(No Model.) 3 Sheets—Sheet 1.

J. W. FOSTER.

SPOOLING MACHINE.

No. 404,831. Patented June 11, 1889.

Fig. 1.

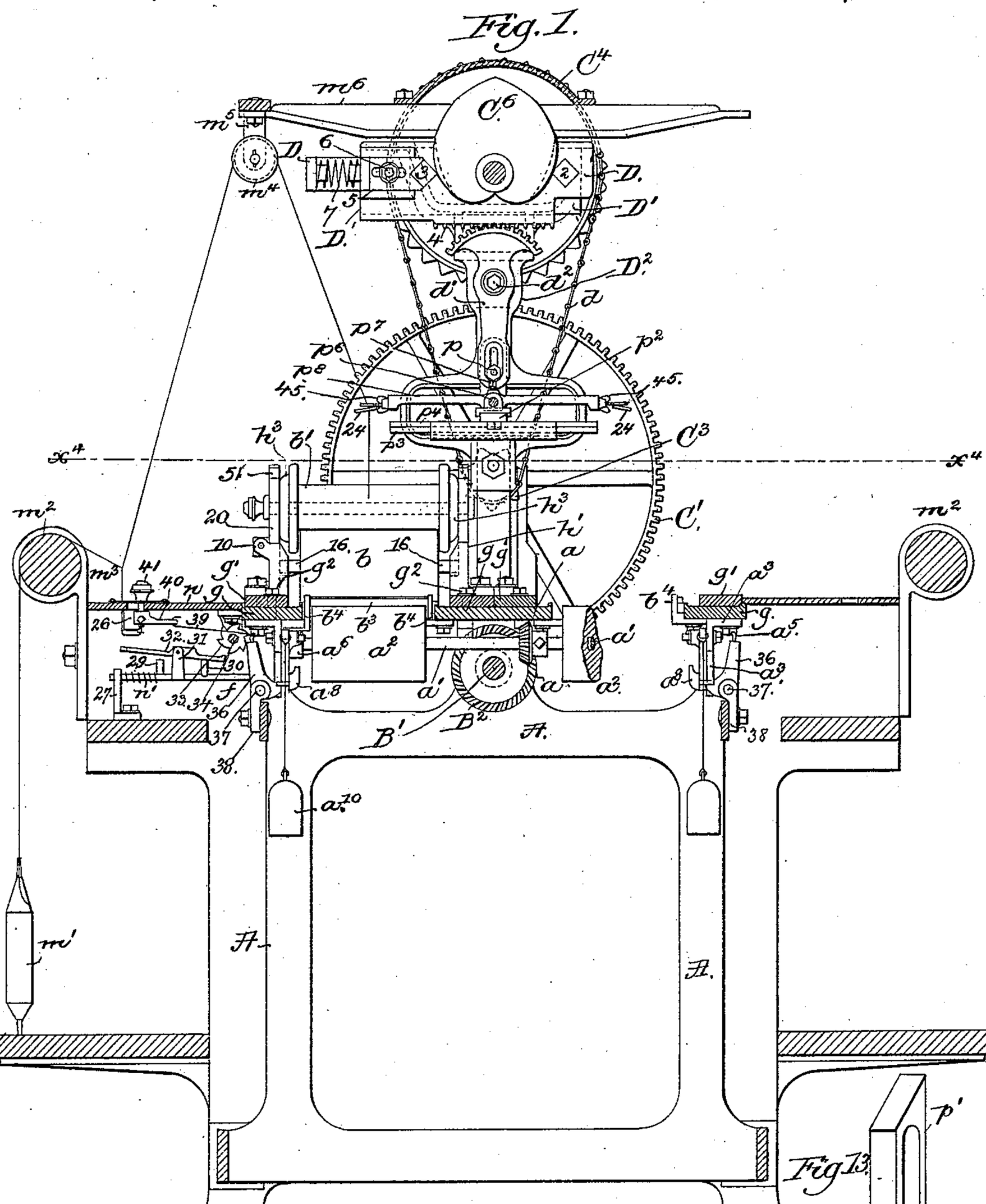


Fig. 13.

