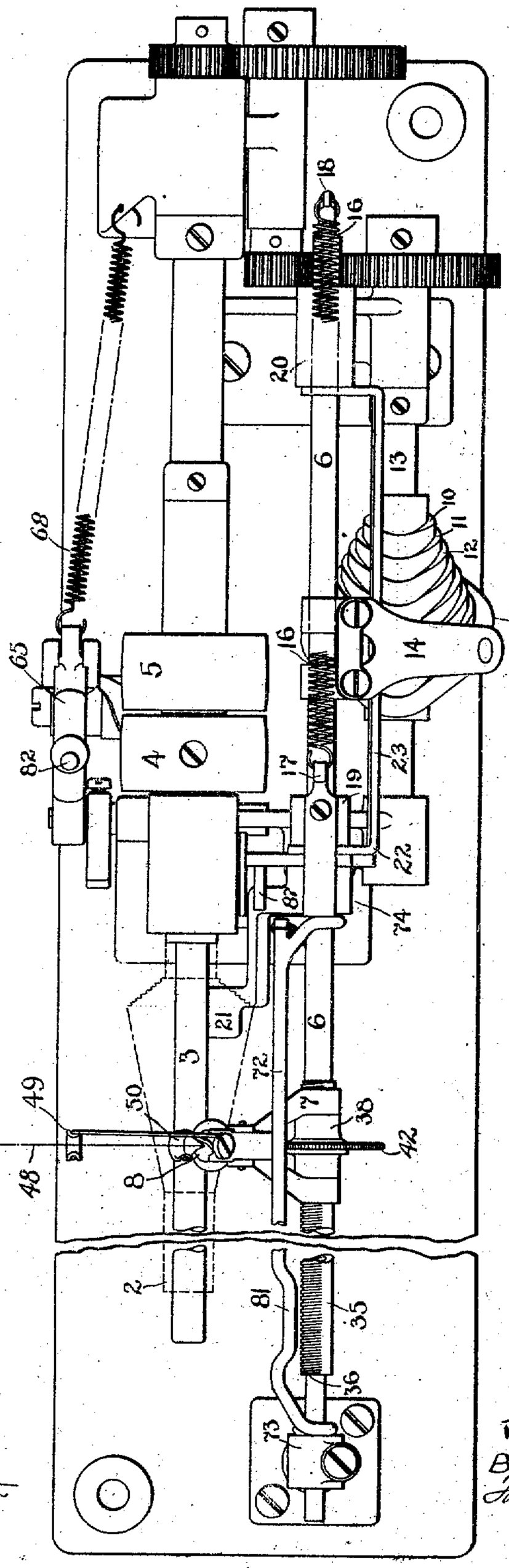

Fig. 2.

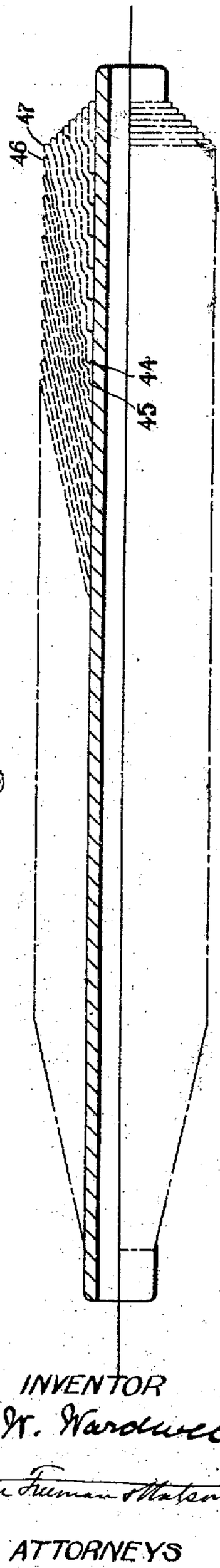

Fig. 3.

WITNESSES

J. J. McCarthy

Milton Tibbetts.

