No. 678,507. Patented July 16, 1901.

J. O. McKEAN.

WINDING MACHINE.

(Application filed Aug. 17, 1900.)

(No Model.) 3 Sheets—Sheet 1.

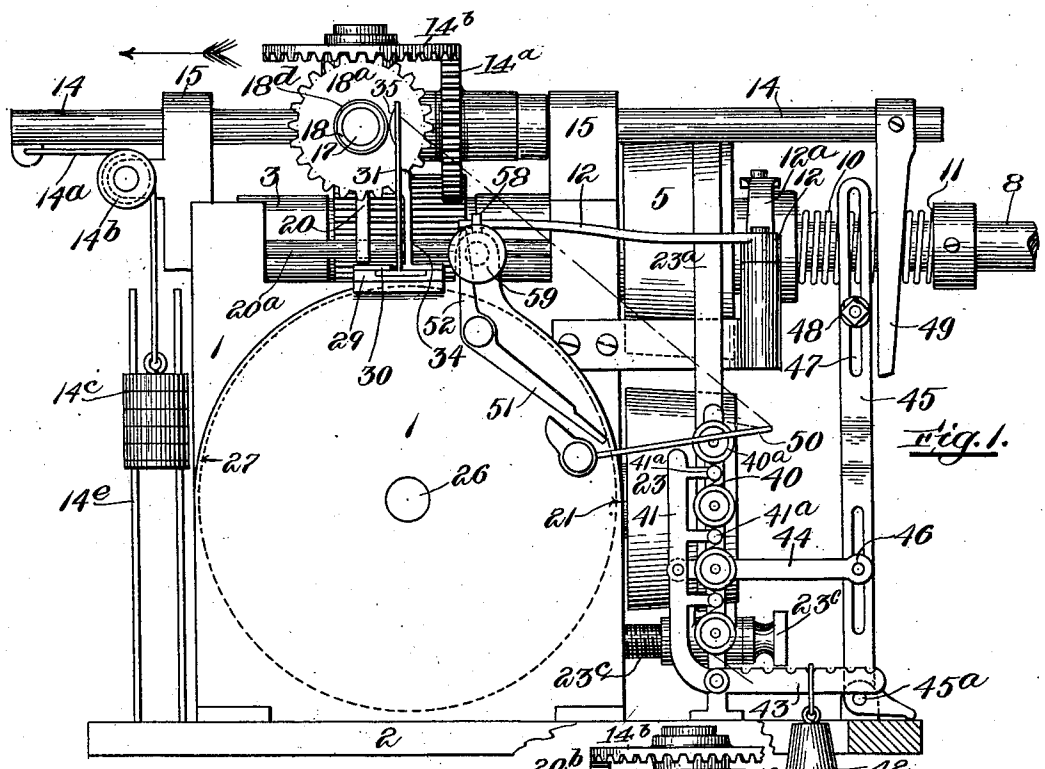


Fig. 1.

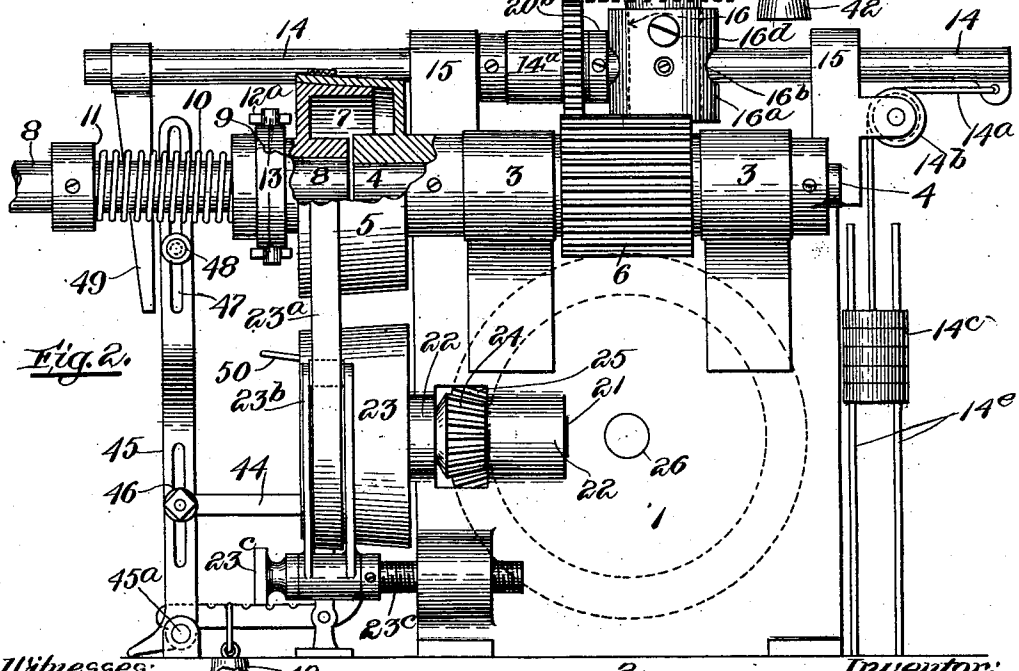


Fig. 2.

