No. 747,404. PATENTED DEC. 22, 1903.

G. W. FOSTER.

THREAD WINDING MACHINE.

APPLICATION FILED JAN. 13, 1903.

NO MODEL. 4 SHEETS—SHEET 1.

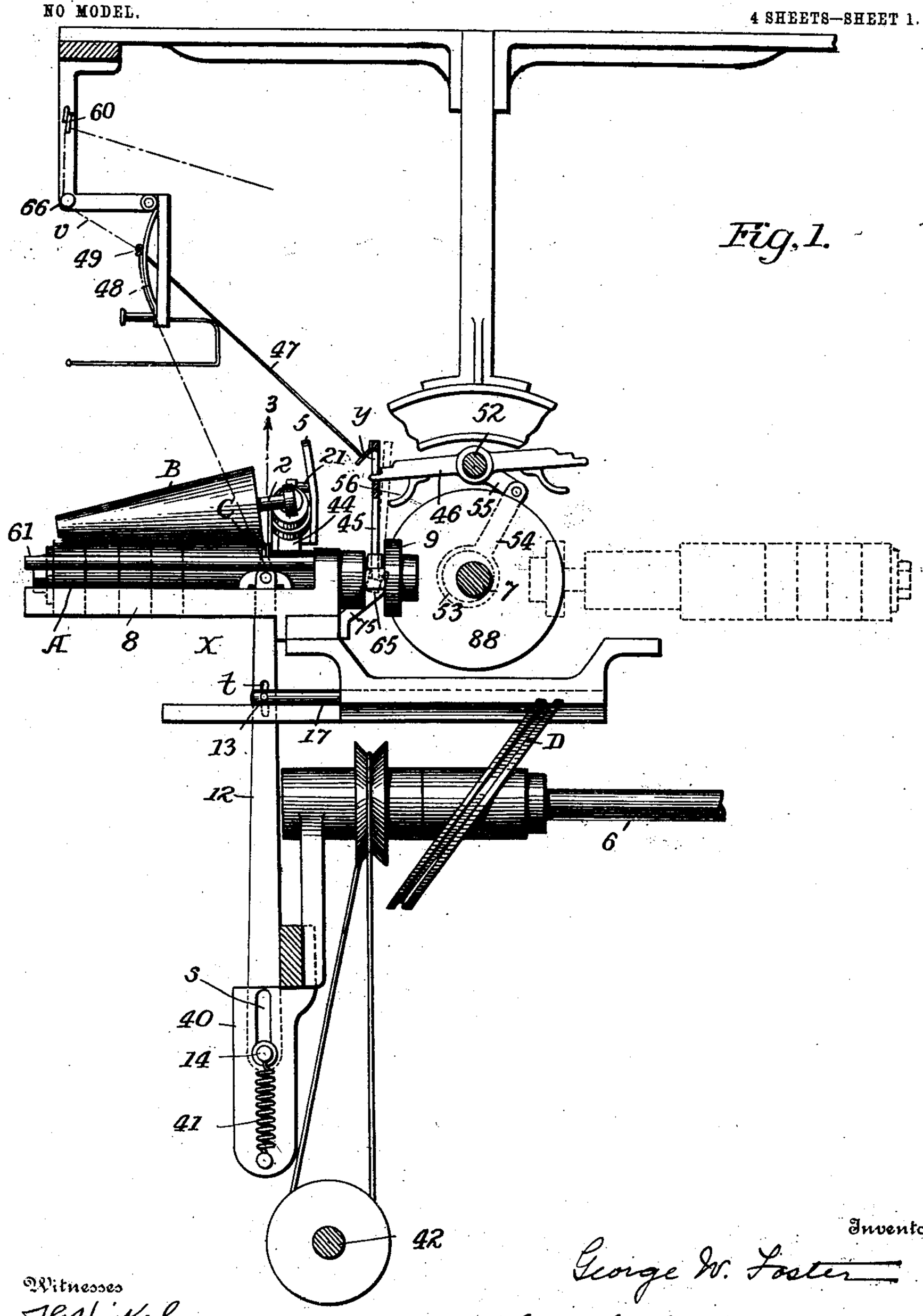

Fig. 1.

