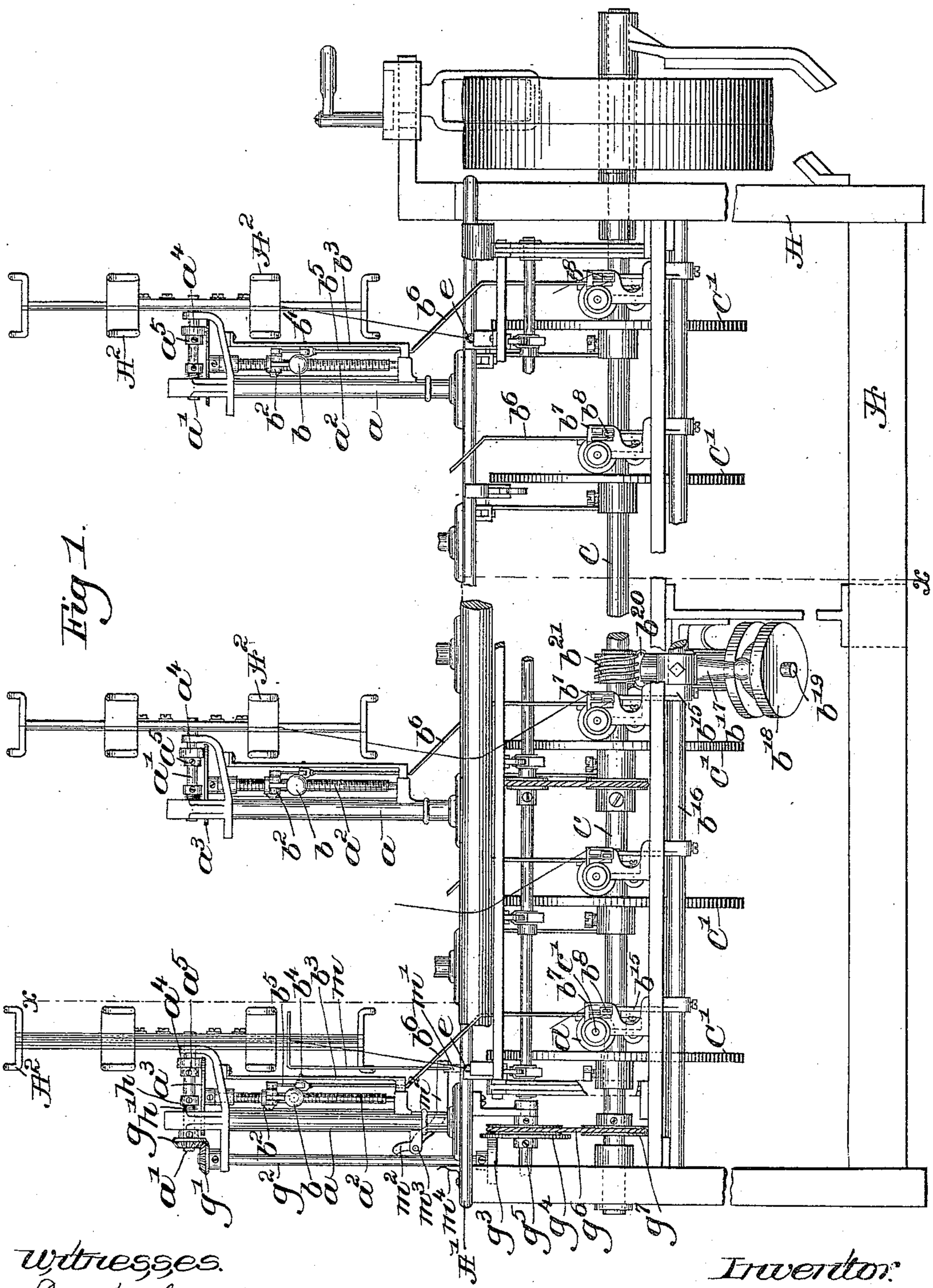
(No Model.) 2 Sheets—Sheet 1.

J. W. FOSTER.

THREAD WINDING MACHINE.