INVENTOR

S. W. Wardwell

BY

Foster Freeman & Watson

ATTORNEYS

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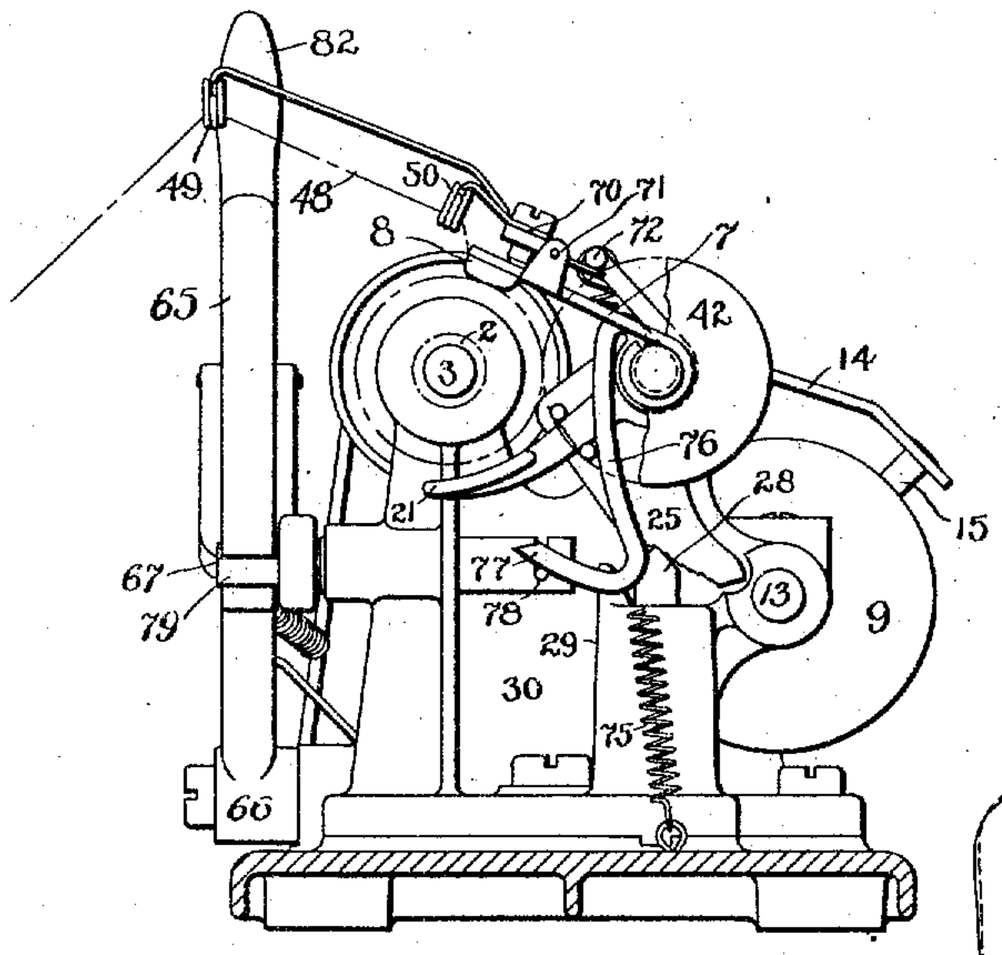

Fig. 4.

Fig. 5.