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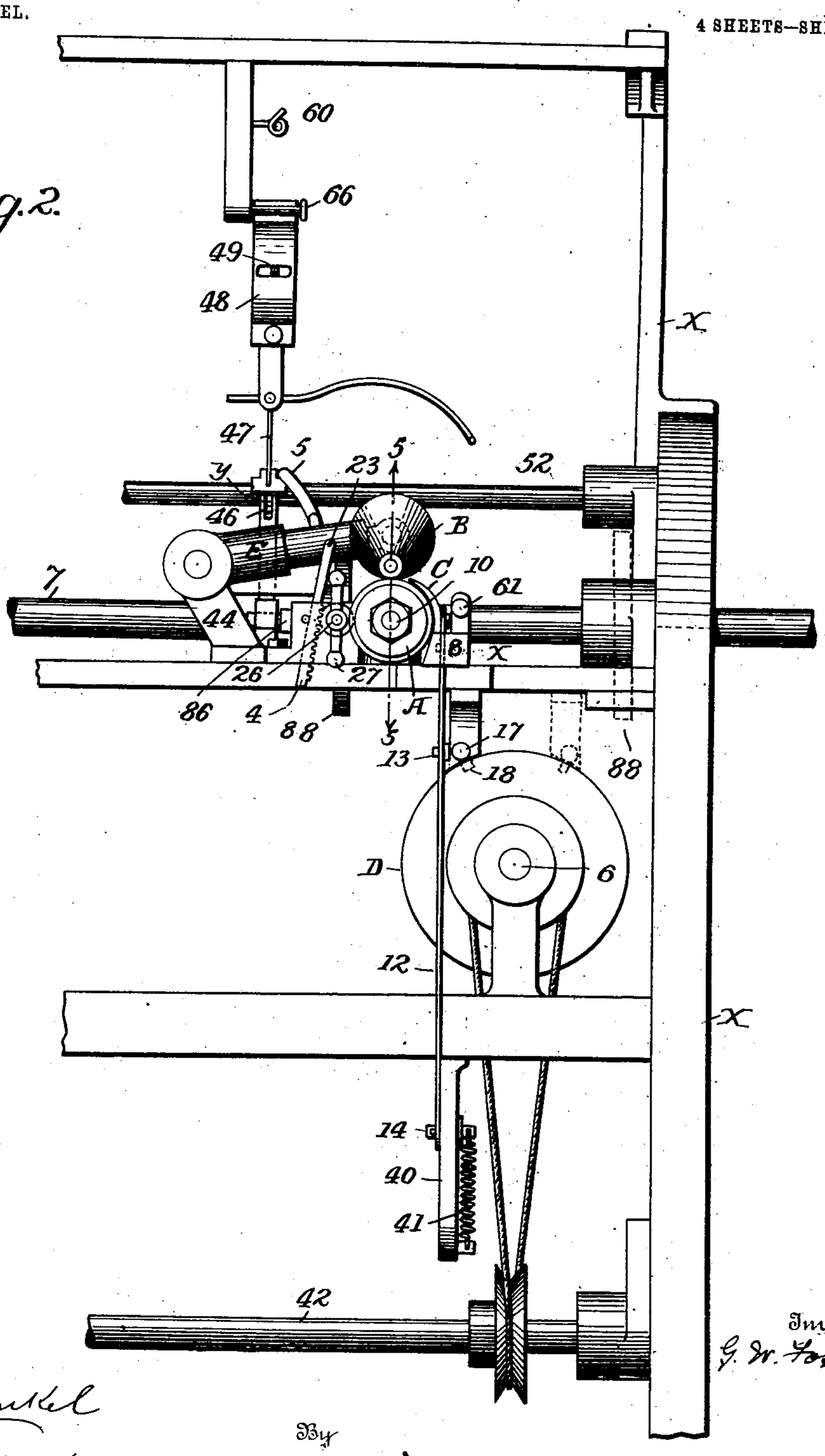
NO MODEL. 4 SHEETS—SHEET 2.

Fig. 2.



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NO MODEL. 4 SHEETS—SHEET 3.

Fig. 3.

