(No Model.) 6 Sheets—Sheet 1.

J. W. FOSTER.

THREAD WINDING OR SPOOLING MACHINE.

No. 554,621. Patented Feb. 11, 1896.

Fig. 7a.

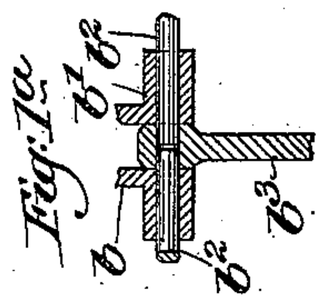
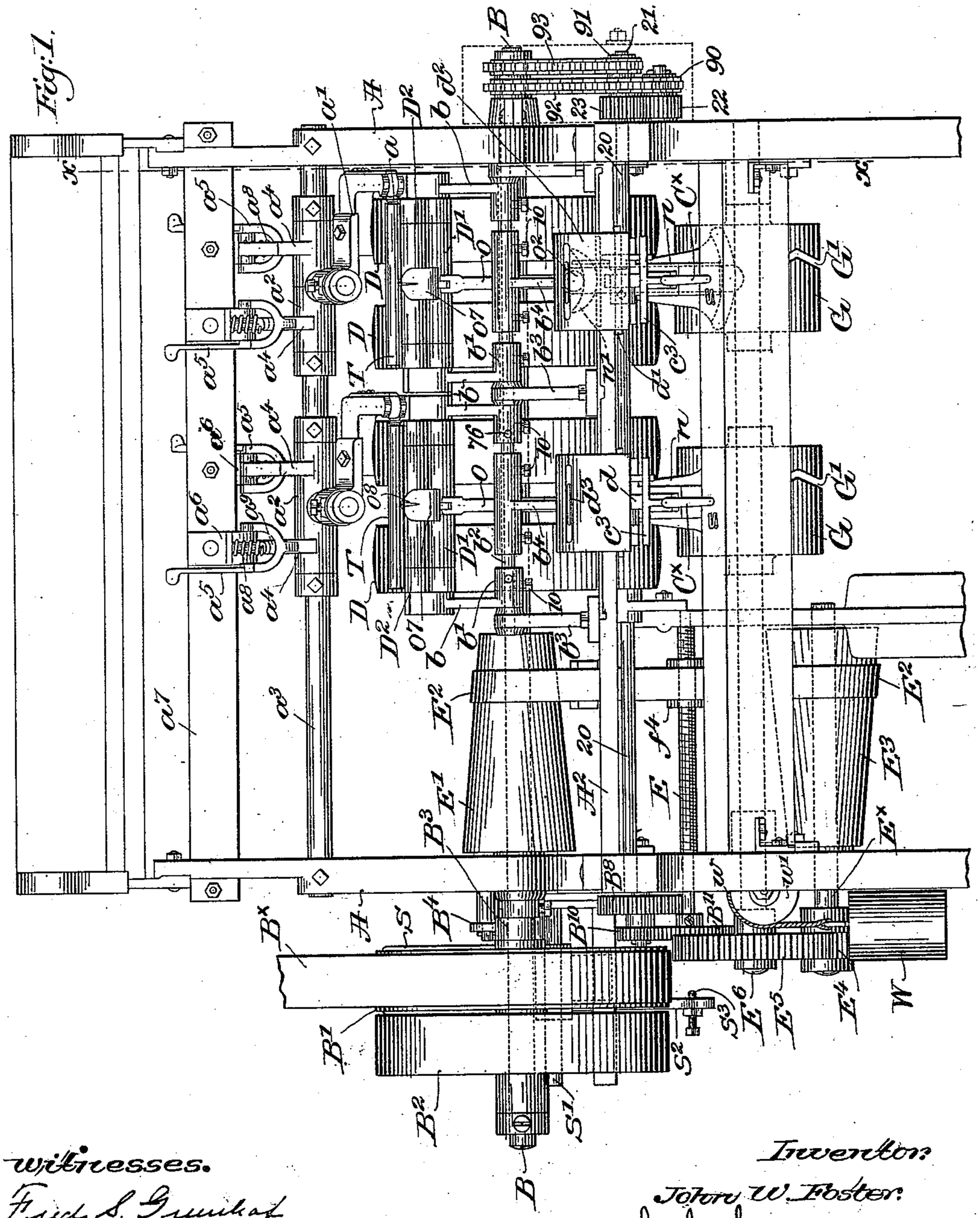


Fig. 1.



Witnesses.
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John W. Foster:
by Crosby & Gregory. Attys.

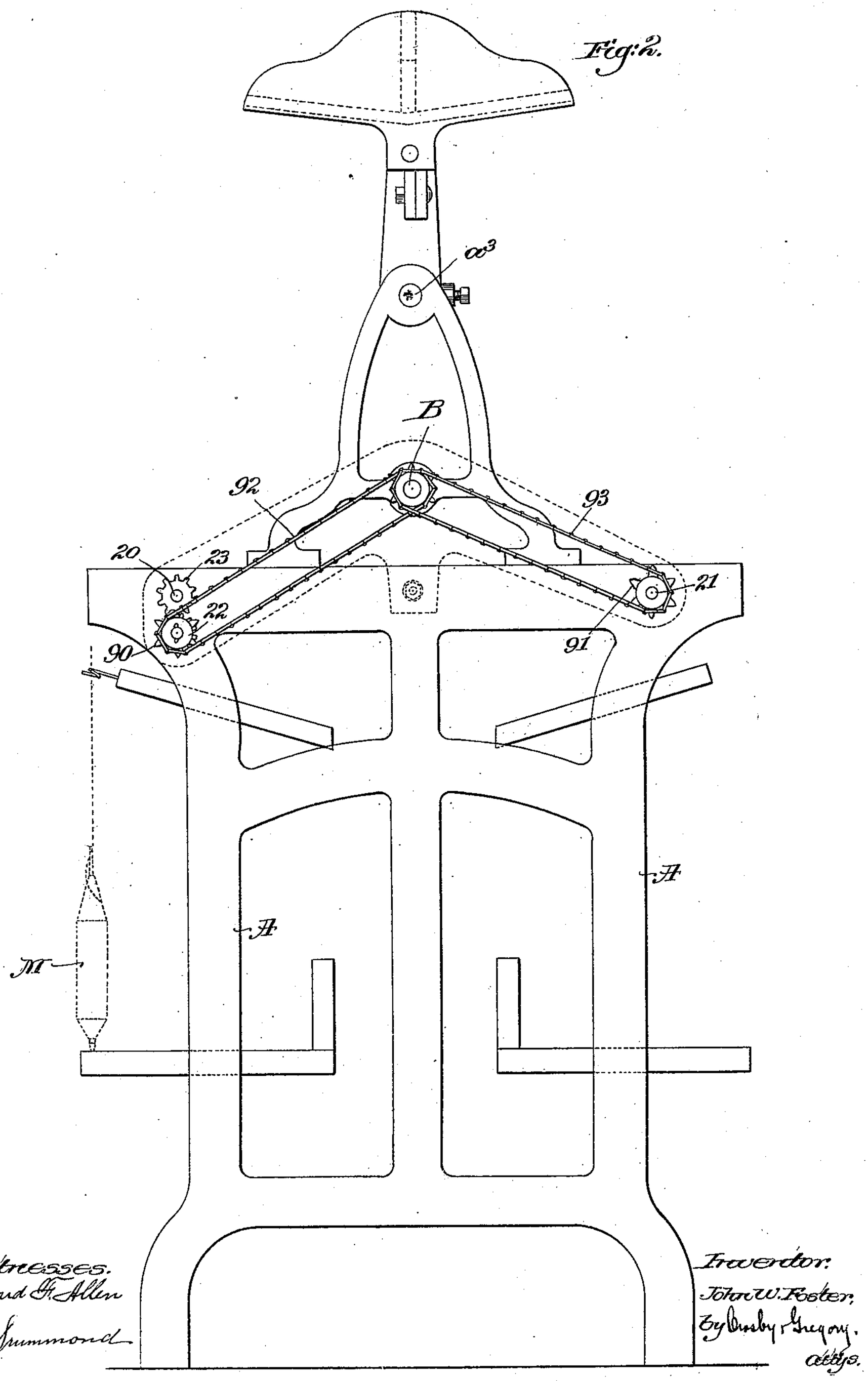
(No Model.) 6 Sheets—Sheet 2.

J. W. FOSTER.

THREAD WINDING OR SPOOLING MACHINE.

No. 554,621. Patented Feb. 11, 1896.

Fig: 2.



Witnesses.
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(No Model.) 6 Sheets—Sheet 3.

J. W. FOSTER.

THREAD WINDING OR SPOOLING MACHINE.

No. 554,621. Patented Feb. 11, 1896.

Fig. 3.