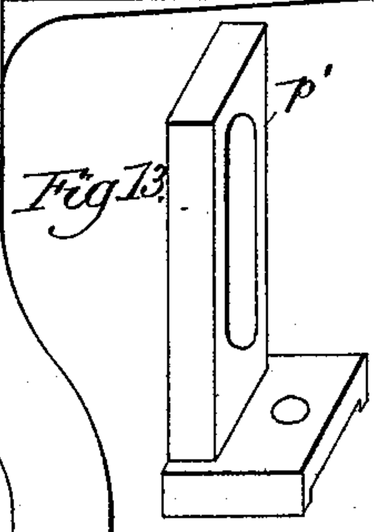
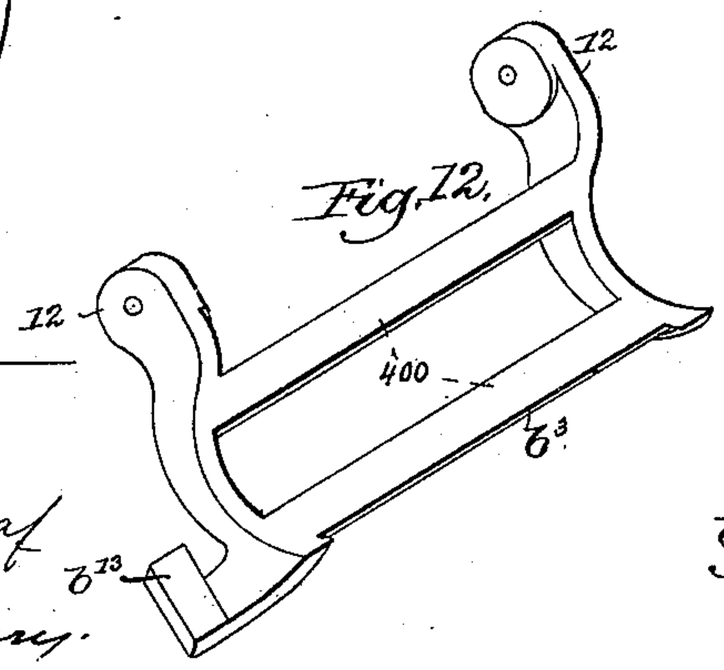


Fig. 12.



Witnesses.

Fred. S. Greenleaf

Frederick L. Emery.

Inventor.

John W. Foster

by Keroby & Gregory Attys.

(No Model.)