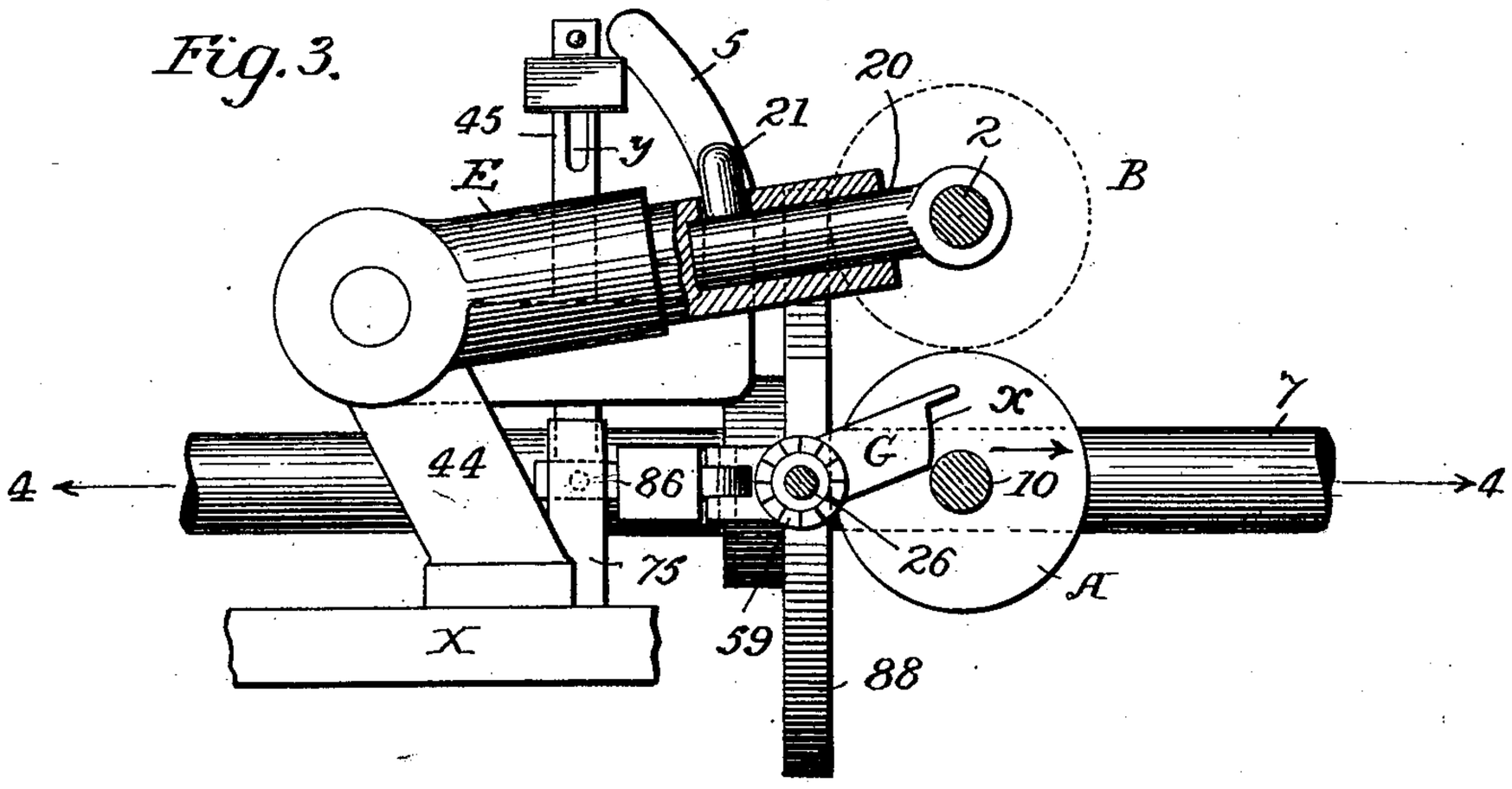