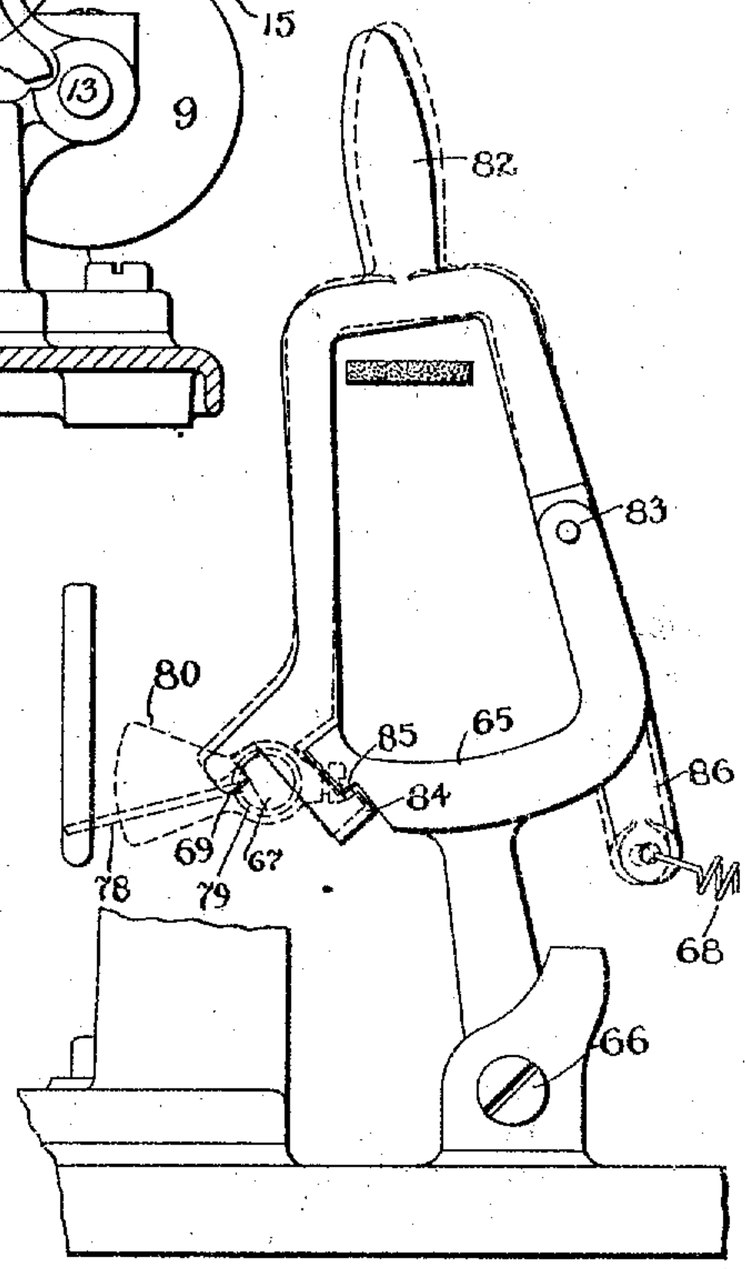

Fig. 6.

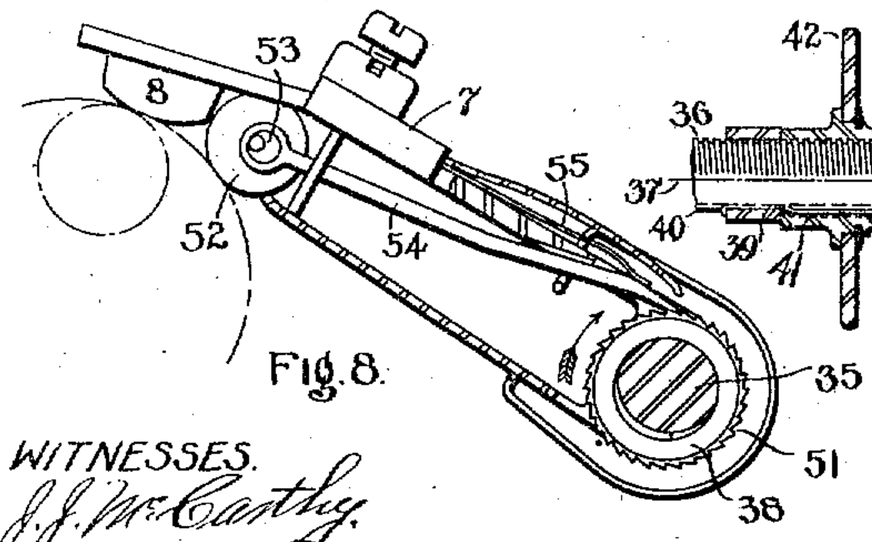

Fig. 8.

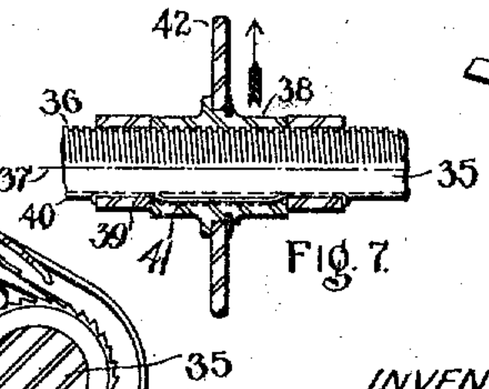

Fig. 7.

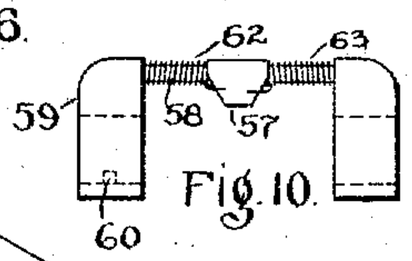

Fig. 10.

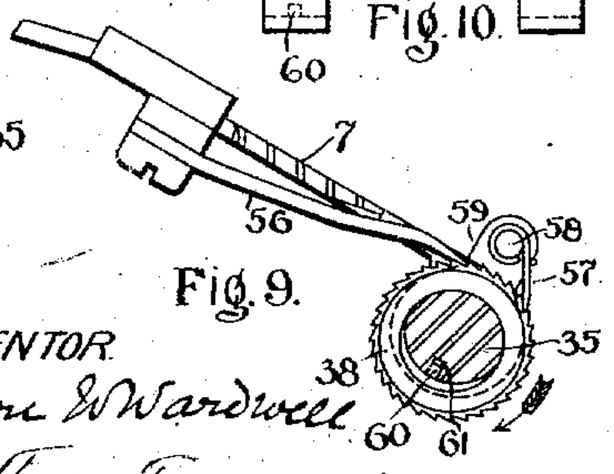

Fig. 9.

WITNESSES.

J. J. McCarthy.

Willis Dibbets.

INVENTOR.

Lemuel W. Wardwell

BY Foster Freeman & Watson

ATTORNEYS.

UNITED STATES PATENT OFFICE.

SIMON W. WARDWELL, OF PROVIDENCE, RHODE ISLAND.

WINDING-MACHINE.

No. 881,211. Specification of Letters Patent. Patented March 10, 1908.