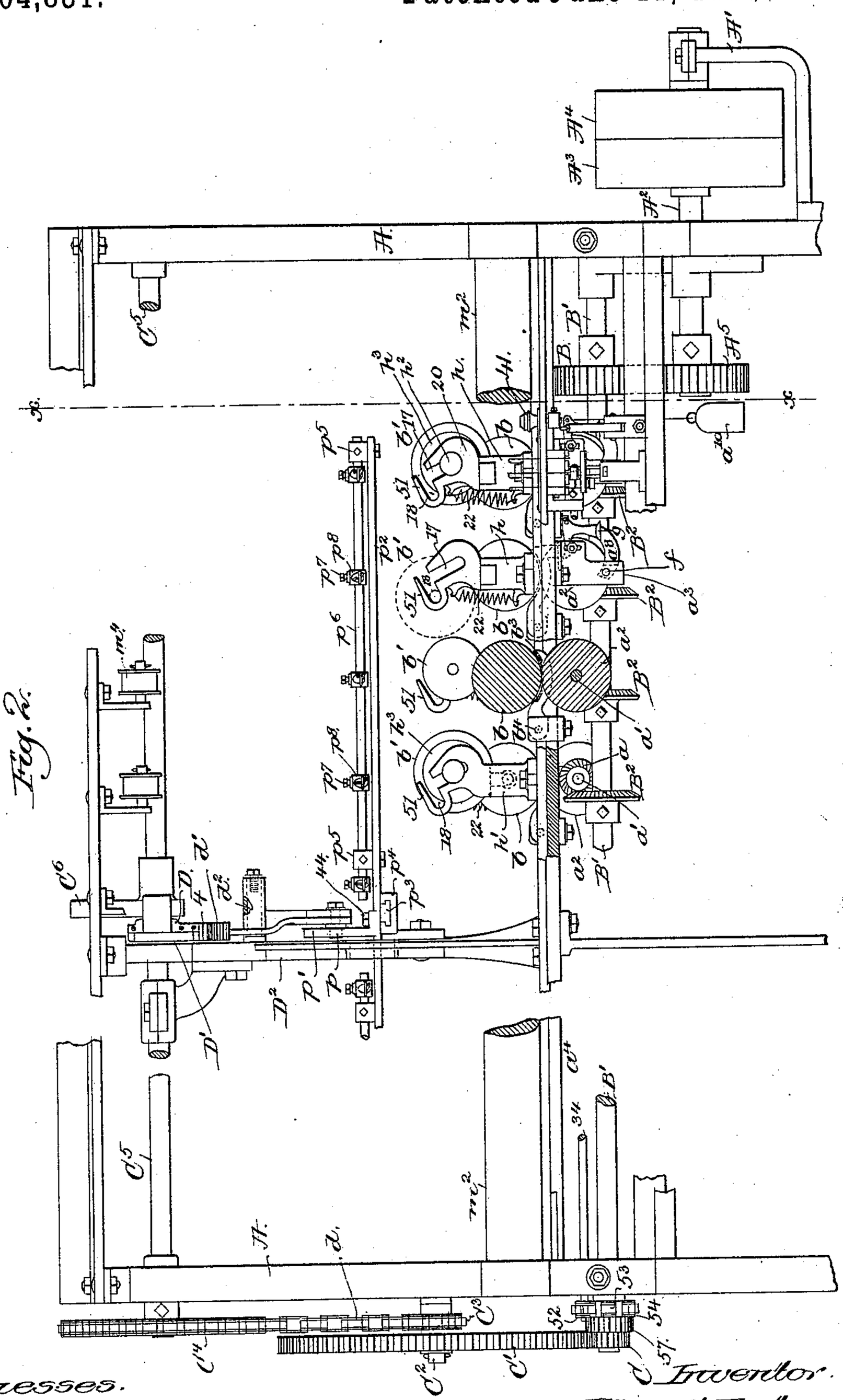
3 Sheets—Sheet 2.

J. W. FOSTER.

SPOOLING MACHINE.

No. 404,831. Patented June 11, 1889.

Fig. 2.



Witnesses.
Fred. S. Greiff
Frederick L. Emery

Inventor.
John W. Foster.
by Lerosby & Gregory
Attys.

(No Model.) 3 Sheets—Sheet 3.

J. W. FOSTER.

SPOOLING MACHINE.

No. 404,831. Patented June 11, 1889.

Fig. 3.