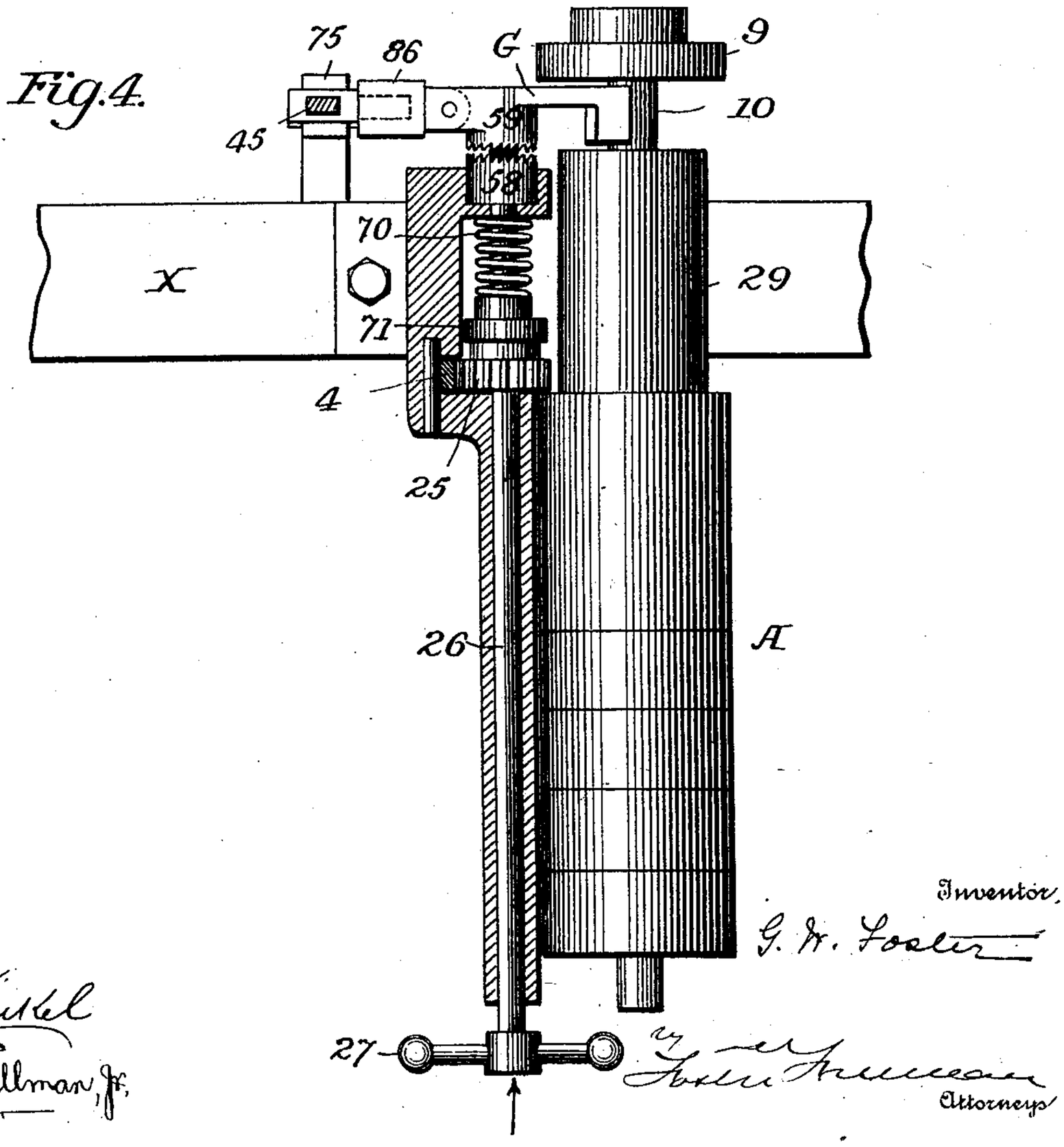