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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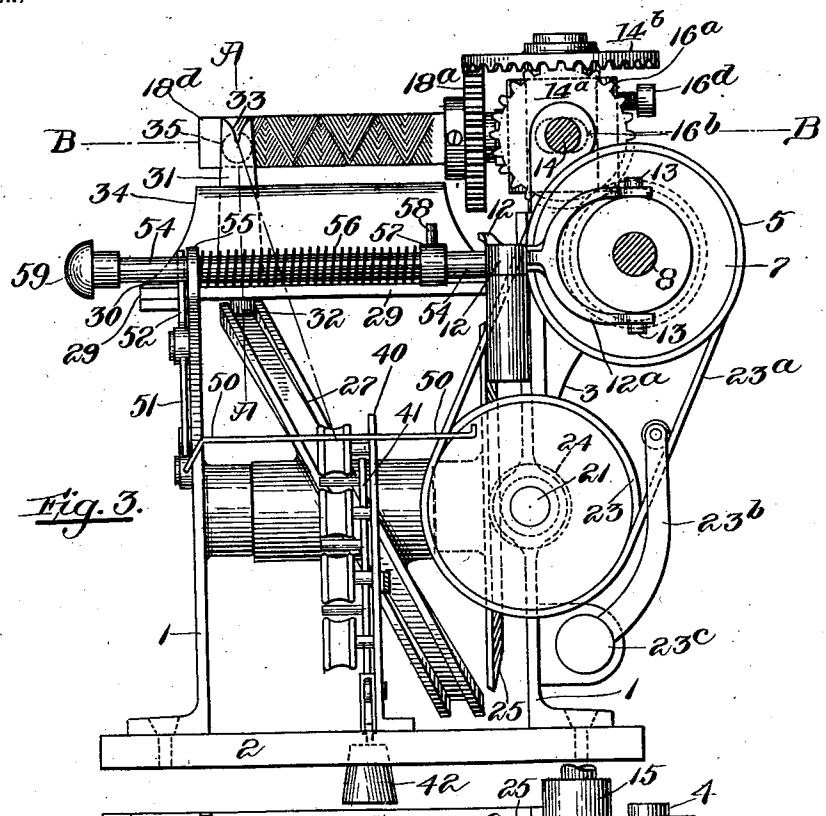


Fig. 3.