Application filed July 19, 1906. Serial No. 326,889.

To all whom it may concern:

Be it known that I, SIMON W. WARDWELL, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Winding-Machines, of which the following is a specification.

My invention is a winding machine for producing cops or yarn packages of cylindrical form, with taper ends, the winding being done in advancing layers of regularly disposed coils, the growth of the package being by longitudinal extension instead of diametrically. These cops are employed as "filling" or "weft" in weaving cloth, their particular form being disclosed in my pending application, Serial No. 323137 filed June 23, 1906.

The following specification is a complete description of the invention, illustrated by the accompanying drawings, representing, respectively:

Figure 1, a front elevation of the machine; Fig. 2, a plan view; Fig. 3, an enlarged diagrammatic sectional view of the cop, showing the diposition of the layers; Fig. 4, a part sectional view on the line A—A, Fig. 1, looking in the direction indicated by the arrow; Fig. 5, a detail view of the automatic traverse shifting mechanism; Fig. 6, a detail view of the belt shifting arrangement; Figs. 7, 8, 9 and 10, views showing modifications of the guide advancing mechanism.

The machine herein described is designed to produce a cop having a cylindrical body, a substantially flat or slightly tapered base and a comparatively long tapered nose or delivery end.

Referring to Figs. 1 and 2, the tube or bobbin 2 is carried on a winding spindle or cop-holder 3, which is adapted to be rotatably controlled by a suitable agency, as the tight and loose pulleys 4 and 5. Adjacent and parallel to the winding spindle 3 is a reciprocating rod or bar 6 on which is mounted the guide holder 7, carrying the yarn depositing guide 8, and adapted to advance along the member 6 during the winding, as afterward described.

To produce a substantially flat-based cop of the character described, it is necessary to deposit the yarn in superimposed layers of different lengths resulting from corresponding variations of traverse of the guide, as indicated in Fig. 3, until a base or core composed of yarn and having the requisite form is secured. Then the winding continues with a uniform but shifting traverse of the guide until the desired length of cop has been secured.

In my application, Serial No. 325676 filed July 11th, 1906, is shown and described a machine for performing the same operations as the one herein disclosed. In the former machine the reciprocation of the guide is accomplished by two oppositely rotating screws engaging alternately a threaded member connected with the guide, the length of traverse of the guide being varied by changing the point of shifting the member from one screw to the other.

In the invention of the present application I prefer to effect the traverse of the guide through a stepped cam 9 having concentric faces 10, 11, 12, etc., formed with different lengths of throw, as shown in Figs. 1 and 2.

Any suitable number of cam faces might be provided, but I prefer to show eight which provide for eight different lengths of layers of yarn in the core of the cop. It will be understood from the drawings that the step of least diameter has the cam face of shortest throw, and in each succeeding step the throw is increased uniformly until the maximum throw of the cam is reached, the latter determining the length of traverse of the guide for building the main body of the cop after the core is formed. It is pointed out that each cam face starts at a point not in line with the starting point of the face beneath, but slightly offset therefrom for the purpose hereinafter described. The cam 9 is mounted on a shaft 13 driven from the spindle 3 through a suitable train of gearing shown in Figs. 1 and 2.

On the rod 6 is fastened an arm 14 having a roll or stud 15 extending toward the center of the cam 9 and adapted to bear on the faces 10, 11, 12, etc. The spring 16, fastened at 17 on the frame of the machine and to the end 18 of the rod 6, maintains the stud 15 in contact with the cam faces. The rod 6 slides in bearings 19 and 20, being capable of rotation to rock the arm 14 and shift the stud 15 from one step to another on the cam.

The shifting of the arm 14 is controlled through an arm 21 pivoted on the rod 6, with its outer end adapted to bear on the base of the cop as the latter is built up on the spindle 3. Connected to the arm 21 is a frame 22, mounted on the rod 6 adjacent the bearings 19 and 20, and having a rail or track portion 23. The arm 14 is formed with, or has at-

tached to it, a lip portion 24, see Fig. 5, reaching down and bearing on the under side of the track 23 so that the arm 14, while slidable on the track, is also adapted to be rocked by the rocking of the frame 22. A spring 88 fastened to the frame and to the base of the machine tends to resist the upward movement of the frame.

To the frame 22 is fastened a member 25 which connects said frame with the arm 21 through two pins 87, 87, engaging either side of the arm, as shown in Figs. 2 and 5. The member 25 is formed at the bottom with a quadrant section having ratchet teeth 26, 27, etc., adapted to be engaged by a spring pressed plunger 28. The plunger 28 is beveled at the top to provide a sharp edge for engaging the teeth of the ratchet and is mounted in the bore of a barrel 29 formed on the bracket 30 of the machine frame. Midway of the plunger is a ring or flange 31 against which the coiled spring 32 bears, tending to force the plunger upward against the memer 25, and a pin 33 extending into a groove or slot 34 in the barrel 29 prevents the plunger from turning.