Fig. 4.



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APPLICATION FILED JAN. 13, 1903.

NO MODEL. 4 SHEETS—SHEET 4.

Fig. 5.

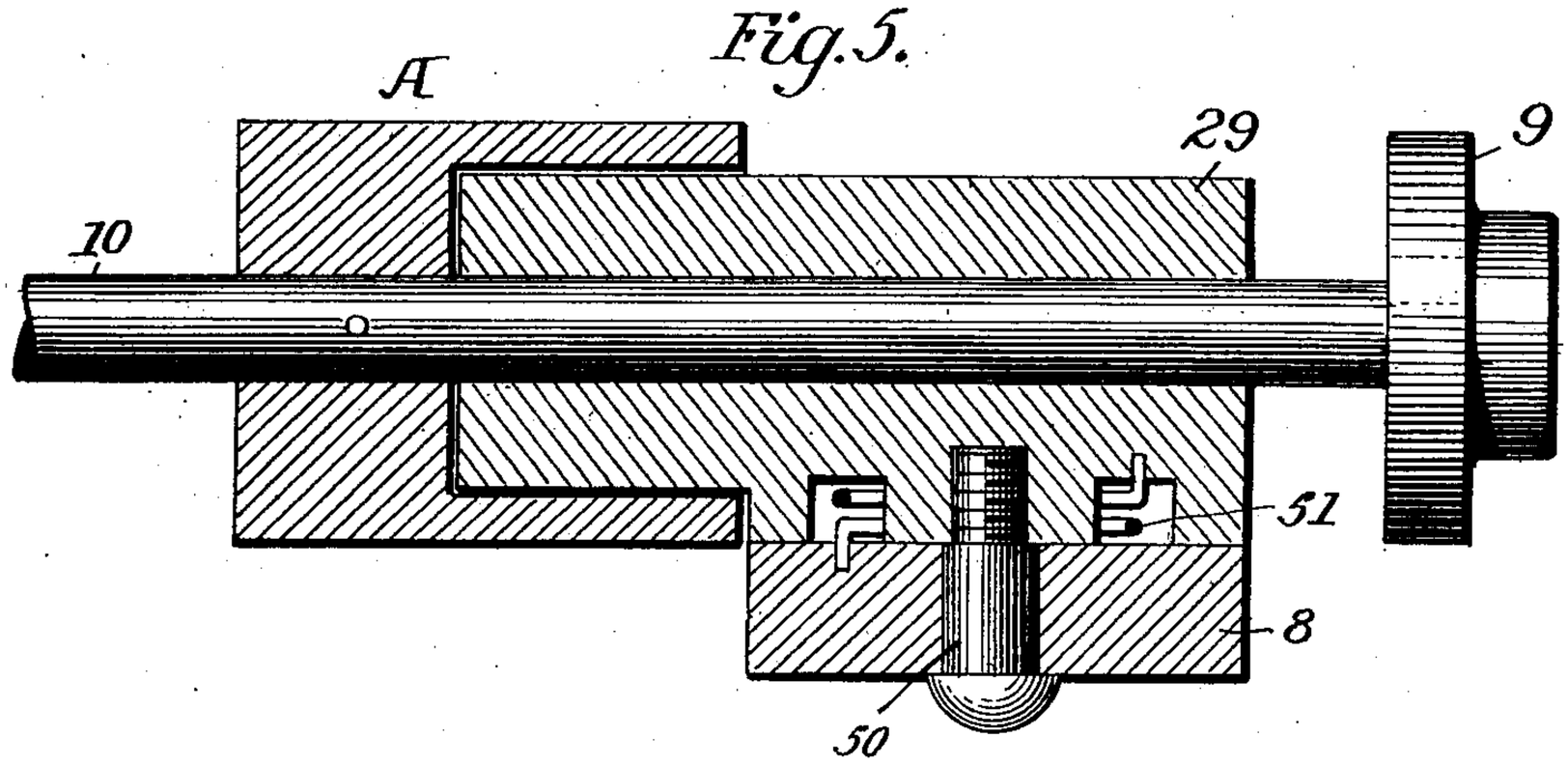


Fig. 7.

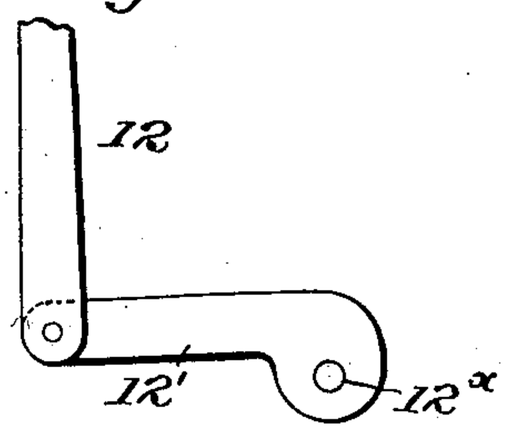
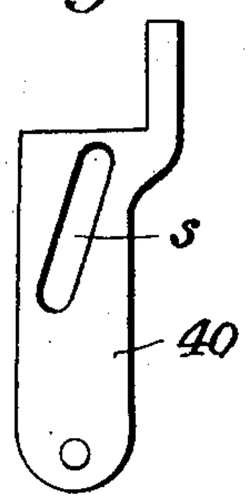


Fig. 6.



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No. 747,404. Patented December 22, 1903.

UNITED STATES PATENT OFFICE.

GEORGE W. FOSTER, OF WESTFIELD, MASSACHUSETTS.

THREAD-WINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 747,404, dated December 22, 1903.

Application filed January 13, 1903. Serial No. 138,904. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. FOSTER, a citizen of the United States, residing at Westfield, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Thread-Winding Machines, of which the following is a specification.

My invention relates to machines for winding cops, and especially to that class of machines in which a conical cop-tube is rotated by contact with a rotating drum; and my invention consists in means for operating the guide to lay the yarn in coils of crossed helices of increasing pitch toward the apex of the cone, and in certain details of construction of the apparatus, as fully set forth hereinafter and as illustrated in the accompanying drawings, in which—

Figure 1 is a transverse part-sectional elevation of sufficient of a winder adapted to operate two series of drums from a central shaft to illustrate my invention and improvements. Fig. 2 is an end elevation; Fig. 3, an enlarged sectional elevation on line 3, Fig. 1. Fig. 4 is a sectional plan on the line 4 4, Fig. 3. Fig. 5 is a part-sectional elevation on the line 5 5, Fig. 2. Figs. 6 and 7 are detached views illustrating modifications.