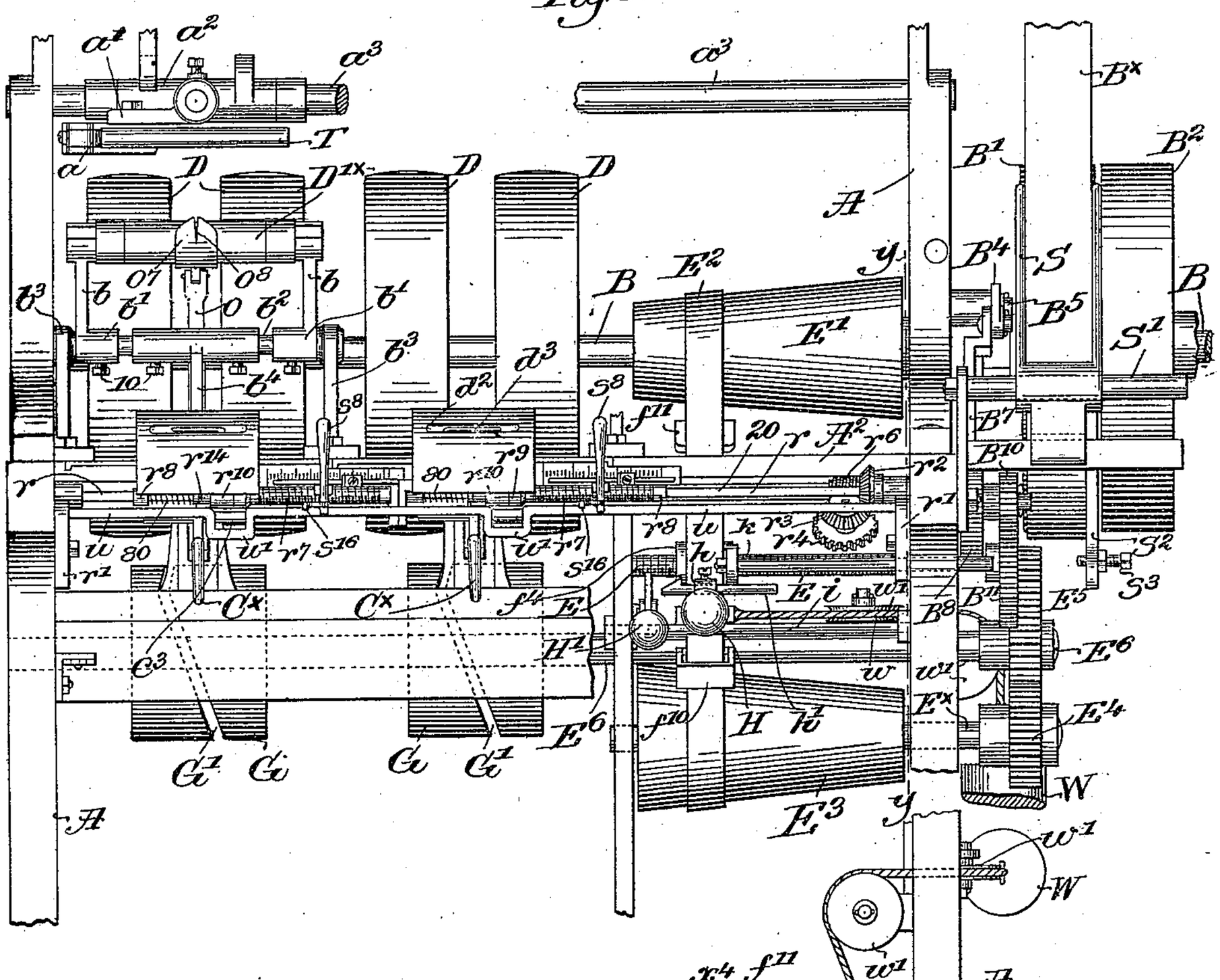
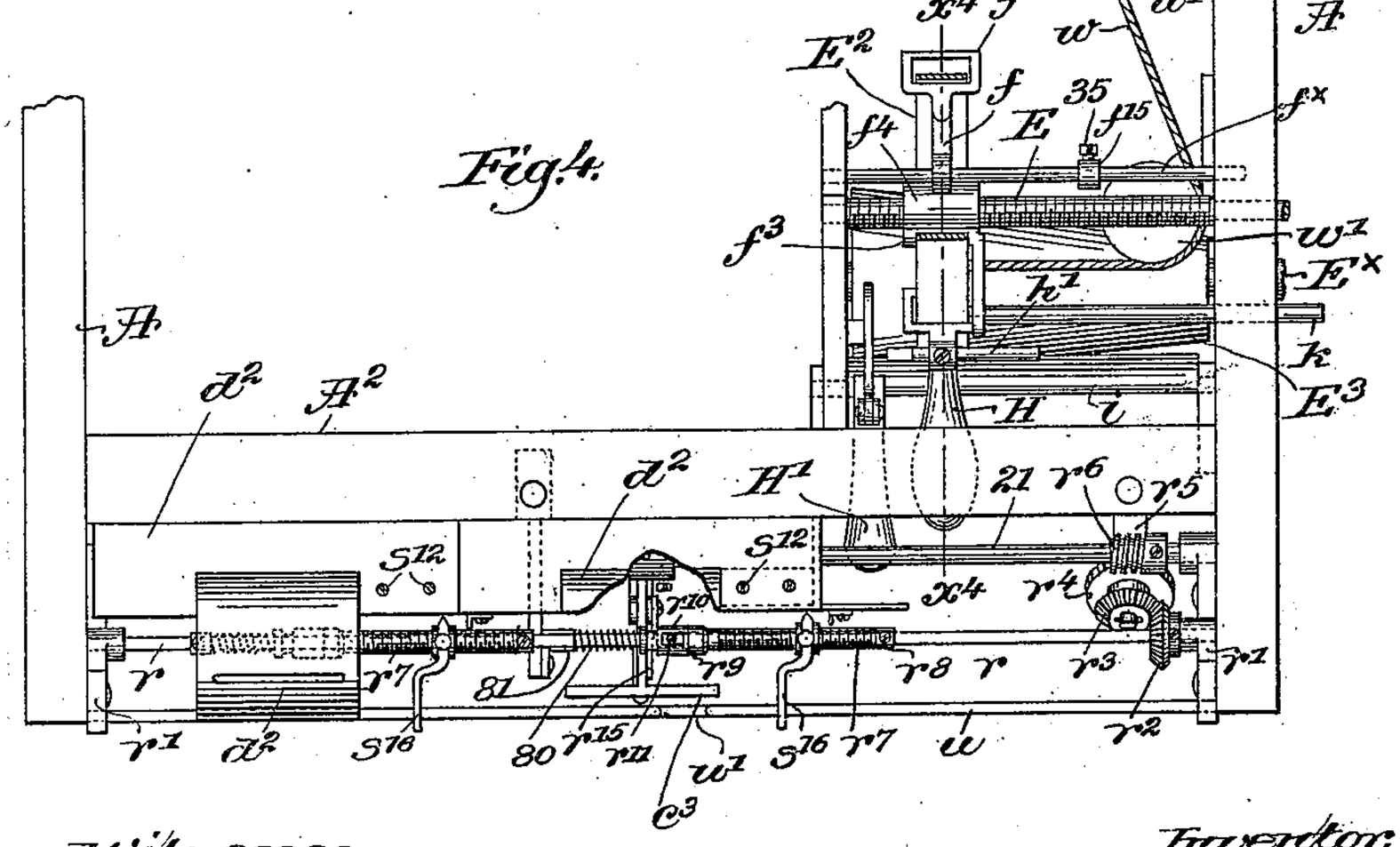


Fig. 4.



Witnesses.
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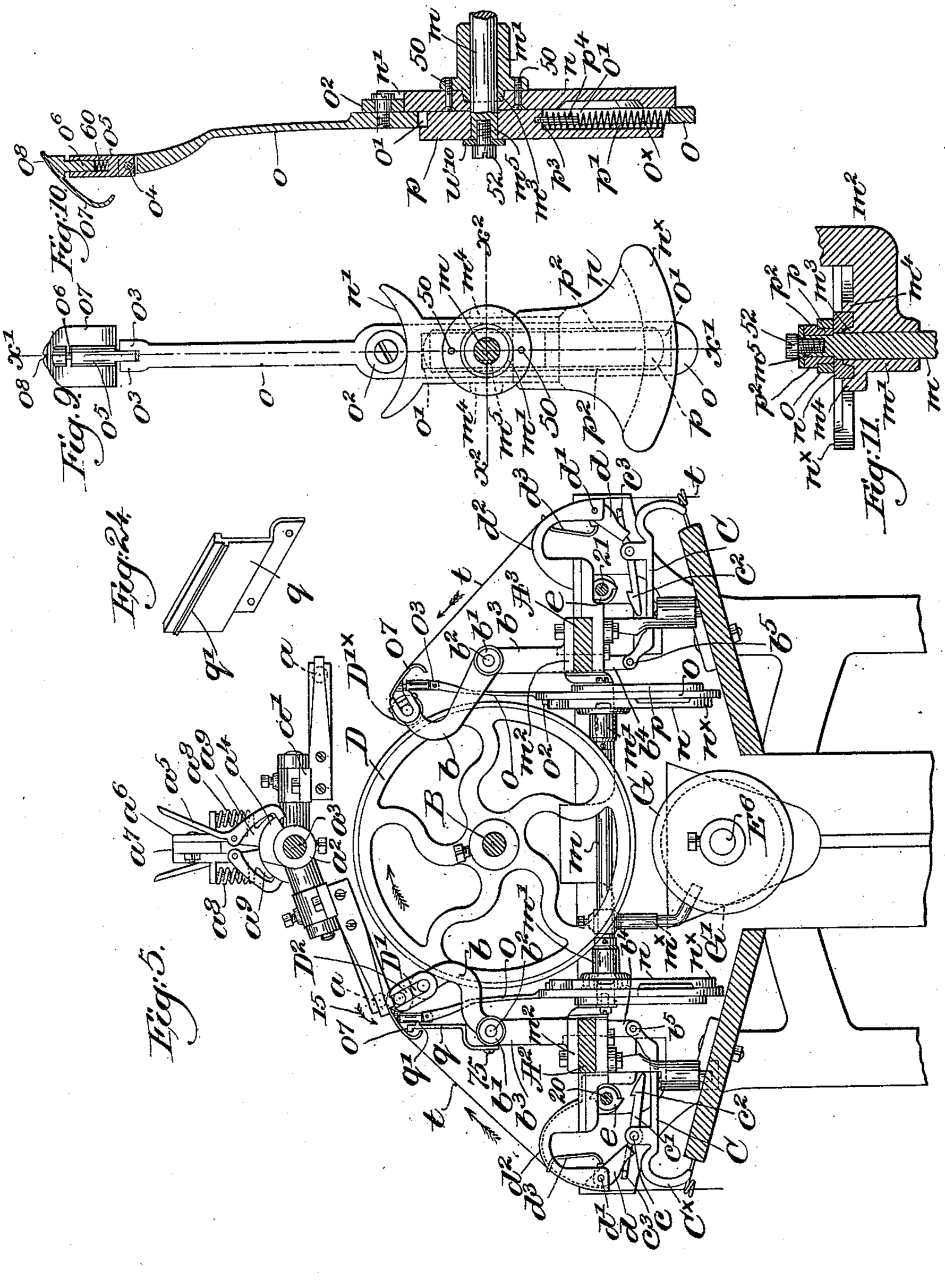
(No Model.) 6 Sheets—Sheet 4.

J. W. FOSTER.

THREAD WINDING OR SPOOLING MACHINE.

No. 554,621. Patented Feb. 11, 1896.