The teeth of the ratchet member 25 correspond in number with the steps on the cam 9, and are so formed that when the ratchet member 25 is moved sufficiently to release one tooth from the plunger 28, the latter then bears on the long face of the tooth, and, acting as a wedge, forces the member 25 away to shift the stud 15 from one step to another on the cam 9. This movement also removes the arm 21 from the yarn surface, and the frame 22 is locked in position until the yarn is built up on the spindle sufficiently to engage the arm 21 again.

The operation described in full is as follows: The winding is started with the stud 15 bearing on the face 10 of the cam 9 and the guide 8 in the position indicated by full lines in Fig. 1 and the arm 14 by dotted lines in Fig. 5. The arm 21 is then in the position indicated by dotted lines, Fig. 5, with the plunger 28 forced down in its bore and bearing on the tooth 26. The yarn is wound on the tube 2 in the initial layer with a comparatively short traverse of the guide as shown in Fig. 3, and when built up to its predetermined diameter the surface contacts with the arm 21, rocking the latter in the direction indicated by the arrow, Fig. 5. The movement of the arm 21 rocks the member 25, releasing the tooth 26 from the plunger 28, and the latter then acts on the member 25 to continue its movement sufficiently to shift the stud 15 clear of the step 10 on the cam 9. The spring 16 now shifts the rod 6 to carry the stud 15 into engagement with the cam face 11, and the yarn guide is thereby given an increased length of traverse, starting at a position slightly in advance of the start of the first layer. The plunger 28 is now engaged with the tooth 27 of the ratchet member 25 and retains the latter in proper position for the stud 15, guided by the track 22, to remain in engagement with the cam face 11. The arm 21 is now clear of the yarn surface until the second layer of winding is completed, when it is again engaged and shifted, and the plunger 28, acting as before, shifts the stud 15 to the next cam face 12. The traverse of the yarn guide is again lengthened and advanced slightly, and this action continues until the last tooth of the ratchet 25 comes into engagement with the plunger 28.

It will be seen from Fig. 3 that the effect of increasing the length of traverse of the yarn guide at predetermined points is to deposit the yarn in successive layers and to cause the layers of yarn to overlap each other so that gradually the mass takes a conical form, as shown by dot and dash lines, Fig. 2. It will be understood that this tapered core might be built up with its base perfectly flat, but it has been found preferable to give a slight taper to the base to make it more stable, the outer layers being more firmly supported and less liable to derangement. The taper of the base results from the slight advance of the starting point of each layer of yarn caused by the offset of the different steps on the cam.

The completion of the last layer of yarn on the core, wound with the stud 15 on the last step of the cam 9, brings the cop to the predetermined diameter at its base, and the cop then grows by longitudinal extension instead of by diametrical increase. To effect this, the reciprocating guide feeds gradually along the rod 6, as now explained.

The reciprocating rod 6 is formed with an extension 35 having partial screw threads 36, the axis 37 of which is eccentric to the rod 6, see Fig. 7. The guide holder 7 is mounted on the extension 35 of the rod 6, being forked, with each branch of the fork embracing said rod, and between the branches is a rotatable nut 38 engaging the partial screw threads 36 to feed the guide holder along the rod. The bore of the nut 38 is of sufficient diameter to provide clearance for the threaded portion of the rod 6 when the axes of the nut and rod are in alinement, but the bore is threaded to engage the screw threads when the nut is positioned eccentric to the rod. Means for carrying the nut 38 into engagement with the threads 36 are provided in the spring 39 which extends along the groove 40 in the member 35 under the member 7, being turned up at its ends to retain it in position, as shown in Fig. 7. The central portion of the spring is bowed out at 41 to engage the bore of the nut 38. By pressing the nut 38 in the direction indicated by the arrow, Fig. 7, against the action of the spring 39, the screw threads in the nut are released from

the threads 36, and the guide holder may be slid along the rod 6 to position it properly in relation to the spindle 3 at the beginning of the winding.

The automatic feed of the guide holder along the rod 6 is secured by action of the cop. On the nut 38 is a wheel 42 of such diameter as to be engaged by the surface of the cop at its full diameter, as shown in Fig. 4. Each time that the guide 8 returns from the points 44, 45, etc., on the cop tube, to the points 46, 47, etc. on the portion of the winding of largest diameter, Fig. 3, the wheel 42 is engaged by the cop surface and rotated slightly, causing the guide to advance slowly along the rod 6 in the direction indicated by the arrow *a*, Fig. 1.

It will be understood that the guide is maintained in close contact with the surface of the winding at all times to effect a regular systematic laying of the coils. This is effected by the tension of the thread 48 passing through the guide eyes 49 and 50, see Fig. 4, the guide holder 7 oscillating slightly at each reciprocation to allow the guide to recede from and approach the spindle as it travels up and down the taper.