The driving drum or roll A is shown as consisting of a series of sections mounted upon a shaft 10, the section nearest the base of the winding-cone being secured to turn with the shaft and the others turning loosely on the shaft, as is common. The shaft turns in any suitable support upon the frame X of the machine. Above the drum or roll is supported the inclined spindle 2, round which rotates the conical holder B for supporting a conical cop or "cone" tube, the spindle 2 being connected with a movable support, so that the spindle can rise as the cop is wound upon the tube and as the drum rotates the holder and the cop.

The thread or yarn passes from a carrier C, which reciprocates along a cross-bar 8, supported by the frame X, and combined with this carrier are devices for reciprocating the same at a speed to lay the yarn in crossed helices and which are so constructed as to impart to the carrier or guide an increased speed of movement as it approaches the apex of the cone, the movement decreasing in speed as the guide passes back toward the base of the cone. As a result of this peculiar movement of the carrier or guide the yarn is laid upon the cop-tube and in the cop in helices or spirals which gradually expand toward the apex to a greater extent than the normal increase of angle in conical cops, but are closer at the base, so that the cop is thicker and has a closer wind at the base and is thinner and more open at the apex, a character of wind which it is found will result in a much better delivery of the yarn than where the spiral is uniform from end to end of each coil laid in the cop and will further insure a more perfect delivery by counteracting the natural tendency to increase in diameter more rapidly at the apex than at the base.

Any desired character of mechanism may be employed for increasing the speed of the guide as it travels toward the apex of the cop. As shown, there is jointed to the guide C the upper end of a blade 12, which extends through a slot in the cross-bar 8 and which carries at the lower end a pin 14, that extends through a slot *s* in bracket 40, attached to the frame, a spring 41, attached to the pin 14 and to the bracket, tending to draw down the blade. A bar or rod 17 slides in the frame parallel to the shaft 10, from which bar a pin 13 extends through a slot *t* in the blade 12, and a stud 18, Fig. 2, extends from the rod 17 through a slot in the frame into the groove of a driving-cam D, secured to a shaft 6, to which rotation is imparted from a shaft 42 through the medium of a belt and pulleys or otherwise.

When the guide C is at the base of the cone, the blade 12 is vertical, and as the guide C is carried in horizontal line toward the apex of the cone the blade 12, actuated by the rod 17 and its pin 13, assumes an inclined position, traveling at an increasing rate of speed. By connecting the operating-rod 17 with the blade 12 at a distance from the upper end of the blade the full movement of the guide is secured by a more limited traverse of the rod 17 than would be required if the connection was near or at the point where the guide is connected to the blade. The acceleration of speed may be increased by inclining the slot *s*, as in Fig. 6, or by piv-

otally connecting the lower end of the blade 12 to the free end of an eccentric-lever 12′, pivoted at $12^{\times}$, as in Fig. 7.

While any suitable means may be employed for rotating the shaft 10, I prefer a friction-drive consisting of a friction pulley or disk 88 on a shaft 7, turning at right angles to the shaft 10 and constituting the main driving-shaft of the machine, and a friction pulley or wheel 9, secured to the shaft 10 and normally bearing on the face of the friction-disk 88 to be driven thereby. This constitutes a simple drive mechanism especially adapted for use in apparatus where there is a series of driving drums or rolls, in which case the shaft 7 may carry a series of friction pulleys or disks for engaging the friction-wheels of the different drum-shafts.

While any suitable movable support may be employed for supporting the spindle 2, I have shown a swinging arm E, pivoted to a stationary arm 44 on the frame and carrying the spindle so that the latter may swing freely upward as the cop increases in size. Inasmuch, however, as the cop, owing to the peculiar wind above described, increases in thickness more rapidly at the base than at the apex, I provide means for gradually altering the angle of the spindle to the drum, carrying the rear end of the spindle upward faster than the point is raised. Different means may be employed for this purose; but, as shown, there is an inclined and curved bearing 5, supported by the arm 44, and the spindle 2 is carried by a stud 20, Fig. 3, capable of turning in the arm E, and a lug 21 extends from the stud 20 through a slot in the arm E and bears against the face of the bearing 5, which thus imparts to the stud 20, as the arm E rises, such a rocking motion as will insure the proper change of angle of the spindle 2. The spindle may also be raised whenever required by lifting a rack-bar 4, Figs. 2 and 4, which is connected with a pin 23, extending from the arm E, so that the upward motion of the rack-bar will raise the arm E and the spindle and cop. The lifting motion of the rack-bar may be secured by any suitable devices—for instance, by a pinion 25, Fig. 4, upon a shaft 26, turning in bearings on the frame, and provided with an operating-handle 27.