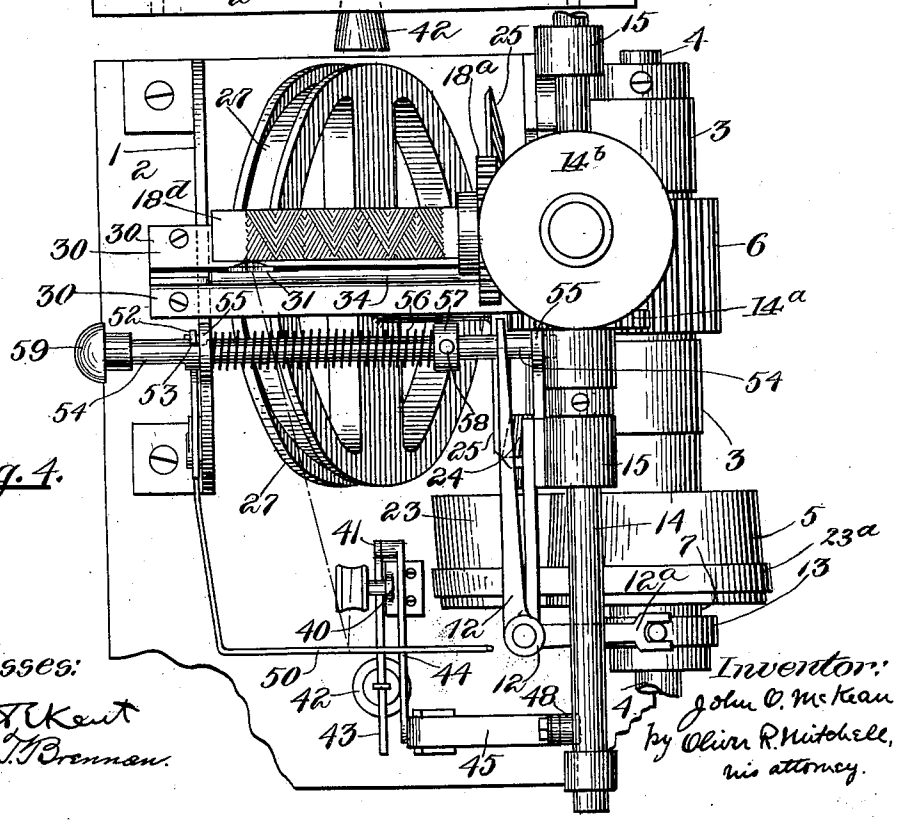


Fig. 4.

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(No Model.) 3 Sheets—Sheet 3.

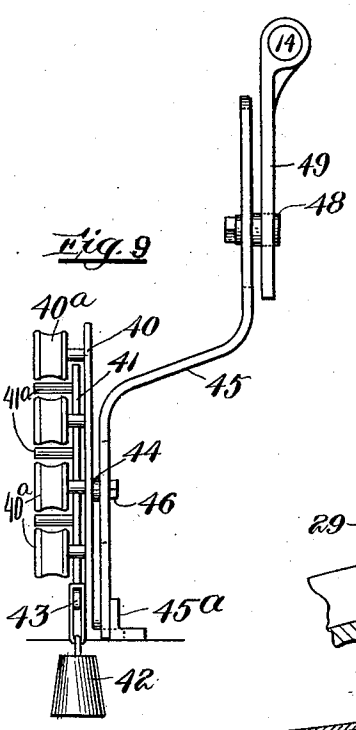


Fig. 9.

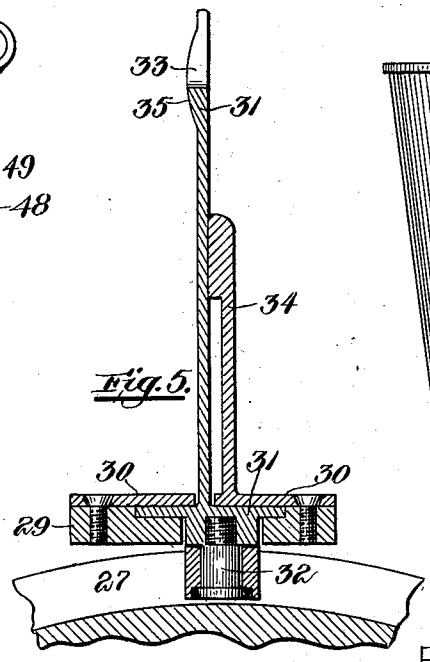


Fig. 5.

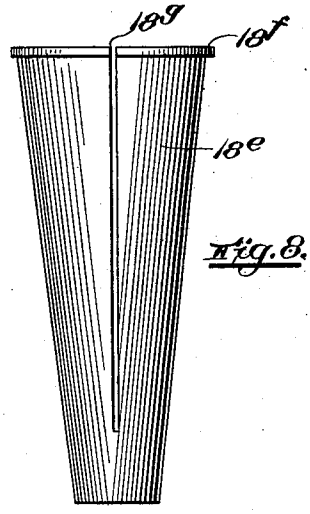


Fig. 8.