The feeding of the guide along the rod 6 might be secured by other means as, for instance, those shown in Figs. 8, 9 and 10. In Fig. 8 the nut 38 is formed with a ratchet wheel 51 on its periphery. Pivoted on the guide holder 7 adjacent the guide 8 is a friction wheel or roll 52 adapted to bear on the surface of the cop when the guide reaches the point of largest diameter, but so arranged as to clear the cop while the guide is traversing the tapered portion. The roll 52 is formed with an eccentric hub or bearing 53 on which is mounted the pawl 54 having its opposite end engaging the teeth of the ratchet wheel 51. A suitable spring 55 bears on the end of the pawl to keep it engaged with the ratchet wheel. As the roll 52 comes into engagement with the periphery of the cop at the end of each complete traverse, after the core has been built up, a partial rotation is imparted to the roll, reciprocating the pawl 54 and, through its engagement with the ratchet, rotating the nut 38 slightly so that the latter is fed along the rod 6 in the same manner as previously explained.

Another method of feeding the guide along the rod 6 is shown in Figs. 9 and 10. It has been explained that the traveling of the thread guide up and down the taper of the cop causes a slight oscillation of the guide holder 7 on the rod 6. This movement of the guide holder is caused to rotate the nut 38 through a spring pawl 56 fastened to the holder 7 and engaging the teeth of the ratchet on the nut. Each time the guide moves out from the spindle, the nut is given a part of a rotation in the direction indicated by the arrow, being held from backward movement in the opposite direction by a pawl 57. The pawl 57 is pivoted on a bearing 58 of the frame 59, Fig. 10, the latter being supported on the rod 6, straddling the nut 38, and held from rotation by a pin 60 which fits a suitable spline 61 running the length of the rod 6. Coiled springs 62 and 63 surround the bearing 58 with their ends engaging the pawl 57 to maintain it in engagement with the ratchet.

The operation of the machine as a whole has been described as effected through the tight and loose pulleys 4 and 5. When the belt is on the loose pulley 5, the machine is stopped; when the belt is thrown upon the tight pulley 4, the machine is driven thereby.

The position of the belt is controlled by the belt shifter 65 hinged at 66 and movable manually into engagement with the lock 67 to shift the belt to the tight pulley 4; and when released by said lock, moved automatically by the spring 68 to shift the belt to the loose pulley 5. The lock 67 engages a detent 69 on the belt shifter, and is rotatable to release said detent under action of the stopping mechanism of the machine.

Referring to Figs. 1, 2 and 4, the yarn 48 passes through the guide eyes 49 and 50 before entering the thread guide 8. These guide eyes are mounted on wires fastened to a rocking frame 70 pivoted at 71 on the guide holder 7. The outer end of the frame 70 extends under a wire bail 72 which is pivotally mounted on the bar 6 between the bearings 73 and 74. A spring 75 fastened to the base of the machine and connected with the bail 72 tends to rock the latter to bear on the end of the frame 70. The tension of the thread passing through the eyes 49 and 50 maintains the frame 70 in approximately the position shown in Fig. 4, and the spring 75 serves to apply the necessary pressure to maintain the guide in close contact with the surface of the cop. The bail 72 has an arm 76 extending downward and formed with an arcal piece 77 adapted to normally bear on a pin 78, see Figs. 1 and 4. The pin 78 projects from the rotatable stud 79 which is formed with the lock 67 for the belt shifter 65, and, with the arm 76 in the position shown in Fig. 4, the lock is maintained in position to engage the detent 69 on the belt shifter to retain the latter in position to render the machine operative. The arcal piece 77 allows the arm 76 to rock slightly when the frame 70 oscillates under the influence of slight changes in the tension on the thread, but upon the complete relief of the tension, as when the thread breaks, the frame 70 will tilt to such an extent as to allow the bail 72 to rock sufficiently to remove the arm 76 from its bearing on the pin 78. The releasing of the pin 78 allows the stud 79 to rotate to unlock the belt shifter, which is moved under action of the spring 68 to shift the belt to the loose pulley to stop the ma-

chine. After the belt shifter has been released, the lock 67 is returned to its normal position by the weight 80, Fig. 6, so that the pin 78 is in position to be engaged by the under side of the arm 76 when the machine is again threaded for winding.

To effect the stopping of the machine when the cop reaches its predetermined length, the following arrangement is provided: Near the outer end of the rod 6 the bail 72 is formed with an offset portion 81 so that when the guide reaches the end of the winding spindle the bail is allowed to rock, under action of its spring, to remove the arm 76 from the pin 78. This causes the release of the belt shifter from its lock to allow its movement to arrest the operation of the machine as previously described.