Witnesses.
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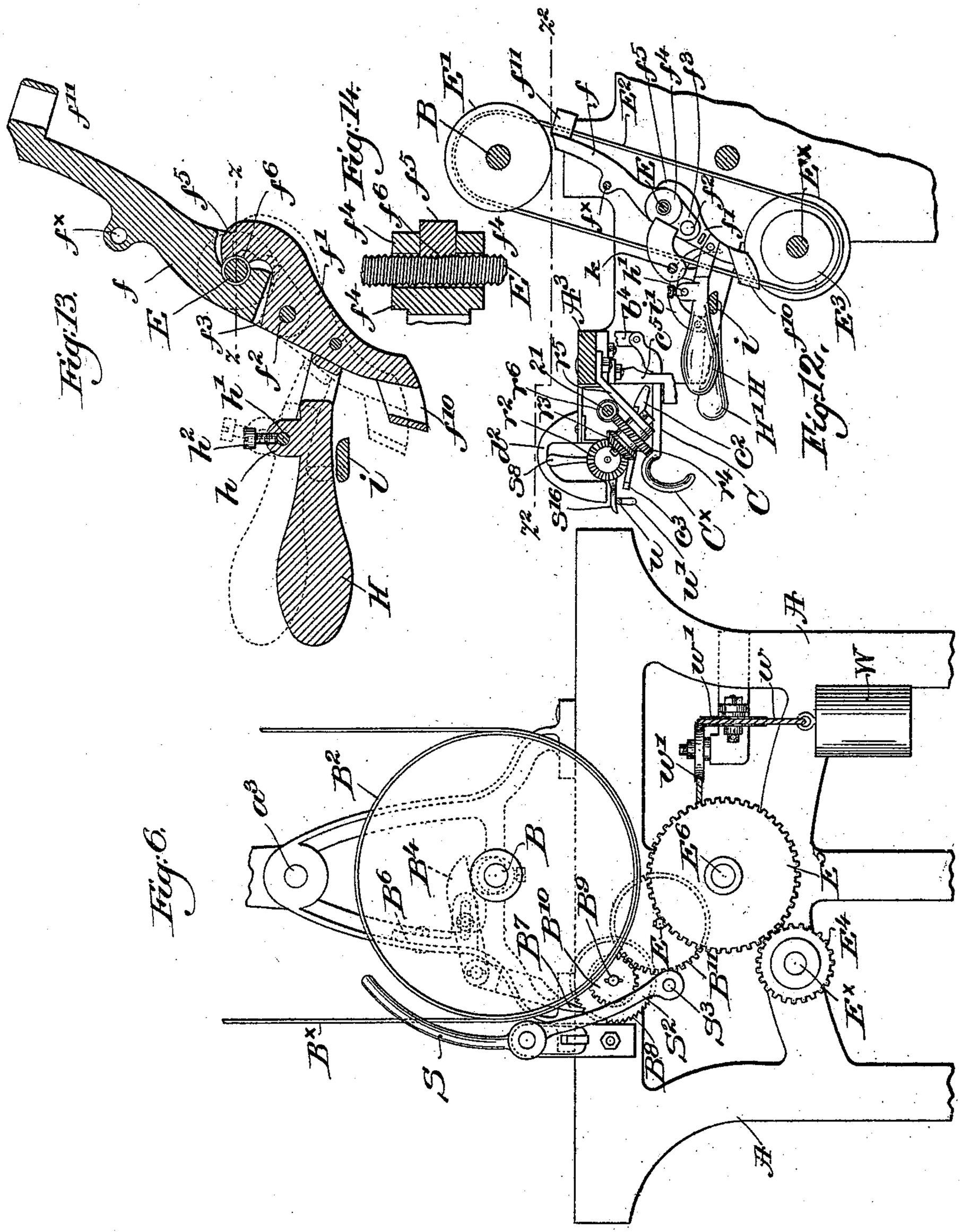
(No Model.) 6 Sheets—Sheet 5.

J. W. FOSTER.

THREAD WINDING OR SPOOLING MACHINE.

No. 554,621. Patented Feb. 11, 1896.



Witnesses.
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(No Model.) 6 Sheets—Sheet 6.

J. W. FOSTER.

THREAD WINDING OR SPOOLING MACHINE.

No. 554,621. Patented Feb. 11, 1896.

Fig: 15.

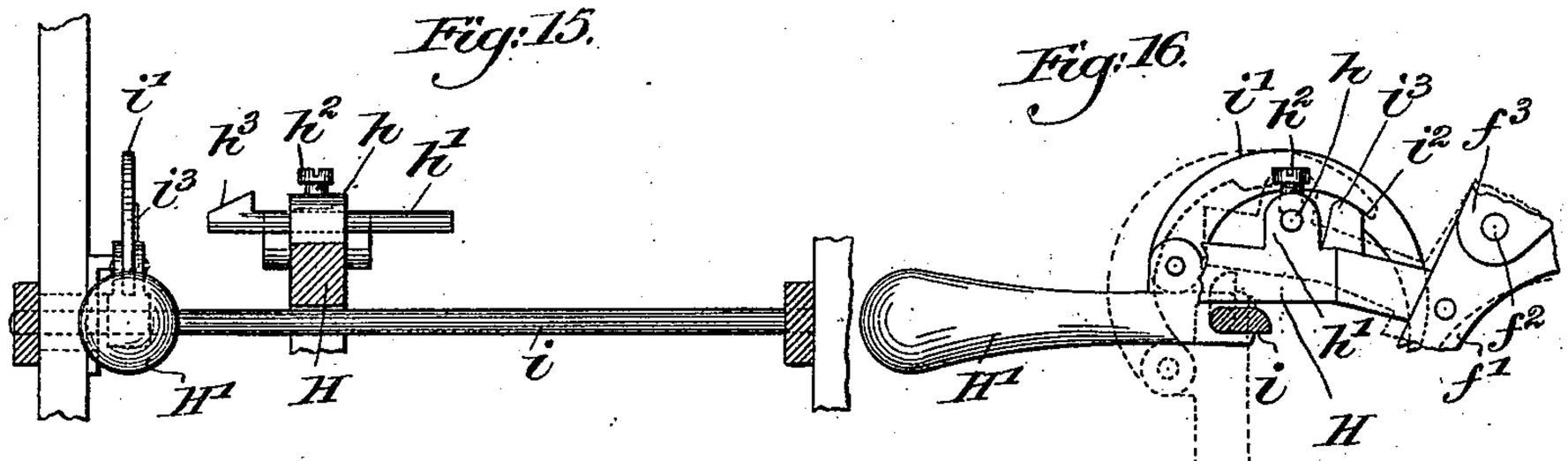


Fig: 16.

Fig: 7.

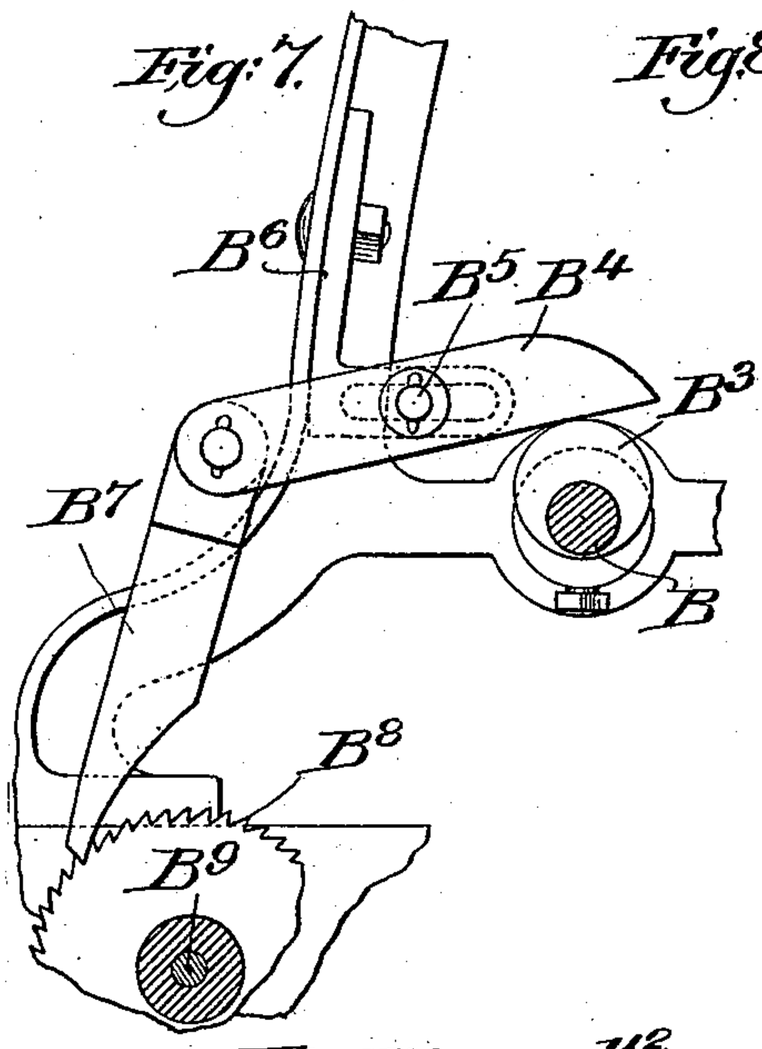


Fig: 8.

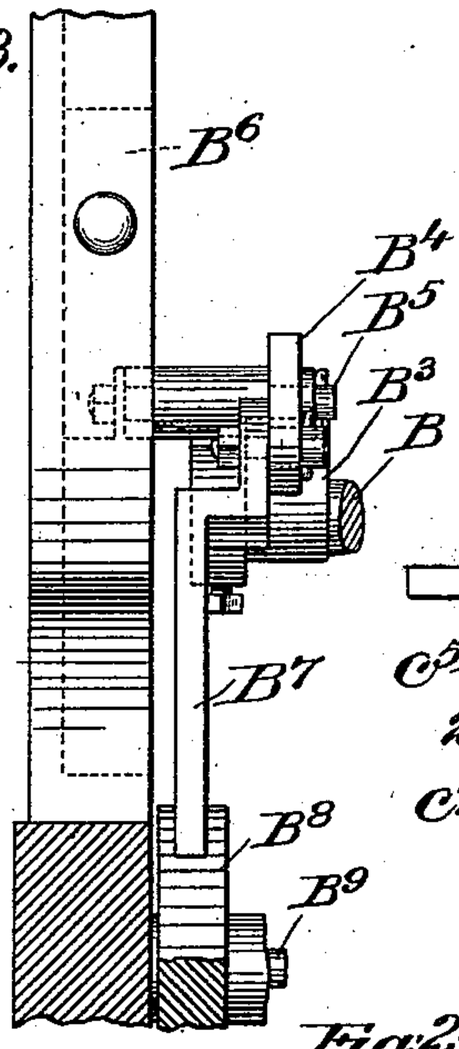


Fig: 19.

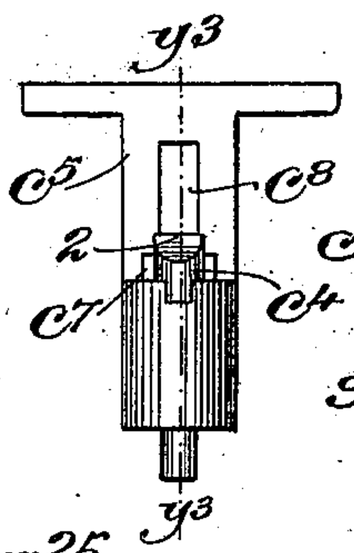


Fig: 20.