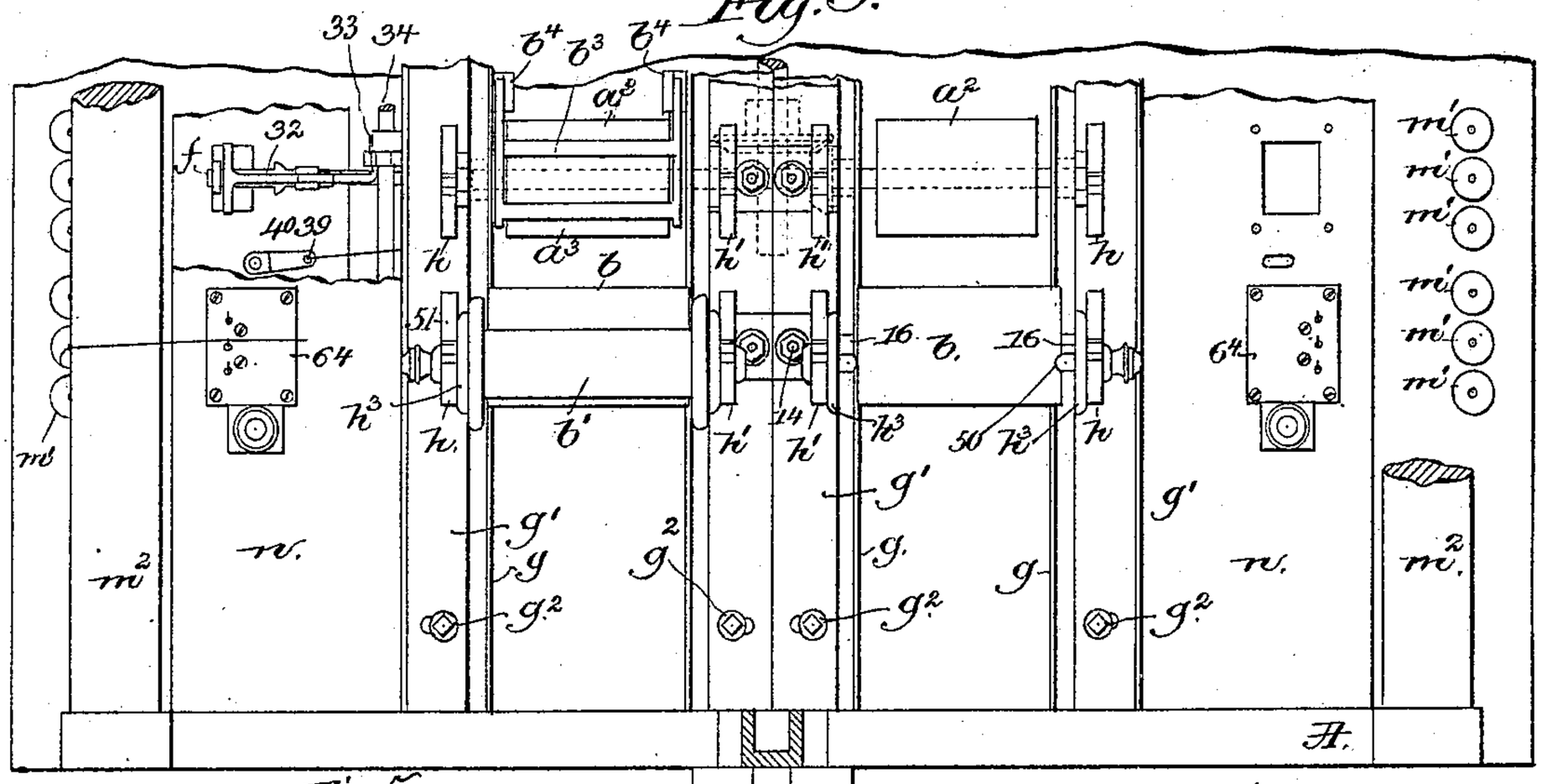


Fig. 5.

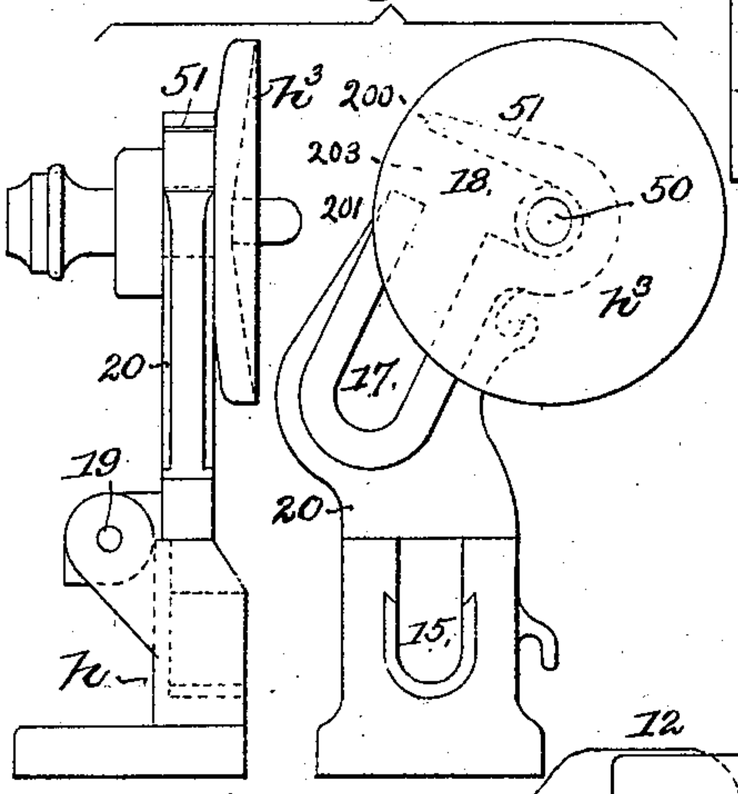


Fig. 6.