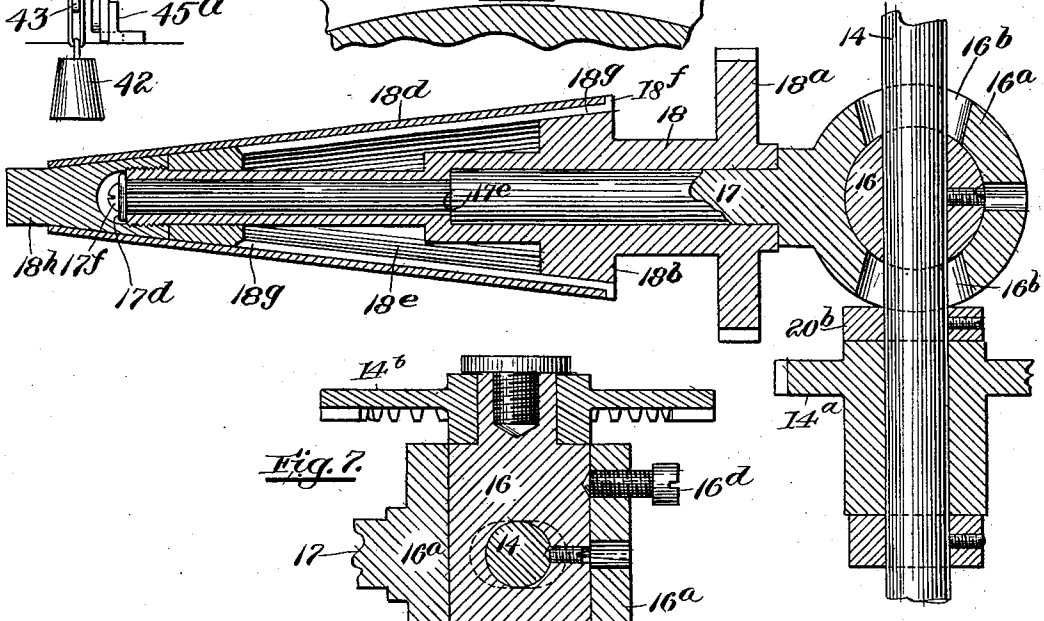


Fig. 6.

Fig. 7.

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN O. McKEAN, OF WESTFIELD, MASSACHUSETTS, ASSIGNOR TO THE FOSTER MACHINE COMPANY, OF SAME PLACE.

WINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 678,507, dated July 16, 1901.

Application filed August 17, 1900. Serial No. 27,118. (No model.)

To all whom it may concern:

Be it known that I, JOHN O. McKEAN, of Westfield, in the county of Hampden and State of Massachusetts, have invented a new and useful Improvement in Winding-Machines, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a front elevation of my improved winding-machine, showing a shell partly wound, the thread as it passes through the tension and stop-action devices being indicated by a dot-and-dash line. Fig. 2 is a rear elevation of the same. Fig. 3 is an elevation of the same as viewed from the right-hand side of Fig. 1, the upright lever and connected parts at the extreme right of Fig. 1 being broken away. Fig. 4 is a plan view of the machine, showing the positions of parts when the winding of a shell has just begun. Fig. 5 is an elevation showing in section the details of construction of the thread-guide, the section being taken on line A A of Fig. 3. Fig. 6 is a plan view showing in section details of construction of the winding-spindle and its support, the spindle shown being adapted to carry a cone-shaped shell, the section being on a line corresponding to the line B B in Fig. 3. Fig. 7 is an elevation showing a vertical section of the hub and stud that support the spindle. Fig. 8 is a detail view showing the shell-carrier of Fig. 6. Fig. 9 is a detail view showing the tension device in side elevation.

The object of my invention is to provide in a machine for winding thread, yarn, or cord upon a shell or into a cop mechanism by which the coils of thread may be laid close together and even in spools of any diameter however large.

In my improved winder I provide a thread-guide which reciprocates along the surface of the shell or cop being wound, and I provide a guide-rod upon which the rotating shell is supported and upon which it slides perpendicularly away from the path of the reciprocating thread-guide as layers are wound upon the shell.

In machines constructed according to my invention the filling of the shell with thread and consequent increase of diameter of the wound mass causes no change in the points at which the presser-button and the thread-guide touch the wound surface of the shell, and the thread is laid close with equal precision however great the change of diameter has been.

One feature of my invention connected with this is the novel mechanism by which the spindle is continuously actuated whatever may be the position of the carriage on which it is mounted.

Referring to the drawings, 1 is the frame of the winding-machine. It is adapted to be bolted or otherwise fastened upon a table or stand 2 to raise it a convenient distance above the floor. In practice the machine shown will be one of a series or gang of machines, several of which may be attended by one operator. On that side of the frame which will herein for the sake of clearness be designated as the "back" side, Fig. 2, supported by and journaled in brackets 3, is the main driving-shaft 4 of the machine, carrying the cone-pulley 5 and spur gear-wheel 6. At one end of the shaft 4 is a clutch 7 to connect the shaft 4 with a driving-shaft 8 in communication with the source of power. By means of the clutch 7, which may be of any suitable form and is in the drawings shown as a friction-clutch, the shaft 4 may be at pleasure engaged with or disengaged from the driving-shaft 8. For economy of space and material the outer member of the clutch which is carried by the shaft 4 is in the machine shown in the drawings made to serve also as the cone-pulley 5. The inner member of the clutch is carried by the driving-shaft 8. It slides loosely upon the shaft and is prevented from rotating thereon by the key 9. A spiral spring 10, mounted upon the driving-shaft 8 between a collar 11 and the sliding member of the clutch, tends to keep the clutch closed and the shafts 8 and 4 engaged. A fork 12^a on one arm of a bell-crank 12, pivoted on a bracket extending from the frame, engages with trunnions 13 on the movable member of the clutch and is adapted to throw the clutch against the spring 10 and out of engagement, thus forming a part of the automatic stop-action device hereinafter described.