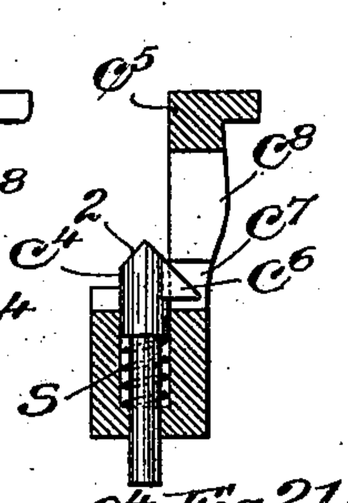


Fig 21.

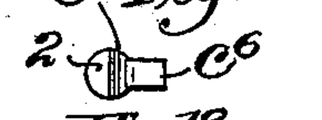


Fig: 17.

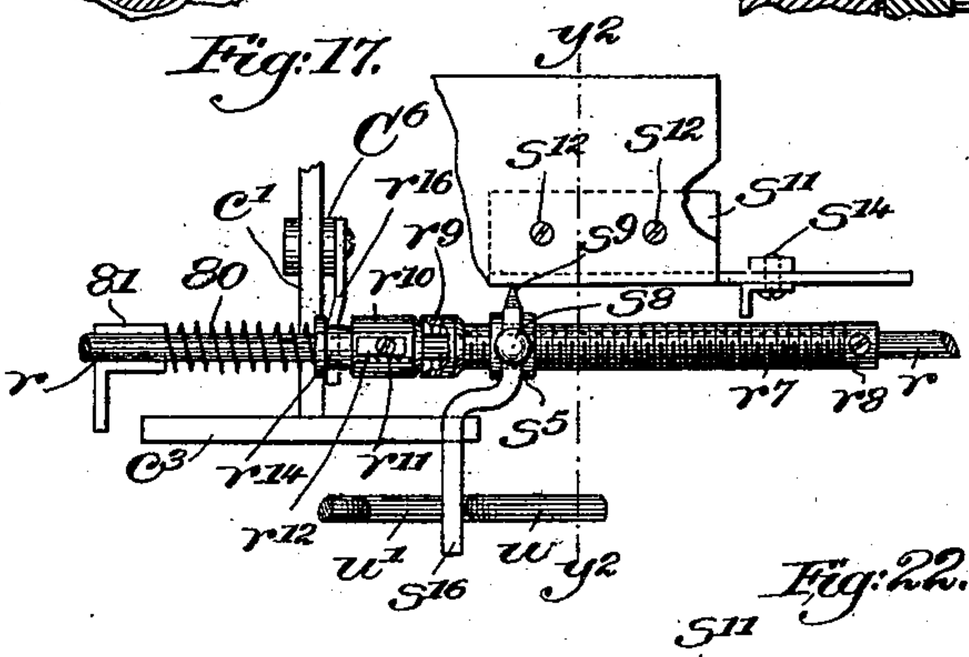


Fig: 25.

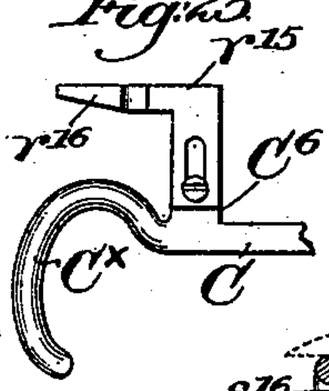


Fig: 18.

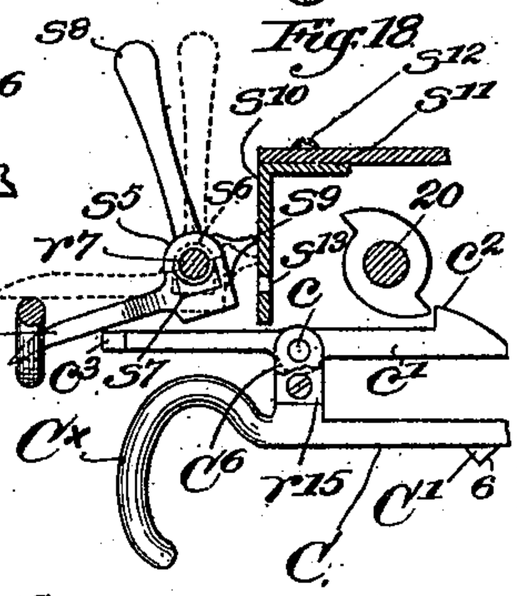


Fig: 22.

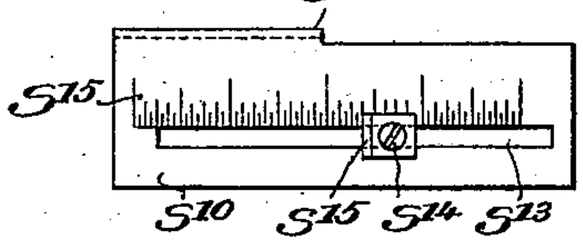
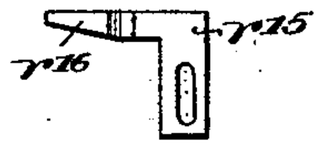


Fig: 23.



Witnesses:
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Thomas J. Drummond.

Inventor:
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by Crosby & Gregory, attys.

UNITED STATES PATENT OFFICE.

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

THREAD WINDING OR SPOOLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 554,621, dated February 11, 1896.

Application filed March 11, 1895. Serial No. 541,297. (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 or Spooling Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

This invention has for its object the production of a machine for winding or spooling thread or yarn upon a tube in the manner that commercial spools of thread are wound—that is to say, the thread or yarn is wound in a close spiral upon the tube, layer by layer, one layer being superposed upon another until the requisite quantity of thread or yarn is wound—the present machine being adapted to wind a mass of thread or yarn of a given weight or length, mechanism being provided for stopping the operation as soon as the requisite quantity of thread or yarn is wound.

In the apparatus herein shown a series of winding-drums are arranged upon a suitable shaft running lengthwise of the machine, and a series of tube-supporting yokes are so located with relation to the winding-drums as to enable two sets of tubes to be wound simultaneously, one set being located at the front and the other set at the rear side of the machine, and a traverse mechanism and stop-motion are provided for each individual tube, so that while they are driven from one and the same source of power the winding of any tube will be stopped upon the failure of the thread or yarn, or when the requisite amount of thread or yarn has been wound thereon.

In winding the tubes to a certain predetermined weight they will all fill and fill alike, and in winding a given length upon the tube the construction is such that when any tube has been filled the winding thereon will be stopped, and if an end has dropped on one or more of the other tubes when the end has been taken up the winding upon that tube will be resumed until it has received its full length of thread or yarn, the registering device remaining inoperative for any particular tube so long as the end of the thread or yarn being wound thereon is down. The traverse mechanism is operated by means of cams of suitable shape, (herein shown as located below the winding-drums,) and rotation is transmitted to the cam-shaft by a variable-speed mechanism adjustable as to its time of starting and stopping, the variable-speed mechanism being provided with a controlling device to gradually decrease the speed of the traverse cam-shaft as a set of tubes fills up. The speed-changing mechanism is set at the beginning of the winding, so that the traverse mechanism will have the proper speed to lay the thread spirally and close together upon the tube, and as the tube fills the speed of the traverse mechanism will gradually decrease, so that the filled tube is of uniform compactness throughout. The traverse mechanism is provided with a presser-foot to rest against the thread or yarn continuously, to lay it smoothly upon the tube.

When the set of tubes has been filled, the winding is automatically stopped and the speed-changing mechanism is thrown out of operation and reset automatically at the predetermined starting-point, ready to be thrown into operation by the attendant when a new set of tubes has been put in place, and the return of the speed-changing mechanism to its starting position also shifts the main driving-belt of the machine, thereby stopping the winding.

In order to wind thread or yarn by length rather than by weight the machine is provided with a registering mechanism, which is actuated from the main or drum carrying shaft at a given rotative speed, the registering device for each tube being under the control of the stop-motion for that particular tube, whereby the failure of the thread or yarn thereon will stop the registering so long as the winding is interrupted.

The registering mechanism is inoperative when the machine is winding by weight, and when winding by length the releasing device for the variable-speed mechanism-controller will be inoperative, the measuring mechanism at such time acting through the stop-motion to stop the winding when the tube is filled with the proper length of thread or yarn.

Figure 1, in elevation, represents the front side of a thread winding or spooling machine embodying my invention, with the parts in

position to begin the winding of a series of tubes with thread or yarn of a certain number, the registering mechanism at the front of the machine being omitted to more clearly show some of the other parts. Fig. 1ª is a sectional detail to be described. Fig. 2 is a right-hand end view of the apparatus shown in Fig. 1, the working parts within the end frame being omitted to avoid confusion. Fig. 3 is a rear side view, in elevation and partly broken out, of the machine shown in Fig. 1 and with the registering mechanism in place. Fig. 4 is a plan view of a portion of the mechanism shown in Fig. 3, taken below the irregular dotted line $z^2 z^2$, Fig. 12, to more clearly illustrate the devices for measuring the length of the thread or yarn being wound; Fig. 5, a vertical section on the line $x\,x$, Fig. 1, looking toward the left, the speed-changing mechanism being omitted. Fig. 6 is a left-hand end elevation of a portion of the apparatus shown in Fig. 1, to particularly show the devices intermediate the main-belt shaft and the speed-changing mechanism. Figs. 7 and 8 are enlarged details in side and end elevation, respectively, of the step-by-step actuator of the controlling device for the speed-changing mechanism. Fig. 9 is an enlarged detail, in elevation, of the traverse mechanism for one of the tubes. Fig. 10 is a longitudinal section thereof on the line $x'\,x'$, Fig. 9. Fig. 11 is a transverse sectional view taken on the line x^2 x^2, Fig. 9. Fig. 12 is a vertical sectional view on the line $y\,y$, Fig. 3, looking toward the left, of the speed-changing mechanism and controlling device therefor. Fig. 13 is an enlarged sectional view on the line $x^4\,x^4$, Fig. 4, of the belt-shipper for the speed-changing mechanism. Fig. 14 is a transverse sectional view of a portion thereof on the line $z\,z$. Fig. 15 is a detail view of the shipper-releasing latch and its co-operating dagger. Fig. 16, in side elevation, represents the shipper-latch in locked and unlocked position by full and dotted lines, respectively. Fig. 17 in plan view and partially broken out is a detail of the registering mechanism and its connection with the adjacent stop-motion, whereby the winding of a tube is stopped when the proper length of thread has been wound thereon or the registering mechanism thrown out of operation by the failure of the thread. Fig. 18 is a partly sectional view thereof on the line $y^2\,y^2$, Fig. 17, looking toward the left. Fig. 19 is a detail, in elevation and on an enlarged scale, of the stop-motion lock. Fig. 20 is a longitudinal section thereof on the line $y^3\,y^3$. Fig. 21 is a top view of the locking-bolt detached. Fig. 22 is a detached plan view of the index-plate of the registering mechanism, and Fig. 23 is a detached side elevation of the controlling-finger for the registering mechanism. Fig. 24 is a perspective view of one of the driving-roll guard-plates detached, showing its inner side. Fig. 25 is a detail showing the controlling-finger of the registering mechanism in position on the controller-bar.