To release the belt shifter manually when the lock is in its operative position it is only necessary to move the handle 82 slightly into the position shown by dash lines Fig. 6. The upper part of the belt shifter is separate from the main piece, being hinged at 83, and the movement of the handle 82, as described, raises the detent 69 clear of the lock 67 to free the belt shifter and allow its movement under action of the spring 68. A stop 84, engaging a lug 85 on the lower portion of the belt shifter, prevents the handle portion being moved farther than is necessary to release the detent 69, and it will be noted that the spring 68 being fastened to an arm 86 extending from the handle portion of the shifter below the hinge 83 tends to keep the two sections closed, as shown by full lines, Fig. 6.

The object of having the belt shifter hinged at 83 is to provide for lifting or tilting the upper part manually to free the detent 69 from the lock 67 without disturbing said lock when the latter is in its operative position during the operation of the machine. Otherwise the arm 76 would have to be released from the pin 78, see Fig. 4, to allow the lock 67 to turn in its bearing.

While I have shown and described the preferred form of my machine, it will be evident that modifications might be made in the structure and arrangement of the parts without departing from the scope of this invention. Therefore,

What I claim is:

1. The combination in a winding machine with a winding spindle and a reciprocating guide, of a cam to reciprocate the guide, said cam having a plurality of helical cam faces of different lengths of throw.

2. The combination in a winding machine with a winding spindle and a reciprocating thread guide, of means to reciprocate the thread guide, including a cam having a plurality of helical cam faces of different lengths of throw arranged concentric with the axis of the cam.

3. The combination in a winding machine with a winding spindle, thread guide and reciprocating rod to traverse the guide, of a cam formed with a plurality of concentric cam faces of different diameters and different lengths of throw, and a member connected to the rod and adapted to engage the cam faces.

4. The combination in a winding machine with a winding spindle and thread guide, of a cam having helical cam faces with varying extents of throw and means to reciprocate the guide successively from the different cam faces.

5. The combination in winding machine with a winding spindle and thread guide, of a stepped cam formed with a plurality of helical cam faces, means connecting the guide with the cam, and devices for automatically shifting said means successively from one cam face to another.

6. The combination in a winding machine with a winding spindle and thread guide, of means to reciprocate the guide, including a cam provided with faces of different lengths of throw, and means controlled by the cop to successively change the extent of reciprocation of the guide to wind successive distinct layers of different lengths.

7. The combination in a winding machine with the thread guide, of means to traverse the guide, including a stepped cam having a plurality of faces with different lengths of throw, and means controlled by the diameter of the cop to automatically and successively change the extent of reciprocation of the guide to wind separate distinct layers, each having one end substantially alining with one end of each other layer, and its other end overlapping all preceding layers.

8. A cam for winding machines having a plurality of concentric steps, formed with helical cam faces of different lengths of throw, the step of least diameter having the face of shortest throw and the throw of each successive step being increased in length, until the maximum throw is reached on the periphery of the cam.

9. The combination in a winding machine with a reciprocating member, of a cam having concentric steps with cam faces of different lengths of throw, of an arm connected with the reciprocating member, a roll or stud on said arm adapted to bear on the cam faces, means to maintain the roll in engagement with each of the cam faces and means to shift the roll from one cam face to another.

10. The combination in a winding machine with the winding spindle and thread guide, of a reciprocating bar to traverse the guide, a cam to reciprocate the bar, formed with a plurality of cam faces having different lengths of throw, an arm on the bar, a stud on the arm adapted to engage the cam, a

track or rail for the arm adapted to rock to shift the stud from one cam face to another, and means controlled by the yarn on the spindle to rock the track.

11. The combination in a winding machine with the winding spindle and thread guide, of a cam to reciprocate the guide, having a plurality of helical cam faces adapted to impart to the guide different extents of traverse until a predetermined extent is attained, and means to then continue the traverse of uniform extent in constantly new positions on the spindle.

12. The combination in a winding machine with the winding spindle and thread guide, of a rod to traverse the thread guide, a cam having a plurality of cam faces adapted to reciprocate the rod with different extents of traverse until a predetermined extent is attained and then continue the attained extent of traverse and means to automatically feed the guide along the rod to wind in a constantly new position on the winding spindle.

13. The combination in a winding machine with the reciprocating thread guide, of a cam to reciprocate the guide, formed with cam faces having different lengths of throw, means connected with the guide and adapted to engage each of the cam faces, automatic devices to shift said means successively from one face to another, and devices to retain the means in engagement with one of the faces during the interval between the shifting.

14. The combination in a winding machine with the thread guide, of a cam for reciprocating the guide, formed with a plurality of faces of different lengths of throw, an arm connecting the guide with the cam, a member adapted to be rocked to shift the arm from one cam face to another and a yielding detent adapted to engage said member to maintain the arm in engagement with the appropriate cam face during the intervals between the shifting.