No. 529,548. Patented Nov. 20, 1894.



Witnesses.
Louis N. Gould.
Thomas J. Drummond.

Inventor:
John W. Foster.
By Crosby & Gregory
Attys.

(No Model.) 2 Sheets—Sheet 2.

J. W. FOSTER.

THREAD WINDING MACHINE.

No. 529,548. Patented Nov. 20, 1894.

Fig. 5.

Fig. 3.

Fig. 2.

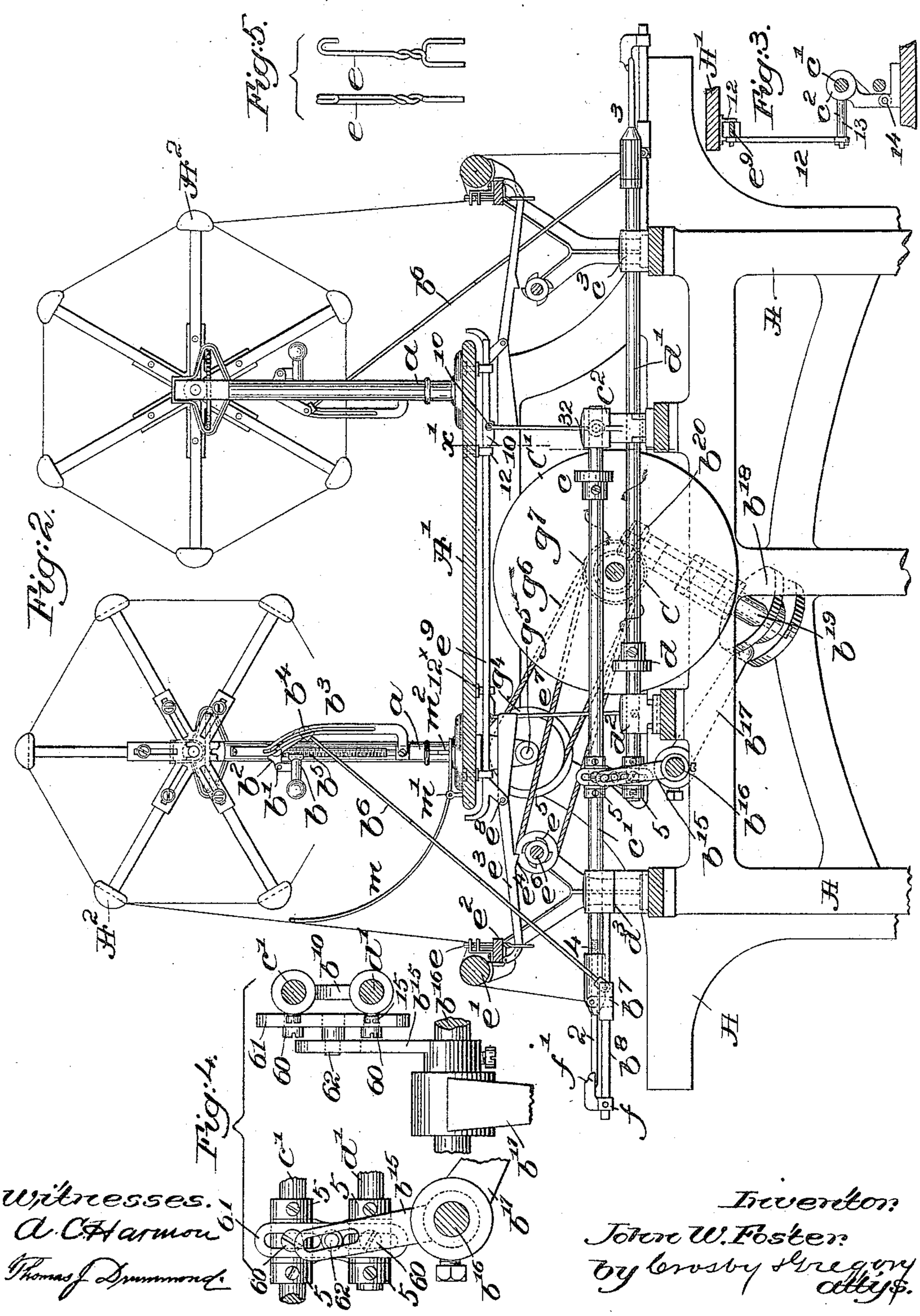


Fig. 4.