The frame A, of suitable shape to support the working parts, has mounted therein in suitable bearings a main driving-shaft B, provided with usual fast and loose pulleys B′ and B^2 respectively, to be rotated by a driving-belt $B^\times$, a driving-belt shipper S (shown best in Figs. 3 and 6) being mounted to slide laterally on a guide S′, said shipper having a depending arm S^2, in which is adjustably secured a longitudinally-movable stud S^3, for a purpose to be hereinafter described.

The shaft B has fast thereon a series of winding-drums D, (herein shown as two for each pair of tubes to be wound,) the said tubes being supported above and on opposite sides of the center of the driving-shaft, as clearly shown in Fig. 5.

The tubes T (herein shown as cylindrical) are rotatably mounted on a spindle a, swiveled in the yoke a', the particular construction thereof forming no part of this invention, as the same is made the subject-matter of United States Patent No. 535,616, granted to me March 12, 1895, the yoke being attached to a hub a^2 on a supporting-rod a^3 extended across the machine, each hub having a projection or shoulder a^4, (see Fig. 5,) which, when the yoke is lifted or turned up about the rod a^3, as shown at the right of said figure, will be engaged by the hooked end of a lever a^5, pivoted upon a stand a^6 bolted to a cross-bar a^7 of the frame, said stand having a shoulder or projection, against which acts one end of a spring a^8, which bears upon a shoulder of a friction shoe or brake a^9, also pivoted to the stand, the said shoe bearing upon the projection a^4 of the yoke-hub when the yoke is in working position, to keep the latter down steadily in place. This construction is substantially as shown and described in the United States patent hereinbefore referred to, and the same is not herein claimed.

It will be understood that the friction exerted by the spring-brake upon the hub projection a^4 prevents too easy movement of the yoke upwardly as the thread or yarn is being wound onto the tube, to be described.

In order to rotate the tubes on both sides of the machine in such manner that the thread or yarn t traveling in the direction of the arrows, Fig. 5, may be wound thereon in proper manner to be controlled by the traverse mechanism hereinafter described, it is necessary to interpose an intermediate roll between one of the tubes and its co-operating driving-roll, as D′, whereby the tubes in each pair are rotated in opposite directions, the driving-rolls D′ and $D'^\times$ resting upon the periphery of and being rotated by the driving-drum D. The journals of the driving-rolls are loosely mounted in slotted arms b, arranged in pairs and having their hubs b' secured, as by set-screws 10, to short rock-shafts b^2, supported in stands b^3, secured to rails A^2 A^3, extended across the front and rear of the machine, respectively, the short rock-shafts being arranged in alignment, so that their ends sub-

stantially abut one against the other within the common supporting-standard, as plainly shown in Figs. 1 and 1ª.

The slots in the arms *b* of the roll-lifters at one side of the machine are made of sufficient length to receive therein the journals of the intermediate rolls D^2, one such roll being provided for each lifter, the tube or mass of thread thereon at that side of the machine being driven by contact with the intermediate roll and rotated thereby in the direction of the arrow 15, Fig. 5, while the tubes at the other side of the machine will rest directly upon and will be driven by the driving-rolls $D'^{\times}$ and in the opposite direction to the arrow 15. Each rock-shaft b^2 has secured thereto a depending arm b^4, pivotally connected at b^5 to a controller-bar C, upon an ear of which is pivoted at *c* a tipping lever *c'*, having a lip c^2 thereon, (see Figs. 5 and 18,) and at its outer extremity said lever is extended laterally, as at c^3, below a drop-wire pawl *d*, pivoted at *d'* in a slotted hanger d^2, and to said pawl the drop-wire d^3 is secured, the normal position of the drop-wire and pawl being shown in Fig. 5.

Ratchet-shafts 20 and 21 are mounted at the front and rear sides of the machine in suitable bearings and are rotated at the same speed as the driving-shaft B by means of sprocket-wheels 90 91 and chains 92 93, as shown in Figs. 1 and 2, said shafts being rotated in the same direction by the introduction of intermediate gears 22 and 23 on one side of the machine, (shown in Fig. 2 as at the front,) though it is obvious that it is immaterial whether the intermediate connection be made with the front or the rear of the ratchet-shaft in accordance with the direction of rotation of the main driving-shaft B. Each ratchet-shaft has fast thereon ratchet-wheels *e* so located upon the shafts as to be in the path of movement of the inner ends of the tipping levers *c'* when elevated.

When the drop-wire d^3 is in the position shown in full lines, Fig. 5, with the thread or yarn *t* passing therethrough from the mass of thread or yarn M, Fig. 2, in any convenient form, the drop-wire pawl will be held away from the lateral extension c^3 of its co-operating tipping lever, its inner heavier end being depressed, as shown in full lines in said figure, but upon failure of the thread or yarn the drop-wire will fall and the pawl *d* will turn upon its pivot and will come in contact with and depress the outer end of the tipping lever, to thereby bring the lip or projection c^2 on its inner end into position to be engaged by one of the teeth of the adjacent ratchet-wheel, continued rotation of the latter moving the controller-bar inward, and by means of the depending arm b^4 it turns the rock-shaft b^2, and thereby moves the roll-lifter arms *b* thereon away from the driving-drum to break the connection between said driving-drum and the driving-roll, supported in said roll-lifter, and consequently to immediately stop the further winding of the corresponding tube.

The controller-bar C, its tipping lever, and the co-operating drop-wire pawl constitute a stop-motion device for each tube, actuated by a ratchet-wheel.

In order to press the driving-rolls against the surface of the driving-drum D, I have provided each controller-bar with a depressor-cam C' to be acted upon by a spring-bolt c^4, mounted in a slotted bracket-like bearing c^5 secured to or forming a part of one of the longitudinal rails A^2 A^3, the bolt c^4 being held from rotation by an ear c^6, to enter a suitable pocket c^7 in said bracket, which latter is slotted at c^8 for the passage therethrough of the controller-bar C, the spring *s* which controls the bolt c^4 being of sufficient strength to cause the outer face 2 of the bolt, when in contact with the inner face 6 of the depressor-cam C', to force the driving-roll, supported in the connected lifter, with considerable pressure against the surface of the driving-drum D.

When the tipping lever *c'* is engaged by its ratchet-wheel and the stop-motion thereby set in operation, the inward movement imparted to the controller-bar will be sufficient to overcome the resistance of the spring *s*, and the depressor-cam will depress and pass over the bolt c^4, the latter immediately rising as the other two sides of the cam and bolt-top are brought into co-operative engagement, and such movement carries the controller-bar inward sufficiently to draw the toe of the tipping lever into the slot c^8 of the bracket, the upper end of the slot acting upon the cam-shaped lip c^2 to depress it, to not only disengage the lip from the ratchet-wheel, but also to elevate the outer end of the tipping lever to act upon the drop-wire pawl and thereby raise the drop-wire into position through the slot in the hanger d^2, to be threaded up by the attendant. By this arrangement much time is saved in operating the machine.

When it is desired to start the winding of the tube controlled by any particular stop-motion, the attendant grasps the handle $C^{\times}$ of the controller-bar, drawing it outwardly until the depressor-cam is moved to the opposite side of the bolt c^4, which normally holds the bar C in outward position, and also supports it in the position shown in Fig. 5.

The main or driving shaft B has fast thereon, or it may be forming a part of the hub of the fast pulley B', a cam B^3 to act upon a pawl-carrier B^4, (see Figs. 6, 7, and 8,) pivoted on a stud B^5, adjustable in a slotted arm B^6, secured to the main frame A, the pawl-carrier having pivoted thereto a pawl B^7 to engage the teeth of a ratchet-wheel B^8 mounted on a short shaft or stud B^9 upon the outer side of the frame, as shown in Figs. 1 and 6, said ratchet-wheel having secured thereto, or forming a part of it, a gear B^{10} in mesh with a gear B^{11} fast on a threaded speed-controlling shaft E, mounted in suitable bearings,

the said shaft being rotated intermittingly by means of the pawl and ratchet-wheel described, the amount of rotation given to the shaft for each reciprocation of the pawl depending upon the position of the pawl-carrier B^5 in the slotted stand B^6, as when winding coarse thread or yarn the ratchet-wheel will be moved several teeth for each reciprocation of the pawl B^7, the movement of the pawl being less for finer numbers of yarn.

The driving-shaft B has fast thereon a cone-pulley E′, connected by a belt E^2 to an oppositely-turned cone-pulley E^3 on an auxiliary shaft $E^\times$, the cone-pulleys, as clearly shown in Fig. 12, being respectively located above and below the speed-controlling shaft E.

The auxiliary shaft $E^\times$ has fast thereon a pinion E^4 in mesh with a gear E^5 fast on a traverse-cam shaft E^6, extended along the main frame and substantially beneath the main driving-shaft B.

Traverse-cams G are secured to the shaft E^6 and actuate the traverse mechanism, as will be described.

The cone-pulleys E′ and E^3, with their connecting-belt, constitute a variable-speed mechanism for actuating the traverse-cam shaft, whereby the speed of the traverse mechanism may be gradually decreased as the operation of winding progresses.

One member, *f*, of a two-part belt-shipper is supported by and longitudinally movable on a suitable cross-rod $f^\times$ and held from tipping sidewise, the other member, *f′*, of the shipper being pivoted at f^2 between suitable ears f^3 of the member *f* to rock thereon, the member *f* having a hub or bushing f^4, which loosely embraces the threaded speed-controlling shaft E, the said hub being cut away at its rear side to permit the free movement therein of the end f^5 of the member *f′*, which is threaded upon its inner face, as at f^6, Fig. 14, to at times engage the threads of the controlling-shaft E, as when in full-line position, Fig. 13, the hub or bushing of one part of the shipper and the threaded portion f^6 of the other part forming a species of separable lock-nut, movement of the member *f′* into the dotted-line position, Fig. 13, withdrawing the toothed portion f^6 thereof from engagement with the threaded shaft, so that the separable lock-nut is free to slide upon said shaft.

The member *f′* has secured thereto a handle H, which fulfills a twofold purpose—viz., to carry a dagger for the releasing-latch to be described and also serving as a handle, whereby the attendant may throw the separable lock-nut into or out of engagement with the speed-controlling shaft, whereby the shipper mechanism may be operated automatically or at the will of the attendant.