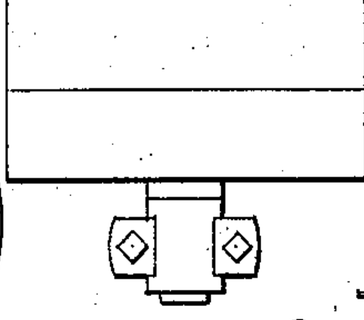
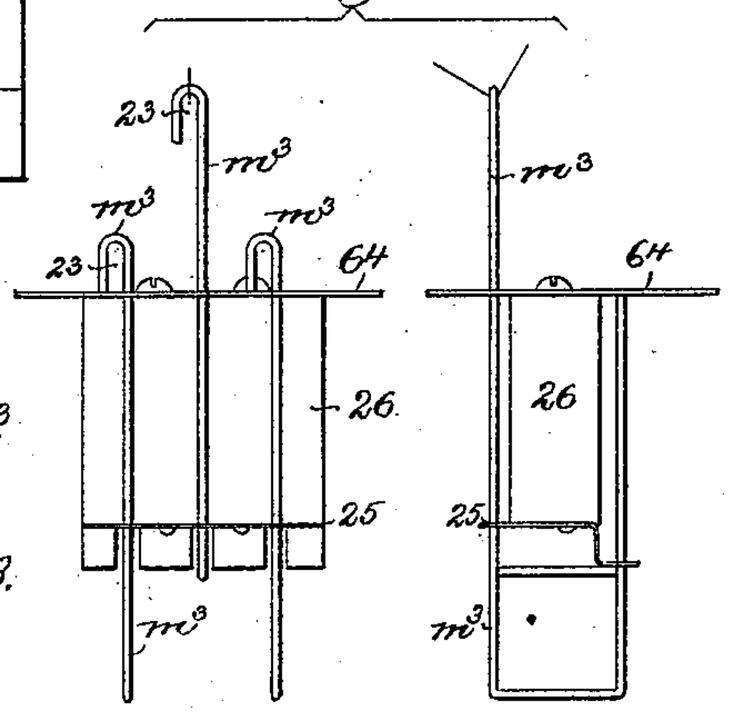


Fig. 4.



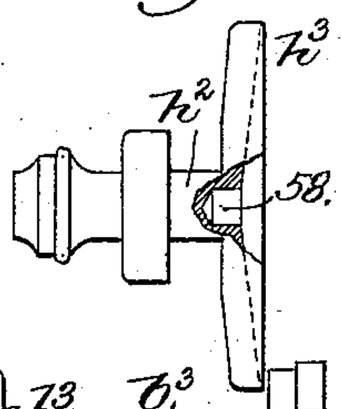


Fig. 7.