Witnesses.
A. C. Harmon
Thomas J. Drummond.

Inventor:
John W. Foster:
by Lovsby & Gregory
Attys.

UNITED STATES PATENT OFFICE.

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

THREAD-WINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 529,548, dated November 20, 1894.

Application filed November 22, 1893. Serial No. 491,658. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. FOSTER, of Westfield, county of Hampden, State of Massachusetts, have invented an Improvement in Thread-Winding Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters and numerals on the drawings representing like parts.

Thread winding machines now commonly in use and employed to wind thread in cop or bobbin form after what is known as "filling wind" for use in loom shuttles and other places, commonly contain spindles which rotate within conical caps, the caps shaping the nose of the cop or bobbin. In this class of machine the friction of the thread against the cap is very considerable, such friction being very objectionable not only to fine threads but to colored threads.

In my studies to improve and simplify machines for winding cops or bobbins, I have devised a machine by which I may wind cops or bobbins without the employment of a conical cap.

In my invention I have combined with a rotating spindle a thread-guide which is controlled as to its movements by a pattern device, which, for greatest simplicity, may be a cam-shaped track, one portion of such pattern device being of such shape as to control the building of the heel of the cop if the thread is to be wound on a bare spindle or paper tube, the remainder of the track causing the thread-guide to be slowly moved toward the free end of the spindle at a slower or faster speed according to the number of the yarn, to thus provide for the winding of one conical layer after another. During this operation the spindles having a motion of rotation have imparted to them a reciprocating motion equal in extent substantially to the length of the required traverse.

In my invention I have aimed to take the thread from its source of supply, a skein or otherwise, at a uniform speed, notwithstanding the different diameters of the thread mass upon which the thread is being laid, and this I provided for by rotating the spindles frictionally from one side of a disk, said spindles having friction wheels to contact with said disks, the said spindles crossing, however, the axis of rotation of said driving disks, said friction wheels being driven from parts of said disks at the rear, rather than at the front sides of said disks. Driving said spindles from the rear sides of said disks enables the friction wheels on the spindles to be moved from the shafts carrying said disks toward the outer edges of said disks as the thread being wound approaches the bare spindle at which time the rotation of the spindle must be faster in order to take up the same quantity of yarn, the rotation of the spindle while winding from the center thereof toward the periphery of the thread mass being slower, for at such time the friction wheels on the spindles are being moved toward the center of rotation of said disks. To reciprocate the spindles I have employed a heart cam device of peculiar construction, it, through suitable connections with the spindle, preferably by a rock shaft, moving the spindles longitudinally substantially in unison, but in opposite directions one to the other as regard the outer ends or points of the spindles. I have mounted the spindles in movable bearings controlled as to their positions by or through suitable stop-motion mechanism depending for its operation upon the breaking of the thread, said bearings being moved to break driving contact between the friction wheel of a spindle and its driving disk on the failure of the thread going to that spindle. I have also devised means whereby I may quickly change the speed of movement of the thread guide, or the feed of the thread, according to the number of the yarn; and I have also further improved the said machine whereby a reel or swift on which a skein to be wound off is held, so that said reel or swift may be rotated positively to supply thread to the spindle at the speed required for the thread being wound so as not to subject the said thread to uneven strain, and, in fact, substantially all strain may be prevented.

The thread may be subjected to a uniform tension in any usual manner, as by a cloth covered rod or otherwise.

Figure 1 in front elevation, partially broken out, shows a sufficient portion of a thread winding machine with my improvements

added to enable my invention to be understood. Fig. 2 is a section in the line *x*, Fig. 1, looking to the left in that figure. Fig. 3 is a detail showing the movable bearing for one of the spindles. Fig. 4 is a detail showing on an enlarged scale some of the devices employed to reciprocate the spindles. Fig. 5 shows a drop wire detached.