The handle H is provided with a projection *h*, in which is adjustably held a dagger *h′* by means of a set-screw h^2, the dagger being movable longitudinally in the projection *h*.

The shipper is provided with usual belt-forks f^{10} and f^{11}, and it will be understood that when the separable nut is locked upon the speed-controlling shaft rotation of the latter will cause the shipper mechanism described to travel thereon toward its inner end to thereby traverse the belt E^2 on the cones, whereby the speed of the driven cone E^3 will be decreased as the belt is traversed from the larger to the smaller end of the driving-cone E′.

In order to automatically stop the traverse of the belt, I have provided a controlling device for the belt-shipper, said controlling device consisting of a rocker-bar *i*, mounted in suitable bearings parallel to the speed-controlling shaft E and normally below the path of movement of the handle H as it moves along the shaft during the traverse of the shipper-belt, said rocker-bar *i* having secured thereto a handle H′ (see Figs. 12, 15, and 16) and a pivoted latch *i′*, the said latch being shown as of substantially arc shape and notched at i^2 on its inner side to engage a catch i^3 secured to a suitable part of the framework, the latch being located at substantially right angles to the rocker-bar and with its inner edge in the path of movement of the beveled end h^3 of the dagger *h′*. As the belt-shipper approaches the end of its traverse, the beveled end h^3 of the dagger is moved under the latch *i′*, and the latter is lifted about its pivot until the notch i^2 is disengaged from the catch i^3, and thereupon the weight of the handle H′ will be sufficient to turn the rocker-bar through an arc of substantially ninety degrees into the dotted-line position shown in Fig. 16, to thereby turn the locking member *f′* of the shipper to withdraw the toothed portion f^6 thereof from engagement with the threaded speed-controlling shaft, so that the lock-nut described will be free to slide along said shaft, the handle H resting upon and being held elevated by the rocker-bar until the return of the shipper mechanism to its starting-point. This return movement is herein shown as effected by means of a weight W secured to one end of a flexible connection *w* passed around suitable guide-sheaves *w′* and having its other end secured to the belt-shipper, as clearly shown in Figs. 3 and 4.

It is desirable when winding by weight to have all the spools of thread or yarn of equal weight, and this is readily accomplished by the mechanism shown herein if the starting and stopping points of the belt-shipper are determined. The stopping-point is determined by adjusting the dagger *h* in the handle H, but the starting-point must to a certain extent be determined by experiment—that is to say, the attendant will wind one or more experimental spools until the proper starting and stopping points have been determined, and the starting-point is set by means of a collar f^{15} held in adjustable position on the supporting-rod $f^\times$ by a suitable set-screw 35. (See Fig. 4.) The collar having been adjusted upon the rod, the movement of the belt-shipper, due to the weight

W, will be stopped when the shipper is brought into contact with the collar. The position of this collar is determined by the number of the thread or yarn to be wound, as when with coarse numbers a quicker traverse is required than with the finer numbers.

When the shipper mechanism is brought back to the starting-point, as has been described, it is necessary to stop the operation of the machine, and this is done automatically by means of a knock-off *k* rigidly secured to a part of the shipper mechanism and extended loosely through a bearing in the frame to contact with the inner end of the adjustable stud S^3 in the depending arm of the belt-shipper S, the stud being adjusted according to the adjustment of the stop-collar f^{15}.

For convenience I have herein provided two pulley-like driving-drums D for each pair of tubes to more conveniently accommodate parts of the traverse mechanism to be described, and more particularly the oscillating shafts *m*, one of such shafts being interposed between each co-operating pair of driving-drums and supported in suitable bearings *m'* formed on the inner ends of brackets m^2 secured to the rails A^2 A^3 of the machine. Each oscillating shaft has fast thereto a vibrating lever $m^\times$, the extremity of which is shaped to enter the cam groove or space G' between the two parts of each traverse-cam G fast on and rotatable with the traverse-cam shaft E^6, the shape of the cam-groove being such that the shaft *m* will be oscillated in proper time to traverse the thread or yarn upon the tube.

The inner end of the bearing *m'* of each bracket has formed thereon a polygonal hub m^3 and guide-ledges m^4 at opposite sides of the hub to engage a balance guide-piece *n* having an opening therein to receive the hub m^3 and to be held between the guide-ledges m^4, as shown in Figs. 9, 10, and 11, the said guide-piece being rigidly secured to the bracket by suitable fastenings. (Shown as screws 50, Fig. 10.)

The lower end of the guide-piece is segmental in form, as at $n^\times$, to guide the lower end of a slotted presser-foot carrier *o*, oscillated with and also reciprocable upon the said guide-piece, the segmental end also acting as a balance for the latter.

The presser-foot carrier is slotted at *o'* to receive therein a portion of a locking-plate *p*, cut away at *p'* for a purpose to be described, and having longitudinal flanges p^2 to overlap the presser-foot carrier along the longitudinal edges of the slot *o'* therein, said locking-plate having a preferably rectangular or other than round opening therein to receive the correspondingly-shaped end m^5 of the oscillating shaft *m*, upon which it is firmly held by means of a set-screw 52 and washer w^{10}, whereby the locking-plate will be oscillated by the shaft *m*, it moving over the adjacent surface of the balance guide-piece *n*, while the latter is held stationary by its attachment to the bracket m^2.

The slotted lower portion of the presser-foot carrier receives therein a spiral spring $o^\times$, bearing at one end against the end of the slot *o'* and at its other end against the shoulder p^3 of the locking-plate, and preferably held in place on said shoulder by a suitable pin or stud p^4 secured therein, as clearly shown in Fig. 10, the spring normally tending to depress the carrier and thereby maintain a suitable roll o^2 mounted upon the inner face of the carrier in contact with a cam-surface *n'* formed on the upper end of the guide-piece *n*.

By means of the locking-plate *p* and its engagement with the presser-foot carrier, the latter is oscillated on the shaft *m* as a center as the latter is oscillated by the traverse-cam G; but in order to move the upper end of the carrier, and thereby the presser-foot to be described, in a substantially horizontal line instead of an arc, I have interposed the lifting-cam surface *n'* on the fixed guide-piece *n*, the action of the cam upon the roll o^2 raising and lowering the presser-foot carrier, and the two movements of the latter—that is, its oscillation and its rising and falling—are so proportioned one to the other that the resultant motion given to the upper end of the carrier will be in a straight line and parallel to the axis of the tube with which it co-operates.

The upper end of the carrier is notched to form ears o^3, between which is pivoted at o^4 a socketed holder o^5 to receive therein the shank o^6 of the presser-foot or thread-guide o^7, (shown in Figs. 9 and 10 as a curved metallic plate having at its upper portion or top a central groove o^8 therein,) to receive and guide the yarn, the grooved top of the presser-foot resting against the tube or the yarn wound thereon close to the point of contact of the latter with the driving-roll, so that the thread or yarn will be delivered as it is wound close to such contact-point in order that it may be laid smoothly and accurately.

The position of the presser-foot relative to the driving-roll and tube is clearly shown in Figs. 1 and 5.

The thread or yarn *t* is led directly from the drop-wire to the presser-foot, as shown in Fig. 5, the plate-like form of the presser-foot preventing accidental displacement of the thread from the presser-foot.

To protect the driving-roll from dust and dirt, and also to prevent a loose end from being drawn in and wound around it, I preferably interpose guard-plates *q*, (shown only in Figs. 5 and 24,) suitably shaped to extend across and in front of each individual driving-roll, and outside of the co-operating presser-foot and carrier, as clearly shown in Fig. 5, the guard-plates being secured to the hubs of the arms *b* of the roll-lifters by suitable screws 75 entering threaded holes 76. (See Fig. 1 in said hubs.) As shown in Figs. 5 and 24, the guard-plate has upon its inner side a longitudinal rib *q'*, which bears against the presser-foot holder o^5, above its pivot o^4, to thereby retain and steady the presser-foot

in proper position with relation to the driving-roll. When the lifters are moved to lift the driving-rolls from the driving-drums, the guard-plates q will be moved in unison therewith, and will then permit the presser-foot to turn about the pivot o^4 by the pressure of the driving-roll exerted thereon. When the roll-lifter is returned to its normal position, the longitudinal rib q' of the guard-plate acts to return the presser-foot to its normal position on the carrier o.

As shown in Fig. 10, a spring 60 is inserted in the socketed holder between the end of the shank o^6 and the bottom of the socket, to thereby yieldingly support the presser-foot.

It will be seen from the foregoing that while the traverse of the presser-foot is the same in extent throughout the operation of winding a tube its speed will gradually decrease from the beginning to the end of the winding operation, due to the change in speed of the traverse-cam shaft actuated by the speed-changing mechanism, as has been fully described, while the size of the cop increases. The speed of rotation of the driving-drum is uniform no matter what the size of the cop or mass of thread to be wound upon a tube, one rotation of the drum thus corresponding to a given length of thread to be wound upon the tube, whether the diameter of the latter is large or small. Now, as the surface speed of the drum is constant and the diameter of the cop is gradually increasing, it naturally follows that its rotative speed will gradually decrease as the diameter of the wound mass approaches the diameter of the drum.

If the speed of the thread-guide in its reciprocations remained the same throughout the operation, it would lay the thread properly upon the bare tube and upon a number of the succeeding layers of thread thereon, but as the surface speed of the wound mass is gradually decreasing the thread-guide would lay the thread in spirals too far apart for compactness. To overcome this and thereby fill the tube with an equally dense mass of thread throughout, I gradually decrease the speed of the thread-guide as the size of the cop or mass of thread increases. Thus when winding close to the tube the speed of the thread-guide is highest, corresponding to the rotative speed of the tube, and as the latter decreases, as described, the speed of the thread-guide is decreased relatively, so that a layer of thread at the exterior of the cop is wound as closely and compactly as are the layers near the tube.

It is now necessary to describe the mechanism for winding the thread or yarn according to length rather than weight, and to accomplish this purpose I mount at the front and rear of the machine a measuring mechanism for each tube, the mechanisms at the front or rear of the machine being operated by a common continuously-moving operating-shaft, but otherwise the several measuring mechanisms are entirely independent one of the other and adapted to be separately thrown into or out of co-operation with the operating-shaft.