The stopping and starting of the drum A may be effected by separating and bringing together the friction-pulleys 9 and 88, and I therefore mount the shaft 10 in a box 29, Fig. 5, capable of a slight oscillation on a pin 50 to carry the inner end of the shaft toward and from the pulley or disk 88, and I mount a cam, shown as a cam-lever G, Fig. 3, to swing upon the end of the shaft 26 and provided with a cam edge x of such a character that when this end of the lever is depressed it will bear against the shaft 10 and force it in the direction of the arrow, Fig. 3, sufficiently to carry the friction-pulley 9 out of contact with the plate 88. A spring 51 in an annular groove in the bottom of the box 29 tends to turn the box and keep the friction-pulleys in contact.

The cam-lever G is normally held in the position shown in full lines, Fig. 3, by suitable stop devices, but is dropped on the breaking of the yarn or thread, being preferably then positively moved to shift the position of the shaft 10. While different devices may be employed to effect these operations, I prefer to connect to the rear end of an arm 86, projecting from the cam-lever G, a bar 45, through the medium of loose connections constituting a universal joint, and which will permit the bar to rise and fall while maintaining a vertical position and also permit it to swing toward and from a rock-shaft 52, Fig. 1, carrying an arm 46, the end of which extends into a vertical slot y of the bar 45. A constant rocking motion is imparted to the shaft 52 from any moving part of the machine—as, for instance, from an eccentric-strap 53, dotted lines, Fig. 1, on the shaft 7, through the medium of a connecting-rod 54 and an arm 55 on the shaft 52, and when the bar 45 is in the position shown in dotted lines, Fig. 1, the upward movement of the arm 46 will lift the bar, swing the cam-lever G, and stop the rotation of the drum A. Normally, however, the bar is maintained in the vertical position (shown in full lines) by the thread passing to the guide and will remain in this position until the thread is broken. To secure this result, a wire or rod 47 extends from the bar 45 through a slot in the plate 48 and has a terminal eye 49, through which the thread v passes on its course through a guide-eye 60 around a guide 66, thence downward around a guide-rod 61, beneath which it is carried on its way to the guide C, the thread bearing on the plate 48 and preventing the eye of the rod 47 from passing through the plate. When, however, the thread breaks, the eye can pass through the plate, allowing the bar 45 to fall back to the position shown in dotted lines, Fig. 1. On the next upward movement of the arm 46 a finger 56 on the said arm will make contact with the bar 45, restoring it to position and carrying the eye 49 beyond the plate 48 for rethreading.

The tendency of the upper end of the bar 45 to swing outward and restore the drop-wire to position is increased by swinging inward the lower end of the bar as it is lifted. Thus an inclined slot 65, Fig. 1, in an arm 75, attached to the frame, receives the end of the arm 86, carrying it inward as the arm rises, thus tending to throw the upper end of the arm 45 toward the bearing-plate 5.

To enable the operator to lift the cam-lever G and start the driving-drum, I make use of the shaft 26, Fig. 4, which is provided with a feather, so that it can slide in the spur-wheel 25, and which carries a clutch 58, having teeth adapted to engage the teeth of the hub 59 of the lever G, so that when the shaft 26 is

pushed in the direction of its arrow, Fig. 4, to bring the clutch members into engagement and is then turned the lever G may be swung on its axis and lifted out of contact with the shaft 10, which may then rotate. When the operating-handle 27 is released, a spring 70, bearing on the collar 71 of the shaft, will carry the latter outward to the position shown in Fig. 4.

Where it is desired to increase the number of winding-heads, this may be effected without increasing the number of cams by setting the rods 17 and their bearings at one side of each cam to permit a second set of rods to be set at the opposite side, as shown in Fig. 2, thereby operating a second guide from the same cam. In this case there will be spindles at both sides of the machine.

It will be evident that some of the features above described may be embodied in machines for winding cylindrical cops.

I do not here claim the cone wound as described, as this forms the subject of a separate application, Serial No. 136,725.