14 is a guide-rod supported from the frame

1 by bearings 15. It is parallel to the main shaft 4 and is adapted to slide in its bearings in the direction of its length. The guide-rod carries fixed to it a hub 16, which has a fork 20, (see Figs. 7 and 1,) projecting downward and bearing against a fixed rod 20^a, supported by the frame 1, to prevent the hub from rotating.

The hub 16 has a vertical sleeve 16^a, (see Figs. 6 and 7,) which carries a stud 17, projecting horizontally forward over the frame of the machine, upon which stud is journaled the spindle 18, adapted to carry the shell, spool, or bobbin 18^d upon which the thread is to be wound. (See Figs. 4 and 6.) The sleeve 16^a has slots 16^b, through which the guide-rod 14 passes into the hub 16, which slots are long enough to permit the sleeve to be turned upon the hub as much as is required for winding conical shells or cops. A screw 16^d fastens the sleeve and hub together in any desired relative position, which positions may be determined as hereinafter described.

It will be obvious that any suitable method of fastening the hub and sleeve together may be employed without departing from the essence of my invention. A crown-gear 14^b is journaled on the hub 16 with its axis in line with the axis about which the sleeve 16^a turns on the hub. A spur-gear 14^a, journaled upon the guide-rod 14 adjacent to the hub 16, from which it is separated by the collar 20^b, meshes with the crown-gear 14^b and also with the gear 6 on the main shaft. (See Figs. 1 and 6.) Integral with or fixed to the spindle 18, near the hub 16, is a spur-gear 18^a, which meshes with the crown-gear 14^b. By this train of gearing power is transmitted from the main shaft 4 to rotate the spindle 18 and the shell carried thereby upon which the thread is to be wound.

In Fig. 6 the spindle 18 is shown as adapted to wind a cone. It is represented as provided with an enlargement or base 18^b, tapered toward the outer end of the spindle and with the spindle threaded at its outer end to maintain in position the shell 18^d, represented in Fig. 6 as conical and supposed to be made of paper or other light-weight material. To maintain the shell in position, a shell-holder 18^e, (see Figs. 8 and 6,) conical in shape and having at its base end a flange 18^f, is provided. The holder is slit on opposite sides, as at 18^g, so that it may be expanded near its base when, having first been inserted in a shell, it is forced upon the base 18^b. Before inserting the holder in the shell I insert in the shell from its base end a conical nut 18^h, threaded internally to engage the screw-threads of the spindle 18. Then I insert the holder in the shell until its smaller end meets the end of the nut, and then I place the holder carrying the shell upon the spindle 18, securing the nut 18^h upon the spindle. Longitudinal motion of the spindle on the stud is prevented by means of the shoulder 17^e on the stud, which meets a shoulder on the spindle, and by means of a washer 17^d on the stud, which bears against the outer end of the spindle and is held in contact therewith by a suitable set-screw 17^f. The angle between the shell and the guide-rod 14 is fixed by adjusting the sleeve 16^a upon the hub 16. What this angle should be depends upon the shape of the shell or cop to be wound. The sleeve should be fastened in such a position on the hub that the side or face of the shell carried by the spindle at which the thread comes on is parallel to the line of travel of the reciprocating thread-guide hereinafter described. If the shell is cylindrical, the angle between the axis of its spindle and the guide-rod should be ninety degrees. If a conical shell is to be wound, the angle will depend upon the angle of the cone. Its value may be found by subtracting from ninety degrees an angle equal to one-half the angle of the apex of the cone.

Attached to one end of the guide-rod 14 is a cord 14^a, which passes over a sheave 14^b to a weight 14^c, all so adjusted that the guide-rod and parts carried by it will normally be drawn toward the thread-guide 31, but may be pushed away therefrom by a slight pressure upon the spindle or partially-wound shell, as by the insertion of each new layer of thread between the spindle and the presser-button of the thread-guide hereinafter described. The weight 14^c is steadied by ways 14^e. The spur-gear 6 on the main shaft is constructed with a very broad face, so that the guide-rod 14 can slide as far as desired in a direction parallel to the main shaft, carrying with it the spindle and train of intermediate gearing without drawing the latter out of mesh with the gear 6.