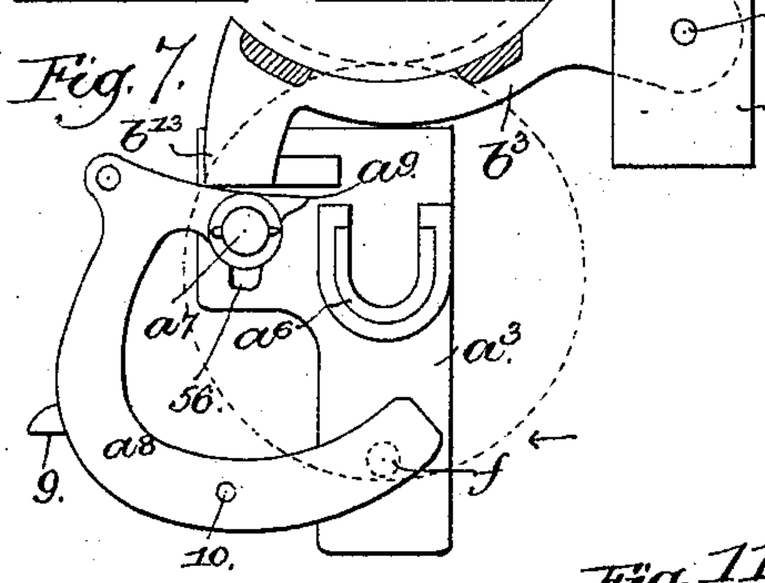


Fig. 8.

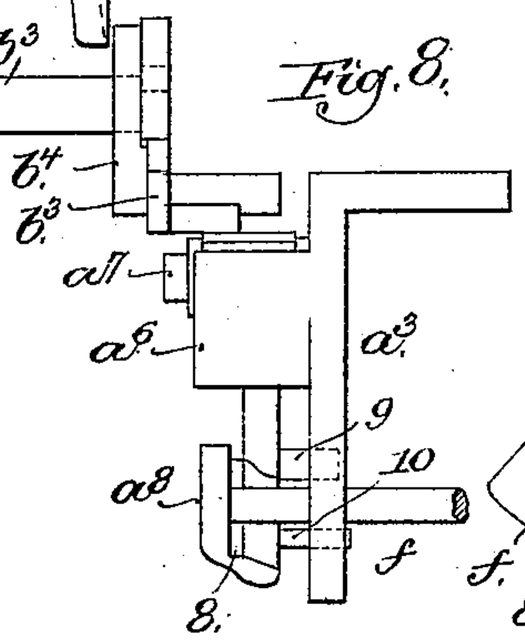


Fig. 9.

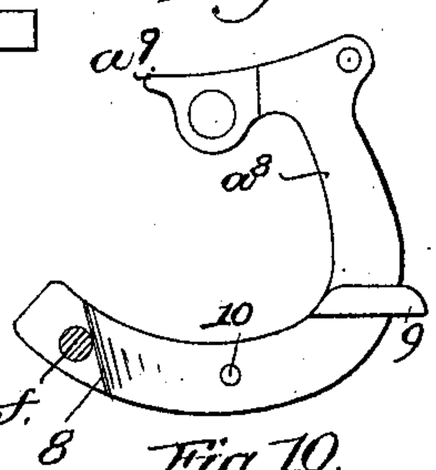


Fig. 11.

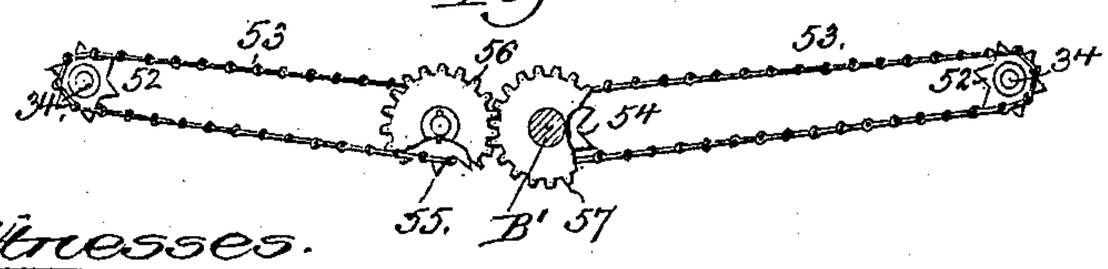
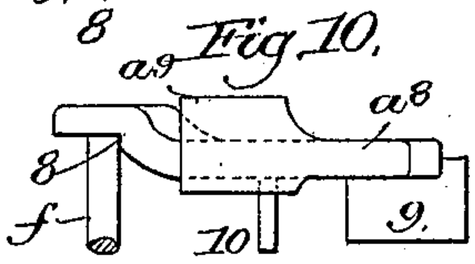


Fig. 10.



Witnesses.
Fred. S. Gould Jr.
Frederick L. Emery

Inventor.
John W. Foster.
By Lemby & Gregory
Attys

UNITED STATES PATENT OFFICE.