The frame-work A, composed chiefly of side frames united by cross-beams or ties, is and may be of any suitable shape to support the working parts, said frame supporting at its top side a beam or plate A′, upon which, as herein represented, I have erected suitable standards *a* at the upper ends of which are suitable heads or yokes, see Fig. 1, to support each shaft *a′* of a reel or swift A^2, which may be of any usual or suitable construction. The upright *a* has suitable lugs to constitute bearings for a rotating feed screw a^2, having connected with it at its upper end a disk a^3, against which bears a friction wheel a^4 secured to the swift shaft preferably in an adjustable manner by a screw a^5, so that said friction wheel may be adjusted longitudinally on said shaft toward and from the center of said disk, that depending upon the speed at which it is desired to rotate the screw shaft a^2, the said shaft being rotated the more rapidly as the friction wheel a^4 is moved toward the center of the disk, these differences in speed enabling the use of yarns of different numbers by the use of one and the same sized reel. The screw referred to has co-operating with it a pawl-nut *b*, the end of which next the screw is threaded to engage the threads of the screw, the pawl-nut being pivoted at *b′* upon a lug attached to a sleeve b^2 surrounding the said screw loosely.

The upright *a* serves to support a pattern device b^3, shown as a track fixed at its opposite ends, the track being herein represented as being of cam-shape and slotted for the reception of a roller or other stud b^4 carried by a radius bar or arm b^5, pivoted at its upper end to the said sleeve b^2. The radius bar has jointed to it a connection b^6 shown as a rod, which at its opposite ends is jointed to a thread-guide b^7 of suitable shape, which is mounted upon a guide b^8 preferably fixed at one end to some part of the frame-work. As the swift or reel is rotated, which may be either by the pull of the thread upon it on its way to the spindle, or positively, as will be hereinafter described, the screw a^2 is rotated at a greater or less speed, and the sleeve b^2, through the action of the nut *b* is drawn down causing the roller or other stud b^4, co-operating with the track, to move the thread-guide upon its guide b^8, such movement being a slow movement and the speed depending upon the number of the yarn.

When the thread is to be wound upon a bare spindle or a tube, then the upper end of the pattern device will be more or less curved or irregular in shape to enable the thread *b′* to be wound into a more or less conical shape, according to the shape desired for the heel of the thread mass, such heels being commonly employed as starters for winding in spinning machines.

If the thread is to be wound upon a bobbin having a conical base, then the track casting will be changed to adapt it to that class of work, the cam being almost obliterated or being of but slight extent.

The frame-work has bearings for what I shall denominate the main shaft C, it having attached to it at suitable intervals disks C′ against which bear friction wheels or pulleys *d*, *c*, attached respectively to spindles *d′*, *c′*, said spindles having suitable bearings as d^2, c^3, and c^2, d^3, in which they may slide in the direction of their length, the said bearings c^2, d^2, being preferably each pivoted so that it may be moved laterally or about a pivot substantially at right angles to the axis of the shaft C, so that the friction wheels *c* and *d*, may, when a thread breaks, as will be described, be removed from driving contact with the disks. In this class of machine it is desired frequently to wind different classes of cops, quills, or bobbins, and to do this effectually I have made the tips 2 and 3 of the spindles *c′*, *d′*, removable by or through suitable threaded portions, as shown at 4, at the left of Fig. 2, so that said tips may be removed and a tip of any desired length, shape or diameter be employed in connection with the spindle according to the work to be done.

The spindles *c′*, *d′*, see Fig. 2, are extended from the sides of the machine across and beyond the main-shaft C, so that the friction wheels *c* and *d*, may be rotated from the portions of said disk C′ at the rear side, as, for instance, the spindle *c′* is having wound upon its free end, as at the left in Fig. 2, thread, and the opposite end of the spindle goes beyond the shaft C to the right viewing said figure.