It will be seen that the hub 16, with the guide-rod 14 and the fork 20, constitutes a carriage for the parts supported by the hub. The bearings 15 of the rod 14 may be made rollers, and rollers may be mounted upon the prongs of the fork 20, if desired; but I consider the sliding bearings shown superior, being cheaper and steadier.

The secondary shaft 21 on the lower side of the machine and parallel to the main shaft 4 is journaled in bearings 22. A cone-pulley 23 on this shaft 21 is adapted to be driven by a narrow belt 23^a from the cone-pulley 5 on the main shaft. To enable the operator to adjust and fix the belt at any desired position, a belt-shipper 23^b is provided, which may be of any suitable construction and which in the drawings, Figs. 2 and 3, is shown as supported by a screw 23^c, projecting from the frame. The shaft 21 is driven by the cone-pulley 23 and carries a small bevel-gear 24, which meshes with and drives a large bevel-gear 25 on a shaft 26, journaled in the frame at right angles to the shaft 21 and parallel, therefore, to the winding-line of the shell carried on the spindle 18. A convenient ratio for the number of teeth of these gears is one

to six. The shaft 26 is centered approximately under the line at which the thread passes from the reciprocating thread-guide 31 to the shell being wound. The shaft carries fixed to it a cam 27, which is like a drum, having in its surface an endless groove or raceway cut in the form of a spiral. This spiral 27 has the form which would be generated by a point making one complete circuit about the drum, the axial travel of which point is in a positive direction during the first half of a revolution and in the negative direction during the second half-revolution, thus returning to the point of beginning. Over the cam secured to the top of the frame 1 is a slotted plate 29, the slot being parallel to the axis of the spiral. This plate, with its connected guards and guides 30, (see Fig. 5,) forms the raceway in which the thread-guide 31 reciprocates. A stud 32 on the under side of the thread-guide passes down through the slot of the plate 29 into the spiral groove, and a roller placed thereon to reduce friction rides in the spiral raceway 27. The thread-guide 31, with its stud and roller 32, being free to move longitudinally in the slot of the plate 29, but not transversely, are reciprocated therein by the action of the spiral cam whenever the drum 27 is rotated. As it reciprocates one side of the thread-guide 31 bears against the shell or the wound surface of the shell, which is pressed up against it by the weight 14ᶜ. The other side of the thread-guide bears against the back plate 34, which rises from the upper plate 30 of the horizontal raceway. At the top of the thread-guide 31 and upon the side of it toward the shell to be wound is a button-shaped piece 35, cut with a notch or fissure 33 from its top to receive and guide the thread. The thread-guide and button are so designed and adjusted that the point at which the thread issues from the fissure in the button will be in that part of the button that presses on the surface of the wound mass of thread. The button is made wide enough to press upon several preceding coils of the layer in process of being wound. It thus constitutes a presser-button to press the coils in position, the pressure resulting from the action of the weight 14ᶜ. By adjustment of the belt 23ᵃ on the cone-pulleys the successive coils in each layer can be made to lie close together side by side.

From the foregoing description it will be understood that the shell upon which the thread is to be wound is rotated about the stud 17 by the train of gearing from the main shaft 4, that the diameter of the wound mass of thread increases uniformly from end to end of said shell, the outer surface of the wound mass pressing against the presser-button, and that as the thread is added layer by layer the axis of the wound mass and with it the carriage and train of gearing will be gradually moved perpendicularly away from the presser-button in the direction of the arrow in Fig. 1. The force which must be overcome to enable the stud and gearing to travel thus, as above stated, may be adjusted by adjusting the weight 14ᶜ. The weight 42 of the tension device hereinafter described also exerts force opposing this travel of the carriage. Assuming the main shaft 4 to rotate at a constant velocity, as the diameter of the wound mass increases the surface speed thereof increases, and therefore the speed of the thread being wound increases. It is desirable, therefore, to have a tension device which shall automatically adjust itself to the speed at which the thread is being wound, less tension being necessary when the speed is greater. Although any suitable tension device may be used, I have provided a device which I shall now describe as being peculiarly adapted to give the variable tension desired. My device consists of a tension member made up of two members 40 41, one of which is a fixed upright supporting a series of smooth curved surfaces 40ᵃ, which may be spools or rolls, between which enter the bearing-points 41ᵃ of the other tension member, the lever 41. These bearing-points may also be rolls, if desired. In the drawings, Figs. 1, 3, and 9, they are represented as smooth studs. From the uppermost tension member the thread passes around a take-up device 50 to the thread-guide. The tension of the thread at starting is controlled by a weight 42, hung adjustably upon a beam 43 of a lever, the other beam of which is one of the tension members. In the machine shown it is the member 41. The lever is so arranged that the pull of the weight tends to pull the tension member 41 toward the tension member 40 and increase the tension. A link 44 connects the tension member 41 with an upright lever 45, fulcrumed at 45ᵃ on the frame supporting the machine. The connection between the link 44 and the lever 45 is adjusted by means of a pin and a slot 46 with screw-clamp fastening, so that the link may be attached to the lever at a greater or less distance from the fulcrum, as desired. At the upper end of the lever 45 is a slot 47, from which projects a pin 48, adjustable therein by means of a screw-clamp. Upon the guide-rod 14 is a lever or finger 49, adjustably fixed thereto approximately parallel with the lever 45 and adapted to engage the pin 48 upon it as the finger moves with the guide-rod 14. The operation of the tension device is as follows: Before starting the machine the weight 42 is adjusted to a position proper for the strength of the thread to be wound and the finger 49 is adjusted so as to touch the pin 48. When the wound mass of thread begins to increase in diameter, the guide-rod moves in the direction of the arrow, Fig. 1, and the finger 49 on it swings the lever 45 about its fulcrum 45ᵃ, thereby, through the medium of the link 44, swinging the tension member 41 in a direction away from the tension member 40, thus reducing the tension. The rate at which the tension shall be thus