Referring now to Figs. 3, 4 and 12, an operating-shaft r is supported in suitable bearings r' on the ends of the main frame A, said shaft having fast thereon a miter-gear r^2, in engagement with a like gear r^3 fast on or forming a part of the hub of a worm-wheel r^4 mounted on a stud secured to a bracket r^5 attached to one of the rails A^2 A^3. The teeth of the worm-wheel r^4 are in engagement with a worm r^6 fast on the adjacent ratchet-shaft 20 or 21, as the case may be, the continuous rotation of the ratchet-shaft thus transmitting rotative movement to the operating-shaft r. The worm r^6 is double-threaded, and the worm-wheel r^4 has seventy-seven teeth therein, so that one revolution of the ratchet-shaft will rotate the worm-wheel through two seventy-sevenths of its movement, as herein shown, and by the miter-gears the operating-shaft will be rotated once for every thirty-eight and one-half revolutions of the ratchet-shaft. The operating-shaft r has loose thereon a threaded sleeve r^7 held in place by a collar r^8 fast on the shaft and abutting against one end of the sleeve, the other end of the sleeve, as best shown in Fig. 17, being enlarged at r^9 to form one member of a clutch device, the other member being shown as a collar r^{10} movable longitudinally on the operating-shaft, but keyed thereto by means of a suitable dowel-pin, as r^{11}, the collar being slotted at r^{12} to permit the sliding movement thereof on the shaft. The adjacent ends of the clutch members are shaped to be at times brought into close frictional contact one with the other to clutch the sleeve r^7 on the shaft. The movable member r^{10} of the clutch is acted upon by a spring 80 surrounding the operating-shaft between an abutment 81 and the outer end of the member to normally force the movable member of the clutch into engagement with the member r^9. The member r^{10} is annularly grooved at r^{14} to be entered by the bent arm of a retractor r^{15}, (shown separately in Fig. 23,) the retractor being mounted upon the outer side of one of the ears c^6 on the controller-bar, as shown in Fig. 25, the outer portion of the bent arm r^{16} bearing against the outer wall of the annular groove r^{14} when the controller-bar C is in its innermost position, such position being shown in Figs. 17 and 18, but when the controller-bar is pulled outwardly by the attendant to start the winding of a tube the inner end of the bent arm will be brought into the annular groove r^{14} and will permit the spring 80 to force the clutch member r^{10} into engagement with the other member r^9.

It will therefore be obvious that when the stop-motion of any particular tube is put in operation the threaded sleeve r^7 will be unclutched from the operating-shaft r automatically, and it will also be automatically clutched when the winding is resumed, so

that the operation of the measuring mechanism is controlled entirely by the stop-motion and will only register when winding on.

A traveler s^5 is mounted upon the threaded sleeve r^7, the opening through which the sleeve passes being threaded at its upper side at s^6 (see dotted lines, Fig. 18) to engage the threaded sleeve when resting thereon, the bottom of the opening, however, being cut away, as at s^7, to permit the traveler to be lifted by means of a handle s^8 to disengage it from the threaded sleeve, so that it may be freely moved thereon by the attendant. The traveler is provided with a pointer s^9 which moves across a graduated scale S^{15} on a plate s^{10} having an ear s^{11} which is secured to the under side of the base of the hanger d^2 by suitable screws s^{12}. (See Figs. 17 and 18.) The plate s^{10} is slotted longitudinally at s^{13} to receive therein the adjusting-screw s^{14} of a gage s^{15}, which may be set at different points along the scale S^{15} to determine the starting-point for the registering, the starting-point being nearer to the right-hand end of the scale the longer the amount to be wound.

The traveler s^5 has secured to or forming a part of it an outwardly-projecting offset finger s^{16}, which normally rests upon the top of a stop-rod u, bent down or depressed at u', so located that the finger s^{16} of the traveler will drop into the depression when the traveler has been moved the extreme length of the threaded sleeve r^7 by its rotation, the dropping of the finger into the depression allowing the traveler to partially rotate on the sleeve, as shown by full lines, Fig. 18, and such movement of the traveler also causes the offset finger to act upon the extension c^3 of the tipping lever c' to elevate its inner end and bring the lip c^2 thereon into engagement with one of the teeth of the ratchet-wheel, so that the stop-motion is immediately operated to stop the winding of the tube.

The stoppage of the mechanism, due to the action of the traveler, always occurs at one and the same point—that is, when the full length of the thread has been wound upon the tube—and the winding is simultaneously stopped, as has been described.

If a thread should break or fail while the traveler was at an intermediate point on the sleeve r^7, the stop-motion would operate to unclutch the sleeve from the operating-shaft r, as has been described, so that the registering will cease until the winding has been resumed.

When the traveler has reached the end of its movement, as shown in Fig. 17, the attendant turns it into dotted-line position, Fig. 18, by means of the handle s^8, and lifts it slightly to disengage the threaded portion s^6 from the sleeve, after which the traveler can be slid back to the starting-point, which is determined by the position of the gage s^{15}.

In order to adapt the machine for winding between twelve and thirteen thousand yards or less upon a tube, the sleeve r^7 has forty threads to the inch cut thereon, and the threaded portion is four inches long, the proportions of the gearing for actuating the shaft r having been given. With such an arrangement the scale S^{15} is preferably graduated to sixteenths of an inch, so that every sixteenth indicated thereon by the pointer s^9 will register two hundred yards of thread or yarn wound upon the tube.

Each tube has its own measuring and registering mechanism similar to that described, the threaded sleeves of the several mechanisms at the front or rear of the machine being mounted on the same common operating-shaft and each registering mechanism co-operating with the particular stop-motion.

When winding according to length, the releasing-latch i' is preferably not operated, the dagger h' being for this purpose set back in its support, so that it will not lift the latch, the attendant lifting the handle H of the shipper when it is desired to stop the traverse of the connecting-belt of the speed-changing mechanism. As a precautionary measure, however, to obviate breakage, should the attendant be careless, the dagger h' will release the latch if allowed to move far enough.

While it is the object to wind a series of tubes simultaneously, either by weight or according to length, if the latter method is carried out it will be noticed that the filling of some of the tubes may be delayed by reason of breakage of the thread or yarn, while the filling of the remaining tubes will be continued, but in such a case the attendant will tie up the broken ends as rapidly as possible and throw the temporarily-delayed mechanism into operation as soon as possible.

As those tubes which have had no interruptions to their filling will be wound sooner than those which have been interrupted, it will be obvious that after the former have been filled and their winding mechanism has been stopped by the means described the winding of the remaining tubes will continue for different lengths of time until each one has been filled, the full tubes being, of course, removed and the machine started. Before the winding of a new set can be begun the attendant will wait until the most delayed tube has been filled.

While I have herein shown two sets of tube-holders on each side of the machine, to thereby wind four tubes at a time, it is to be understood that the number of tubes which may be wound may be greatly increased, as in actual practice the machine may be adapted to wind as many as fifty tubes upon a side.

I have herein shown my invention as embodied in a machine for winding thread or yarn upon tubes, but by changing the shape of the traverse-cam and by other slight changes in the mechanism the machine may be equally well adapted to winding cones, but the same is not herein shown or described.

The construction, arrangement, and operation of the various parts of the mechanism

herein shown, while well adapted to carrying out the object of my invention, may be modified or rearranged without departing from the spirit and scope thereof.

By the term "thread" hereinbefore used is to be understood thread, cord, twine, or silk, or in fact any filamentous material which it is desired to wind as commercial spool-thread is wound, but without the use of headed spools.

I claim—

1. In a thread-winding machine, a rotatable drum, a yoke, a tube rotatably supported therein, and a thread-guide reciprocated parallel to the tube, combined with a driving-roll intermediate the drum and tube, movable bearings to sustain and guide said driving-roll, stop-motion mechanism controlled by the failure or breakage of the thread, to stop the rotation of the driving-roll, connections between said mechanism and the movable bearings to lift the driving-roll from the drum, and mechanism to reciprocate the thread-guide at a gradually-decreasing speed as the size of the cop increases, substantially as described.

2. In a thread-winding machine, a rotatable drum, a yoke, a spindle pivotally mounted therein, a tube rotatably supported on the spindle, and a thread-guide reciprocated parallel to the tube, combined with a driving-roll intermediate the drum and tube, movable bearings to sustain and guide said driving-roll, stop-motion mechanism controlled by the failure or breakage of the thread, to stop the rotation of the driving-roll, connections between said mechanism and the movable bearings to lift the driving-roll from the drum, and mechanism to reciprocate the thread-guide at a gradually-decreasing speed as the size of the cop increases, substantially as described.

3. In a thread-winding machine, a rotatable drum, a yoke, a tube rotatably supported therein, and a thread-guide reciprocated parallel to the tube, combined with a driving-roll intermediate the drum and tube, movable bearings to sustain and guide said driving-roll, stop-motion mechanism controlled by the failure or breakage of the thread, to stop the rotation of the driving-roll, connections between said mechanism and the movable bearings, to lift the driving-roll from the drum, variable-speed mechanism to reciprocate the thread-guide at a gradually-decreasing speed as the size of the cop increases, a controlling device therefor to stop said mechanism when a predetermined speed of reciprocation is reached, and means to adjustably fix the starting and stopping points of the variable-speed mechanism, substantially as described.

4. In a thread-winding machine, a rotatable drum, a yoke, a tube rotatably supported therein, and a thread-guide reciprocated parallel to the tube, combined with a driving-roll intermediate the drum and tube, movable bearings to sustain and guide said driving-roll, stop-motion mechanism controlled by the failure or breakage of the thread, to stop the rotation of the driving-roll, connections between said mechanism and the movable bearings to lift the driving-roll from the drum, variable-speed mechanism to reciprocate the thread-guide at a gradually-decreasing speed as the size of the cop increases, and a controlling device for said variable-speed mechanism, to stop the latter when a predetermined speed of reciprocation is reached, substantially as described.

5. In a thread-winding machine, a rotatable drum, a yoke, a tube rotatably supported therein, and a thread-guide reciprocated parallel to the tube, combined with a driving-roll intermediate the drum and tube, movable bearings to sustain and guide said driving-roll, stop-motion mechanism controlled by the failure or breakage of the thread, to stop the rotation of the driving-roll, connections between said mechanism and the movable bearings to lift the driving-roll from the drum, variable-speed mechanism to reciprocate the thread-guide, at a gradually-decreasing speed as the size of the cop increases, and devices to stop said mechanism and also the rotation of the drum when a predetermined speed of reciprocation of the thread-guide is reached, substantially as described.

6. In a thread-winding machine, a rotatable drum, a yoke, a tube rotatably supported therein, a thread-guide, and means to reciprocate the said thread-guide parallel to the tube, combined with a driving-roll intermediate the drum and tube, movable bearings to sustain and guide said driving-roll, stop-motion mechanism controlled by the failure or breakage of the thread, to stop the rotation of the driving-roll, connections between said mechanism and the movable bearings, to lift the driving-roll from the drum, variable-speed mechanism to govern the reciprocation of the thread-guide, and to gradually decrease its speed as the size of the cop increases, a device to stop said mechanism when a predetermined speed of reciprocation of the thread-guide is reached, and means to release said device when the variable-speed mechanism has been stopped, substantially as described.