15. The combination in a winding machine with the reciprocating thread guide, of a cam to reciprocate the guide, formed with a plurality of cam faces with different lengths of throw, an arm connecting the guide with the cam, a member adapted to be engaged by the cop to shift the arm from one cam face to another, a quadrant member adapted to be moved with the arm and having notches or teeth, and a plunger adapted to engage said teeth to regulate the position of the arm.

16. The combination in a winding machine with the thread guide, and traverse bar, of a cam to reciprocate the traverse bar with different extents of traverse, an arm adapted to connect the traverse bar with the cam, and means to shift the arm to change the extent of traverse of the bar, comprising a member adapted to bear on the cop, a quadrant having ratchet teeth, and a spring pressed plunger adapted to act on the teeth to move the member away from the cop and to adjust and retain the arm in its appropriate position on the cam.

17. The combination in a winding machine with the spindle and thread-guide, of means to reciprocate the thread guide with different extents of traverse, a member adapted to be engaged with the periphery of the cop at different diameters to change the extent of traverse of the thread-guide, and means to adjust said member away from the cop during the interval between the times of changing the traverse.

18. In a winding machine the combination with the thread guide, of means for traversing the guide with different extents of traverse, means to shift the traverse and means engaged by the cop to control the shifting, said means arranged to bear on the cop only at certain intervals of the winding.

19. The combination in a winding machine with the winding spindle and thread-guide, of a guide holder, a tilting frame on the guide holder, guide eyes for the thread fastened to said frame at one end, a bail adapted to bear on the opposite end of said frame, and stopping devices engaged by said bail upon the tilting of the frame to stop the machine.

20. The combination in a winding machine with the stopping devices, of a thread-guide, a tilting frame supported thereon, a yieldingly pressed bail bearing on one end of the frame, guide eyes on the frame on which the thread bears to maintain the frame in its normal position, and means whereby the release of the tension on the thread allows the frame to tilt to release the bail and cause the action of the stopping devices.

21. The combination in the controlling mechanism of a winding machine with the tight and loose pulleys, of a belt shifter formed with a detent, a spring for moving the belt shifter, a rotatable pin formed with a lock to engage the detent on the belt shifter and means controlled by the tension of the yarn to maintain the pin in its normal position during the operation of the machine, said means adapted to release the pin to allow it to rotate to free the belt shifter upon the release of tension on the yarn.

22. The combination in a belt shifter for winding machines, of a rocking forked member, a second member hinged on the first and provided with a detent, said member adapted to oscillate on the first member to raise the detent and a spring fastened to an arm on the second member, tending to keep the two members closed and to move the belt shifter as a whole.

23. The combination with the traverse bar of a winding machine, of a thread guide and means for feeding the same along the

bar, comprising a nut engaging threads on the bar, said nut formed with ratchet teeth, a wheel adapted to be rotated by the cop and a pawl connected to be moved by the wheel and engaging the ratchet on the nut to turn the latter.

24. The combination in a cop winding machine with the winding spindle and traverse bar, of a thread-guide supported on the bar and adapted to oscillate to and from the spindle, a nut engaging threads on the bar and connected to feed the guide along the bar, said nut formed with a ratchet on its periphery, a wheel supported adjacent the guide and adapted to be rotated by contact with the cop, an eccentric on said wheel and a pawl connected to said eccentric and engaging the teeth of the ratchet.

25. The combination in a winding machine, and with the rotatable spindle and reciprocatable guide thereof, of a differential helical cam and means thereby increasing the traverse of the guide on the completion of winding each layer to build up a conical cone base.

26. The combination in a winding machine, and with the rotatable spindle and reciprocatable guide thereof, of a differential cam formed with helical cam faces and means for thereby increasing the traverse of the guide on the completion of winding each layer to build up a conical cone base, and means for operating the guide to deposit layers successively on the conical face of the base to build up a cylindrical cone body.

27. The combination in a winding machine and with the rotatable spindle and reciprocatable guide thereof, of a differential cam having succeeding faces and means constructed to be shifted by successive layers of the cop to bring the guide under the control of the succeeding faces of the cam.

28. The combination in a winding machine, of a rotatable spindle, reciprocatable guide and carrier therefor, and means for operating these parts to deposit the yarn in successive layers and further means adapted to be actuated by each layer as completed to thereby shift the position of the guide on its carrier.

29. The combination in a winding machine, of a rotatable spindle, a reciprocatable guide, a differential cam, and means driven by the cam for operating the guide, of controlling means to cause the guide to deposit the yarn in successive layers, and means actuated by each layer as completed to shift the position of the cam driven parts to vary the throw of the guide.

In testimony whereof I affix my signature in presence of two witnesses.

SIMON W. WARDWELL.

Witnesses.
EDWARD F. PARKS,
CHAS. A. EDDY.