reduced obviously depends upon the rate of increase of diameter of the wound mass. This rate is, however, adjustable at the pleasure of the operator by adjusting the position of the pin 48 upon the lever 45, also by adjusting the position at which the link 41 connects with the lever 45, or by a combination of the two. Thus when the pin 48 is raised to its extreme top position the reduction of tension corresponding to one inch of travel of the guide-rod will be less than when the pin is at its lowest position, because the lever 45 will be swung through a smaller arc by the finger 49, the contact being made at a greater distance from the center of revolution 45^a.

The method of operation of the tension device just described is the ordinary one. In some kinds of work it is desirable to have the tension remain constant without reduction until the winding has progressed for some time. My device is peculiarly adapted to such requirement, and this adaptation constitutes a novel feature of especial value. The finger 49 can be set on the rod 14 so that it will not engage and begin to move the lever 45 to reduce tension until the guide-rod 14 has traveled any desired distance, corresponding to any desired number of layers of thread wound on the shell. My device is applicable to all winding-machines in which the axis of the wound mass of thread and the thread-guide move apart as the mass increases, whether by movement of the wound mass or the thread-guide, or both.

To be operative in the best manner, the machine should also have a stop-action device to stop the machine when the thread breaks. I provide such a device by fulcruming on the frame of the machine (see Fig. 1) a take-up device 50, the outer arm of which is heavier than the inner and is of such shape and position that normally the thread passes under and around it after leaving the tension device and sustains it from falling. The inner end is adapted to engage one arm 51 of a rocker when the arm 50 is released by the thread and dropped. The other arm of the rocker 51 is a latch 52, adapted to engage in a notch 53 (see Fig. 4) of the rod 54, which rod is supported in bearings 55 in the frame, in which it is free to slide. A spiral spring 56 on the rod between the frame and a collar 57 tends to push the rod in. The collar 57 carries a pin 58, adapted to engage one end of a bell-crank 12, pivoted on a bracket extending from the frame, the other arm of which bell-crank is a fork 12^a, engaging trunnions on the movable member of the clutch 7. The rod 54 may be drawn outward by the handle 59 and is normally locked in that position by the latch 52. The operation of the device is as follows: When the thread breaks, the outer arm of the lever 50 falls. The inner arm thereof strikes the lever 51 a blow which disengages the latch 52 and allows the rod 54 to be forced in by the spiral spring 56. The pin 58 then engages one arm of the bell-crank 12, and thus opens the clutch 7 between the driving-shaft 8 and the main shaft 4, the spring 56 being stronger than the spring 10, which when free keeps the clutch closed.

I claim--

1. In a winding-machine, a guide-rod 14 adapted to guide and sustain a carriage; that carriage; a stud 17 supported thereby; a rotatable spindle journaled on the stud and adapted to receive a shell for the thread to be wound; a second rod, 20^a, adapted to support the carriage against rotation about the axis of the guide-rod; a stationary raceway; a thread-guide adapted to reciprocate in the raceway in contact with the surface of the wound mass in a fixed line perpendicular to the line of travel of the spindle; means to reciprocate the thread-guide; means to rotate the spindle; and means to press the spindle normally toward the thread-guide, the spindle being movable away therefrom by the increase of the wound mass.