The spindles *c′* and *d′* have fast upon them suitable collars 5, preferably two such collars to each spindle, and between said collars the said spindles are surrounded by a coupling b^{10}, best shown in the detail Fig. 4, said coupling having adjustably connected with it by screws 60, a slotted plate 61, having a stud 62, which, as shown, is engaged by a slotted arm b^{15} of a rock-shaft b^{16} having another arm, as b^{17}, provided at its end with a ball or other like end to enter a groove in a double heart cam b^{18} fast upon a shaft b^{19} mounted in suitable bearings supported by the frame, said shaft b^{19}, as herein represented, being provided with a worm-gear b^{20} which is engaged by a worm b^{21} secured to the shaft C, so that said heart cam is rotated uniformly from the said shaft C, and in its rotation the heart cam, through the rock-shaft b^{16}, reciprocates the said spindles in unison in their bearings, but the spindles are rotated in opposite directions with relation to their points, the length of reciprocation being determined by the adjustment of the pin 62 in the slot of

arm b^{15}, such adjustment providing for the traverse required for the spindle, that depending upon the number of the thread to be wound. The thread coming from, as herein shown, the reel or swift, is passed under a suitable drop wire *e*, thence over a tension or guide-roll *e'* and down to and through a suitable eye in the thread guide b^7.

The drop wire, shown separately in Fig. 5, is guided in a suitable bar e^2, and, as represented, straddles a pivoted lever e^3, which at its rear end is so weighted as to normally keep the outer end of said lever pressed up to, or nearly to, said bar, at which time a hook e^4 on said lever is out of the range of movement of a ratchet wheel e^5 mounted on a suitable shaft e^6 which is rotated by a suitable belt, as e^7. This ratchet wheel and shaft is common to United States Patent No. 404,831, granted to me June 11, 1889.

The lever e^3 is pivoted at e^8 on a slide-bar e^9 mounted in suitable bearings 12, 12× underneath the plate A', said slide-bar having a suitable cam lug or projection 10 beveled at one end near the bearing 12, so that as said bar e^9 is drawn forward by means of the ratchet wheel e^5, the said cam acting against the bearing 12 will lift the said bar, and by or through a connecting rod 32, see Fig. 3, joined at its lower end to a finger 13 of the bearing c^2, will cause said bearing to be tipped about its pivot 14 to carry the spindle *c'* away from the disk C', so that the friction wheel *c* carried by said spindle will cease to rotate.

It will be understood in order to wind the yarn upon the spindle at a uniform speed that the spindle itself must be rotated at a variable speed, it rotating the faster as the thread is nearer the center of rotation of the spindle, and it is only by arranging the friction wheels *c* and *d*, referred to, at points behind the said shaft C that this variation in speed may be practically made to accommodate the requirements of the thread to the movement of the spindle, and this manner of driving the spindle is one of the essential features of my invention.

I have shown one simple way of moving the spindles so as to stop their rotation when the thread breaks and lets the lever e^3 drop, but it will be obvious to a skilled mechanic that many different forms of devices, without the exercise of inventive genius, might be substituted for the devices shown.

As the thread masses increase in length and diameter and reach the proper size the machine should be stopped, and to effect this automatically I have mounted upon the guide b^8 a blade-holder *f* having a suitable notch or blade *f'*, against which the thread between the thread-guide and the thread mass strikes when the proper amount of thread has been wound, said blade automatically cutting the said thread and letting the drop-wire act to stop further winding on, as before described.

It is, with some classes of yarns, a very great desideratum to feed the thread from the swift or reel positively, so that the said thread shall not be called upon to furnish the power to rotate the reel, so to rotate the reel positively, when desired, I have provided the reel shaft *a'* with a bevel gear *g* which is engaged by the bevel gear *g'* on a shaft g^2 extended upwardly from the machine, said shaft having fast upon it at its lower end a friction wheel g^3 which bears against the face of a disk g^4 fast upon a suitable shaft g^5 having a suitable pulley, so that the said shaft may be rotated in any suitable manner, as for instance by the belt g^6, extended over the pulley g^7 on the shaft C. The disk g^4 rotates the shaft g^2 and the latter rotates the reel shaft.