JOHN W. FOSTER, OF PAWTUCKET, RHODE ISLAND, ASSIGNOR OF ONE-HALF TO GEORGE E. MANNING, OF TAUNTON, MASSACHUSETTS.

SPOOLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 404,831, dated June 11, 1889.

Application filed January 30, 1888. Serial No. 262,315. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. FOSTER, of Pawtucket, county of Providence, and State of Rhode Island, have invented an Improvement in Spooling-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention has for its object the production of a novel machine for doubling or winding yarn from cops or bobbins upon spools.

The spool employed by me is and may be of usual construction, and as herein shown the spool has at each end a hole in line with the center of the barrel, the said holes receiving bosses extended from metallic cheeks having journals which enter slots in the spool-stands; but instead the bosses may be on the heads and enter holes in the cheeks. The cheeks, one at each end of the spool, have projections which constitute journals or bearing means for the spool, and the spool held between the inner sides of the said cheeks may be readily lifted by a slight pull on the part of the operator when it is desired to remove the spool, the said cheeks also serving as weights for and revolving with the spools, and at the same time rising in the slots of the spool-stands while the spools are being filled with yarn; but when the spools are full the journals of the cheeks pass automatically from their usual guiding-slots into pockets communicating therewith, the said pockets having overhanging edges or flanges, and the said journals having entered the said pockets the rotation of the spool ceases, and the spool having ceased to rotate the yarn passing to it becomes slack, permitting the drop-wires to fall and operate the stop-motion for the drum driving that spool.

The portions of the spool-stands guiding the bearing means or journals of the cheeks are so constructed that one may be readily moved away from the other, taking with it the cheek, thereby permitting the ready insertion or removal of a spool, the movable portion of the spool-stand referred to being preferably hinged, and also acted upon by a suitable spring which acts to keep it in one position.

The feet of the spool-stands are bolted or fixed to a stand-rail extended from one to the other end of the frame, the said stand-rail in turn being adjustably attached to a permanent rail, the latter having preferably at each edge a suitable flange or upright, against which one or the other edge of the stand-rail may be brought, thus enabling the spool-stands to occupy a position more or less apart to adapt them to receive between them drums and spools of different length, this change being readily effected.

In my improved machine the wave motion is arranged above the spools in such position that the operator may plainly see the yarn and reach it readily to correct any faults.

The wave-motion consists, essentially, of a carriage sliding in ways transversely of the frame, the said carriage having a series of guide-rods and eyes parallel to the axes of the spools.

The wave-motion carriage is actuated by a sector-lever deriving its motion from a toothed carriage actuated by a heart-cam so constructed, as will be hereinafter described, as to insure the winding of yarn uniformly and with equal closeness from end to end of the spool, thereby insuring an equal diameter of yarn on the spool at all points.

My invention consists, essentially, in a series of horizontally-placed driving-cylinders having their axes of rotation substantially at right angles to the frame, means to rotate them, and the series of drums resting thereon and adapted to rotate a series of spools by frictional contact, combined with a series of open-centered brakes interposed directly between the said driving-cylinders and drums, each brake having bars, as shown, extended in the direction of the length of the drums and at opposite sides of the axis of rotation of the said drums to thereby engage and instantly lift the drum above it from contact with the cylinder driving the said drum, the contact of the brake with the drum to lift the same from the cylinder acting instantly to check the rotation of the drum, substantially as described.

Other features of my invention will be hereinafter set forth in the claims at the end of this specification.