7. In a thread-winding machine, a rotatable drum, a tube rotatably supported adjacent thereto, a thread-guide and means to reciprocate the said guide parallel to the tube, combined with a driving-roll intermediate the drum and tube, bearings to sustain and guide the driving-roll, variable-speed mechanism to govern the reciprocation of the thread-guide and to gradually decrease the speed as the size of the cop increases, and means to reset the variable-speed mechanism when a tube is filled, substantially as described.

8. In a thread-winding machine, a rotatable drum, a tube rotatably supported adjacent thereto, a thread-guide and means to reciprocate the said guide parallel to the tube, combined with a driving-roll intermediate the drum and tube, bearings to sustain and guide said driving-roll, a traverse-cam shaft, a cam

thereon to reciprocate the thread-guide, variable-speed mechanism to rotate said shaft at a gradually-decreasing speed as the size of the cop increases, a device to regulate the speed imparted to the shaft, and means to return the said device to its initial position when a tube is filled, substantially as described.

9. In a thread-winding machine, a rotatable drum, a tube rotatably supported adjacent thereto, a thread-guide and means to reciprocate the said guide parallel to the tube, combined with a driving-roll intermediate the drum and tube, bearings to sustain and guide the driving-roll, variable-speed mechanism comprising cone-pulleys and a connecting-belt, to cause reciprocation of the thread-guide, a device to gradually move the belt from one to the other end of the pulleys, means to automatically stop the movement of said device when the belt has been moved a predetermined distance, and means to return said device to its initial position, and a stop-motion actuated by the return of the said belt-moving device to stop the rotation of the drum, substantially as described.

10. In a thread-winding machine, a rotatable drum, a tube rotatably supported adjacent thereto, a thread-guide and means to reciprocate the said guide parallel to the tube, combined with a driving-roll intermediate the drum and tube, bearings to sustain and guide the driving-roll, variable-speed mechanism comprising cone-pulleys and a connecting-belt, to cause reciprocation of the thread-guide, a rotating threaded operating-shaft adjacent said pulleys, a belt-shifter provided with a separable nut adapted to normally engage and be moved in one direction by the operating-shaft, to thereby gradually shift the belt, a releasing device to disengage said nut and the operating-shaft, and means to retract the belt-shifter after such disengagement and return it to its initial position, substantially as described.

11. In a thread-winding machine, a traverse-cam, a rock-shaft oscillated thereby, a fixed guide-piece provided with a lifting-cam, a longitudinally-movable presser-foot carrier oscillated by said rock-shaft, a roll on the carrier to rest on the lifting-cam and move the carrier longitudinally on the guide-piece, whereby the upper end of the carrier is reciprocated in a straight path, a yielding presser-foot or thread-guide supported at the upper end of the carrier, and means to rotate the traverse-cam, substantially as described.

12. In a thread-winding machine, a traverse-cam, a rock-shaft oscillated thereby, a fixed guide-piece provided with a lifting-cam, a longitudinally-movable presser-foot carrier oscillated by said rock-shaft, a roll on the carrier to rest on the lifting-cam and move the carrier longitudinally on the guide-piece, whereby the upper end of the carrier is reciprocated in a straight path, a yielding presser-foot or thread-guide supported at the upper end of the carrier, variable-speed mechanism to rotate the traverse-cam at a gradually-decreasing speed as the size of the cop increases, and a device to gradually decrease the speed of said mechanism from the beginning of the winding, whereby the traverse of the thread-guide is gradually decreased in speed, substantially as described.

13. In a thread-winding machine, a fixed support, a guide-piece rigidly secured thereto and provided with a lifting-cam, a longitudinally-slotted carrier movable on the guide-piece and provided with a roll to co-operate with the lifting-cam, a locking-plate in engagement with and retaining the carrier on the guide-piece while permitting its longitudinal movement thereon, a rock-shaft extended through said support and carrier and secured to the locking-plate, to oscillate it and the carrier, the combined action of the lifting-cam and the rock-shaft causing the upper end of the carrier to reciprocate in a straight path, substantially as described.

14. In a thread-winding machine, a presser-foot carrier, means to oscillate and also to raise and lower it, to thereby reciprocate its upper end in a straight path, a holder pivoted to the carrier, and a curved presser-foot or thread-guide yieldingly supported in the holder and adapted to deliver the thread upon a tube, substantially as described.

15. In a thread-winding machine, a rotatable drum, a tube rotatably supported adjacent thereto, a reciprocating carrier, and a thread-guide pivoted thereto and movable parallel to the tube and adjacent the bite of the driving-roll, combined with a driving-roll intermediate the drum and tube, movable bearings to sustain and guide said roll, a guard-plate carried by said bearings and normally retaining the thread-guide against the roll, and stop-motion mechanism connected with said bearings and controlled by breakage of the thread, to stop the rotation of the driving-roll and permit the thread-guide to turn on its carrier, substantially as described.

16. In a thread-winding machine, a rotatable drum, a tube rotatably supported adjacent thereto, a thread-guide to traverse the thread thereupon, a driving-roll intermediate the drum and tube, and movable bearings for said roll, combined with mechanism to measure the length of thread to be wound upon the tube, stop-motion mechanism connected with the bearings of the driving-roll and controlled by breakage of the thread, to stop the rotation of the said roll, a controller-bar to put said mechanism into inoperative position and connections between the measuring mechanism and the controller-bar whereby when the controller-bar is moved to put the stop-motion into inoperative condition the measuring mechanism will be operated, substantially as described.

17. In a thread-winding machine, a rotatable drum, a tube rotatably supported adjacent thereto, a thread-guide to traverse the

thread thereupon, a driving-roll intermediate the drum and tube, and movable bearings for said roll, combined with mechanism to measure the length of thread to be wound upon the tube, a continuously-rotated operating-shaft, a clutch between it and the measuring mechanism, stop-motion mechanism connected with the bearings of the driving-roll and controlled by breakage of the thread, to stop the rotation of the said roll, and connections between the clutch and the stop-motion mechanism, to move the clutch into operative or inoperative position as the stop-motion mechanism is moved into normal or abnormal condition respectively, substantially as described.

18. In a thread-winding machine, a rotatable drum, a tube rotatably supported adjacent thereto, a thread-guide to traverse the thread thereupon, a driving-roll intermediate the drum and tube, movable bearings for said roll, and stop-motion mechanism connected with said bearings, combined with mechanism to measure the length of the thread to be wound upon the tube, said mechanism including a longitudinally-movable traveler having a finger, a stop-rod having a depression therein to permit the finger to fall when the proper length of thread has been wound, and a tipping lever controlling the stop-motion and moved into inoperative position by the finger falling thereupon, substantially as described.

19. In a thread-winding machine, a rotatable drum, a tube rotatably supported adjacent thereto, a thread-guide to traverse the thread thereupon, a driving-roll intermediate the drum and roll, movable bearings for said roll, and stop-motion mechanism connected with said bearings, combined with mechanism to measure the length of the thread to be wound upon the tube, said mechanism including a longitudinally-movable traveler having a finger, an adjustable gage to determine the starting-point of the traveler, a stop-rod having a depression therein at a fixed point to permit the finger to fall when the proper length of thread has been wound, and a tipping lever controlling the stop-motion and moved into operative position by the finger falling thereupon, substantially as described.

20. In a thread-winding machine, thread-measuring mechanism comprising a continuously-rotated operating-shaft, a threaded sleeve loose thereon, a clutch to connect said sleeve and shaft to rotate in unison, a traveler to engage and be moved in one direction by rotation of the sleeve, and means controlled by the traveler to unclutch the sleeve and stop the movement of the traveler when the proper length of thread has been measured, substantially as described.

21. In a thread-winding machine, thread-measuring mechanism comprising a continuously-rotated shaft, a threaded sleeve loose thereon, a traveler movable in one direction by said sleeve, a co-operating scale, a clutch to connect or disconnect the shaft and sleeve, a gage to determine the starting-point of the traveler, and an actuator for the clutch, controlled by the traveler when the proper length of thread has been measured, substantially as described.

22. In a thread-winding machine, a rotatable drum, a plurality of yokes therefor, a tube-supporting spindle pivotally mounted in each yoke, and a plurality of thread-guides reciprocated parallel to the tubes, combined with a plurality of driving-rolls located at opposite sides the center of rotation of the drum, movable bearings to sustain and guide said driving-rolls, mechanism to measure the length of thread to be wound, stop-motion mechanism connected with each of said movable bearings, and independent actuating devices therefor controlled respectively by the breakage of a thread and by movement of the measuring mechanism when the proper length of thread has been wound, to stop the rotation of the driving-rolls and measuring mechanism simultaneously, in either event, substantially as described.

23. In a thread-winding machine, a rotatable drum, a plurality of tubes rotatably supported adjacent thereto, thread-guides to deliver the thread to the tubes, and traverse mechanism for said thread-guides, combined with a plurality of driving-rolls located at opposite sides the center of rotation of the drum, and intermediate it and the said tubes, bearings to sustain and guide said driving-rolls, mechanism to measure the thread delivered to each tube, a continuously-rotating operating-shaft therefor, a clutch intermediate said shaft and measuring mechanism, an actuator for the clutch, and a stop-motion mechanism controlled by the breakage of a thread and connected with the bearings of the driving-rolls, to stop the rotation of the latter, and to control the clutch-actuator, substantially as described.

24. In a thread-winding machine, the following instrumentalities, in combination, viz: a series of rotatable drums, a plurality of tubes rotatably supported adjacent each of said drums, driving-rolls interposed between the drums and tubes, movable bearings to sustain and guide the driving-rolls, a stop-motion mechanism connected with each of said bearings and controlled by the breakage of a thread, to stop the rotation of the corresponding driving-roll, a series of thread-guides reciprocated parallel to the tubes, a cam-shaft, traverse-cams thereon to reciprocate the thread-guides, and speed-changing mechanism connected to said cam-shaft to gradually decrease the speed of the thread-guides as the thread is wound upon the tubes, substantially as described.

25. In a thread-winding machine, a rotatable drum, a driving-roll to be rotated thereby, and movable bearings to sustain and guide said roll, combined with a controller-bar con-

nected with said bearings, to render the roll operative or inoperative, a drop-wire normally held inoperative by the thread, a tipping lever on said bar and controlled by the drop-wire, a continuously-rotated ratchet-wheel, and a spring locking-bolt for the controller-bar, failure of the thread causing the tipping lever to be moved into engagement with the ratchet-wheel, to actuate the controller-bar and render the driving-roll inoperative, 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:

JOHN. C. EDWARDS,

FREDERICK L. EMERY.