To prevent the too rapid rotation or overrunning of the reel I have in this instance of my invention provided the reel shaft with an adjustable collar *h* between which and one of the bearings for the reel shaft I have placed a washer or friction device, herein represented as a spiral spring *h'*.

If for any reason the thread becomes slack, it is not then desired to further rotate the reel shaft, and to obviate this I have combined with the machine a suitable feeler, as *m*, it being shown as a wire pivoted upon a stand *m'*, see Fig. 2, the rear end of said feeler lying under a lever m^2 which is pivoted upon a stand m^3, shown best in Fig. 1 at the left, the short arm of said lever bearing against the shaft g^2.

Fig. 2 shows the feeler in its normal position, but should the thread become slack the formation of further injurious slack would be prevented by the dropping of the feeler, so that it would turn the lever m^2 and cause that lever acting against the shaft g^2 to push it away from the disk g^4 against the spring m^4 and thus break the driving contact between the wheel g^3 and said disk g^4. This provision of positively rotating the swift or reel so that it may give off its thread at a desired speed, enables very tender yarn to be wound directly from the skein in cop-form without intermediate handling heretofore considered necessary.

If the yarn is strong enough to furnish the power to rotate the swift or reel, I will then in practice remove the gear *g* from the reel-shaft or so place it on the shaft that it will not mesh with the bevel gear *g'*.

The shaft C in practice will be driven by any usual or suitable fast and loose pulleys controlled by any usual shippers.

By adjusting the block *f* upon the guide b^8 the thread-cutting or breaking device *f'* may be made to operate sooner or later, that depending upon the length of the thread-mass to be wound upon the spindle, quill, or other device carried by the spindle, as it will be understood that the conical thread masses herein produced will be largely used in loom shuttles, and loom shuttles vary in length and diameter.

It will be understood that the speed of rotation of the reel may be made faster or slower, and the length of reciprocation of the spindles be correspondingly changed to thus enable one to wind thread more or less compactly and into masses of any desired size.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A spindle, and devices to rotate it at a variable speed while winding each layer of thread and to reciprocate it during its rotation; combined with a thread-guide, and a pattern device or surface, and connections between said thread-guide and said pattern device, whereby the latter gradually moves said thread-guide toward the point of the spindle as the thread is wound thereon, substantially as described.

2. A spindle, devices to rotate it, and devices to reciprocate said spindle during its rotation to wind the thread helically thereon; combined with a thread guide; a pattern device; and connections between said thread guide and said pattern device, whereby the latter gradually moves said thread guide toward the point of the spindle as layer after layer of thread is wound thereon, substantially as described.

3. A spindle, devices to both rotate and to reciprocate the same; a thread guide; a pattern device; a stand; a screw shaft mounted therein; a sleeve having a threaded nut to engage said screw, and connections between said sleeve and said thread guide, said connections being controlled by said pattern device as the sleeve is moved by the screw shaft, combined with a reel, its shaft, and devices between said reel shaft and said screw shaft to rotate the latter, and move said nut and cause the connections between the nut and thread guide to follow the pattern device, to operate, substantially as described.

4. In a machine for winding thread into cop form, a spindle, devices to reciprocate it and also to rotate it at a variable speed as the thread is being wound from a larger to a smaller diameter, and vice versa, a screw, a pattern device having a portion thereof shaped to build the heel of the thread mass to be wound, and a thread guide, combined with connections between said thread guide and said pattern device, and between said pattern device and said screw whereby said thread guide may be moved more or less rapidly toward the point of the spindle as one layer after another of thread is added to the spindle, the speed of movement of the thread guide being controlled by said pattern device, substantially as described.

5. A spindle, a thread guide, devices to reciprocate said spindle and means to rotate it at a variable speed; devices to move the said thread-guide toward the point end of said spindle; a reel; its shaft, and devices to engage and rotate said reel-shaft whereby the thread carried by the said reel is unwound without straining the thread, substantially as described.