2. In a machine for winding thread or yarn, a thread-guide adapted to reciprocate in a stationary raceway; means to reciprocate said thread-guide; a hub 16 having its axis perpendicular to the line of travel of the thread-guide mounted and adapted to travel on a guide-rod 14 in a direction perpendicular to its own axis and perpendicular to the line of travel of the thread-guide; that guide-rod; a rotatable spindle 18 projecting laterally from and supported by the hub, the spindle being adapted to receive a shell for receiving the thread to be wound; means to rotate the spindle; and means to press the spindle constantly toward the thread-guide, the spindle being movable away therefrom by increase of the wound mass.

3. In a winding-machine, a main shaft; a driving-wheel mounted on that shaft; a driven wheel engaging that driving-wheel, the driven wheel being mounted on a carriage and moving with that carriage; that carriage; a second driven wheel engaging the driven wheel aforementioned in a plane at a right angle to the plane of the driven wheel, and driven thereby; and a third driven wheel fast to the spindle and engaging the second driven wheel aforementioned and driven thereby.

4. In a winding-machine, a main shaft; a spur-gear mounted upon that shaft; a carriage sliding on bearings in the frame of the machine; a spur-gear mounted on the carriage and in mesh with the spur-gear before mentioned; a crown-gear mounted upon the carriage and in mesh with the spur-gear mounted on the carriage aforementioned; a spur-gear mounted on a stud projecting from the carriage and fast to a spindle and in mesh with the crown-gear, all organized, as described, so that the motion of the main shaft is transmitted to the spindle while the carriage moves on its bearings.

5. In a winding-machine, a thread-guide adapted to reciprocate in a stationary race-

way; that raceway; a cam mounted with its axis parallel to the raceway, and having a groove with which the thread-guide engages, to actuate the thread-guide; a main shaft mounted at a right angle to the axis of the cam; a spur-gear mounted on that shaft; a second spur-gear in engagement with the first-mentioned spur-gear and mounted on a carriage; that carriage, moving parallel to the main shaft; a crown-gear, mounted on the carriage and engaging the second-mentioned spur-gear and rotating in a plane at right angles to the plane of rotation of the second-mentioned spur-gear; a third spur-gear fast to the spindle and engaging the crown-gear and rotating in a plane at right angles to the plane of rotation of the crown-gear; a spindle and means to press the carriage constantly toward the thread-guide, all organized and arranged to cause the spindle to be rotated with its surface in the plane of movement of the thread-guide, the carriage being movable away from the thread-guide by the mass of thread being wound as it increases in diameter on the spindle.

6. In a winding-machine, a thread-guide adapted to reciprocate in a stationary raceway; that raceway; a cam mounted with its axis parallel to the raceway, and having a groove with which the thread-guide engages, to actuate the thread-guide; a main shaft mounted at a right angle to the axis of the cam; a driving-wheel mounted upon that shaft; a second wheel in engagement with the driving-wheel and mounted upon a carriage; that carriage, moving parallel to the main shaft; a third wheel mounted upon the carriage and engaging the second wheel and rotating in a plane at right angles to the plane of rotation of the second wheel; a fourth wheel fast to the spindle and engaging the third wheel and rotating in the plane at right angles to the plane of rotation of the third wheel; a spindle; all organized and arranged to cause the spindle to be rotated with its surface in the plane of movement of the thread-guide, substantially as described.

7. In a winding-machine, a thread-guide, adapted to reciprocate in a stationary raceway; that raceway; a cam mounted with its axis parallel to the raceway; and having a groove with which the thread-guide engages, to actuate the thread-guide; a main shaft mounted at a right angle to the axis of the cam; a driving-wheel mounted upon that shaft; a second wheel in engagement with the driving-wheel and mounted upon a carriage; that carriage, moving parallel to the main shaft and carrying a spindle; that spindle; a connection between the second wheel and the spindle; all organized and arranged to cause the spindle to be rotated with its surface in the plane of movement of the thread-guide, substantially as described.

8. In a winding-machine, a carriage made up of a guide-rod, mounted in bearings on the frame of the machine; a body portion 16 mounted on the guide-rod and moving thereon, and in engagement with a second rod, 20^a; that rod 20^a; an adjustable sleeve, 16^a, adjustably mounted on the body 16, and having a projecting stud to carry a spindle; and suitable bearings on the carriage to carry a train of gearing, to connect the spindle and the main shaft.

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