Without limiting myself to the precise constructions set forth, I claim—

1. The combination with a rotating holder and a reciprocating guide and operating means for imparting a quick reciprocation thereto to lay the yarn in successive layers, each consisting of crossed helices on a conical tube supported by the holder, of devices for increasing the speed of movement of the guide as it travels toward the apex of the holder and reducing the speed on the return movement, substantially as set forth.

2. The combination with a rotating inclined holder, driving-cylinder, and a reciprocating guide and operating means for imparting a quick reciprocation thereto to lay the yarn in successive layers, each consisting of crossed helices on a conical tube supported by the holder, of devices for increasing the speed of movement of the guide as it travels toward the apex of the holder and reducing the speed on the return movement, substantially as set forth.

3. The combination with a rotating holder, driving-cylinder, and a reciprocating guide and means for laying yarn in crossed helices on a conical tube supported by the holder, of devices for increasing the speed of movement of the guide as it travels toward the apex of the holder and reducing the speed on the return movement, a support for the holder, and means for varying the angle of the holder to the cylinder as the cop increases in diameter, substantially as set forth.

4. The combination of a driving-drum, holder for a conical cop-tube, a swinging arm, a support upon said arm for the conical cop-tube, and means for positively rocking said support as the arm swings upward, substantially as set forth.

5. The combination of the driving-drum, a swinging arm carrying a support for a conical cop-tube, and means including an operating-handle for raising and lowering said arm and for positively rocking the same as the support is elevated, substantially as set forth.

6. The combination of the driving-drum, conical cop-tube holder, guide, and blade or arm 12 connected with the guide, pivoted at the lower end and occupying a substantially vertical position when the guide is at the base of the cone, there being a slot in the said arm and a reciprocating bar provided with a pin entering said slot, substantially as set forth.

7. The combination with the driving-drum and the holder for a conical cop-tube, of a shaft connected to drive said drum provided at one end with a friction-pulley, a friction-disk arranged parallel to the axis of the shaft and bearing on said pulley, and means for bringing the pulley and disk in contact and for separating them, substantially as set forth.

8. The combination with the drum, holder for a cop-tube above the drum, a shaft carrying the drum, a friction-pulley on the shaft, and a driving-disk engaging said pulley, of a movable support for the shaft, devices for moving said support to separate the pulley and disk, and means bearing upon the yarn passing to the cop-tube for holding said devices out of operation, substantially as set forth.

9. The combination with the shaft, drum carried thereby and cop-holder above the drum and friction-gears, of a movable support for the shaft, a cam adapted to shift the shaft and devices adapted to be supported by the yarn passing to the cop for holding said cam out of operation, substantially as set forth.

10. The combination with the shaft 10 and cam G for shifting the shaft 10, of an arm connected with said cam, a bar jointed at the lower end to said arm, means for positively raising said bar, and means constructed to be supported by the yarn passing to the cop for maintaining the bar normally out of position to be actuated by its operating means, substantially as set forth.

11. The combination with the shaft 10 and devices for shifting the same, of a pivoted bar 45, a reciprocating arm 46, and a drop-wire connected with the bar 45 to hold it out of position to be operated by the arm 46 so long as the yarn is unbroken, substantially as set forth.

12. The combination with the shaft 10 and devices for shifting the same, of the pivoted bar 45, rock-arm 46, drop-wire 47, connected with the bar 45 and a slotted plate through which the outer end of the drop-wire extends, substantially as set forth.

13. The combination of the shaft 10 and its shifting devices, bar 45, rock-arm 46, drop-wire connected with the bar, and a finger 56 on the arm 46, substantially as set forth.

14. The combination of the shaft 10, cam G, jointed arm extending from said cam, bar

45 pivoted to the said arm and connected to be shifted by a drop-wire, and an inclined bearing for carrying the lower end of the bar 45 to one side as the bar is raised, substantially as set forth.

15. The combination with the shaft 10 and cam G, of a clutch device for engaging and turning said cam, a spring for maintaining the parts of the clutch out of contact, and a shaft provided with an operating-handle carrying the movable part of the clutch, substantially as set forth.

16. The combination with the shaft 7 and series of friction-pulleys 88, of two series of shafts 10 on opposite sides of the shaft 7 and driving-cylinders carried thereby, a cop-holder above each cylinder, a guide reciprocating opposite each cylinder, and a cam D and two reciprocating slides with studs engaging the cam-slot on opposite sides of the center thereof, and connections for operating a guide from each slide, substantially as set forth.

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

GEORGE W. FOSTER.

Witnesses:

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JOHN E. CANNING.