6. A spindle, a thread guide, devices to reciprocate said spindle, and devices to rotate it at a variable speed; devices to move the said thread guide toward the point end of said spindle; a reel, its shaft, a gear thereon; the rotatable laterally movable shaft g^2 provided with a gear and a friction wheel, the rotating disk g^4, a feeler to bear on the thread between said reel and said spindle, combined with intermediate devices between said feeler and said shaft, whereby the rotation of the latter is arrested on the occurrence of slack thread, to thus stop the rotation of the reel, substantially as described.

7. In a machine for winding thread the following instrumentalities, viz:—a rotating shaft provided with a friction disk; and a thread guide; combined with a spindle extended across said shaft and having a friction wheel secured to it behind said shaft, said wheel being adapted to bear against and be rotated by said disk; a movable bearing on which said spindle is mounted; devices to move said bearing to remove said friction wheel from driving contact with said friction disk; and devices to reciprocate said spindle longitudinally, substantially as described.

8. A rotating driving shaft provided with a friction disk; a rotatable and reciprocating spindle having a friction wheel secured thereto and adapted to be rotated by the contact of its edge with the side of said disk; a movable bearing for said spindle; a drop wire; a lever adapted to be turned by the drop wire when not supported properly by a thread; a support for said lever, and connections between said support and said bearing, whereby upon the movement of said lever the said bearing may be moved to carry the friction wheel of the spindle laterally away from the side of the friction wheel on the rotating shaft and effect the stopping of the rotation of the spindle, substantially as described.

9. In a thread winding machine the following instrumentalities, viz:—a rotating shaft provided with an attached friction disk; two spindles having their inner ends extended across said shaft from opposite directions, each spindle having a friction wheel and adapted to be rotated by said disk; a coupling to connect said spindles; a heart cam; and devices between said heart cam and said coupling to reciprocate said spindles substantially in unison in the direction of their length and enable them at the same time to be rotated at a variable speed in opposite directions, substantially as described.

10. A thread winding machine containing the following instrumentalities, viz:—a shaft having a friction disk; a spindle having a friction wheel and adapted to be rotated by said disk; a heart cam, devices between it and said spindle to reciprocate the latter across said shaft whereby said spindle is rotated at a variable speed during its reciprocations; a thread

guide; a pattern device; connections between said pattern device and said thread guide to gradually move the same longitudinally with relation to the spindle as the cop is being wound; and a reel to supply said thread guide with thread, substantially as described.

11. A thread winding machine containing the following instrumentalities, viz:—a shaft having a friction disk; a spindle having a friction wheel and adapted to be rotated by said disk; a heart cam, devices between it and said spindle to reciprocate the latter across said shaft whereby said spindle is rotated at a variable speed during its reciprocations; a thread guide; a pattern device; connections between said pattern device and said thread guide to gradually move the same longitudinally with relation to the spindle as the cop is being wound; and a reel, and devices to rotate said reel to cause it to feed off the thread at the desired speed, substantially as described.

12. In a thread winding machine, a rotating shaft having a friction disk; two spindles crossing said shaft substantially at right angles and provided each with a friction wheel to co-operate with said friction disk; a coupling to connect said spindles; and a heart cam; combined with intermediate devices located between said heart cam and said coupling, said devices being adjustable to provide for greater or less reciprocations of the said spindles, substantially as described.

13. In a thread winding machine, a spindle, devices to rotate and reciprocate the same; a thread guide; a pattern device, and intermediate connections to control the movement of said thread guide; and a thread cutter to cut the thread going to the spindle when the yarn mass has been wound to the desired size, substantially as described.

14. A spindle, and devices to rotate and to reciprocate the same, a reel, a screw shaft, and gearing between it and the shaft of the reel to rotate the screw shaft, a sleeve having a threaded nut and embracing said screw shaft, a thread guide, and connections between said nut and said thread guide, combined with a pattern surface co-operating with the connections between the screw and the thread guide to move the said thread guide according to the requirements of the pattern device to gradually provide for building the nose of the cop or thread mass, substantially as described.

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

JOHN W. FOSTER.

Witnesses:

GEO. W. GREGORY,

LAURA MANIX.