Figure 1 is a transverse section in the line

x, Fig. 2, of a doubling and spooling machine containing my improvements, part of the mechanism at the right-hand side of the frame being omitted to show other parts, the parts omitted being duplicates of those shown at the left-hand side of the said figure. Fig. 2 is a broken partial side elevation and partial section of enough of my improved machine to show the construction of the different working parts, the drop-wires and some of the parts co-operating with them being left off opposite the second spool from the right, the second spool and its cheek being, however, shown by dotted lines as in the position it will occupy when filled and the journal or bearing means is in the pocket of the spool-stand, the driving-cylinder and drum for winding the third spool from the right being shown in section, the spool being removed to show the rearmost cheek, while the fourth drum and spool from the right is supposed to be that at the opposite side of the frame, the spool next to the left of the third spool at the front of the machine and its driving-cylinder and drum being wholly omitted. Fig. 3 is a partial top or plan view of the machine shown in Fig. 2 below the wave-motion carriage in the line x^4, Fig. 1, the said figure showing at the left a spool on the drum and opposite it a drum with the spool removed, leaving, however, cheeks; but at the rear of the spool at the left the spool, drum, and cheeks are omitted to show the brake and the cylinder below it, while opposite it in line with the said cylinder the machine is further depleted by removing the brake and the ears on which it is pivoted, the said figure also showing by dotted lines part of the main or gear shaft and a bevel-wheel thereon by which to drive the bevel-wheel on the cylinder-shaft, the said figure at the left also showing the top board as partially broken away to represent part of the stop-motion devices. Fig. 4 shows some of the drop-wires and the guides in which they slide. Fig. 5 is a detail showing in two positions that one of the spool-stands which is adjustable upon its foot portion, together with the connected cheek. Fig. 6 shows one of the cheeks removed, with its bearing means or journals for the spool, the said cheek being, however, modified at its inner side. Fig. 7 is a detail showing the brake for lifting the drum from the cylinder which drives it, together with the weighted lever for lifting the said brake to remove the drum from the cylinder, and with the spring-bolt of the stop-motion for holding the said lever, the said figure also showing one of the bearings for the shaft of the cylinder which drives the drum. Fig. 8 is an elevation of Fig. 7, looking at it from the right. Fig. 9 is an inner side elevation of the brake-actuating lever; Fig. 10, a top or plan view of the lever shown in Fig. 9. Fig. 11 is a detail showing the chains and gearing for rotating the stop-motion shafts. Fig. 12 shows the brake detached, and Fig. 13 is a detail showing the upright slotted stand of the wave-motion carriage.

The frame-work A, of suitable shape to contain the working parts, has at one end, at about thirty inches from the floor, a bearing and stand A′ for the power-shaft A^2, it having a fast and loose pulley, as A^3 A^4. The shaft A^2 has at its inner end a pinion A^5. The pinion A^5 engages the pinion B on and rotates the gear-shaft B′, it having attached to it at suitable intervals bevel-gears B^2, each of which engages a small bevel-pinion, as a, secured to a transverse shaft a', to which is attached near each end a cylinder, as a^2, upon which, by gravity, rests a drum, as b, or it may be the spool.

As shown in Figs. 1, 2, and 3, each cylinder drives a drum, there being a spool b' resting on each drum, the axes of the cylinders, drums, and spools being parallel each to the other and all arranged transversely to the main shaft B′ and to the length of the frame to thus give great compactness of parts, the cylinders, drum, and spools at opposite sides of the frame being preferably in line each with the other.

The bearing-stands a^3 for the cylinder-shafts a' are secured by bolts a^5 to a longitudinal rail g. Each stand a^3 has a U-shaped bearing a^6 for one end of a shaft a' and a slot 56 (see Fig. 7) for the reception of an adjustable stud a^7, which constitutes the fulcrum for the brake-actuating lever a^8, having at its upper end a toe a^9 and at its rear side below its fulcrum a shoulder 8, a shelf 9, and a stop 10, the said lever having hung upon it a weight a^{10}, (see Fig. 1,) which normally turns the lever to bring the stop 10 against a depending portion of the stand, except when the said lever is held in its full-line position, Fig. 7, by the spring-bolt f of the stop-motion, as will be described, or by the starting-lever 36.

The brake b^3, one for each cylinder a^2, and shown separately in Fig. 12 as an open-centered concavo-convex plate, has ears 12, which are pivoted at 13 to ears b^4, (see Figs. 1, 3, 7, and 8,) suitably secured, preferably by bolts, to the under side of the permanent rails g, the said ears rising past or above the inner edges of the said rails.

Each brake b^3 is cast open at its center to leave a space, so that the cylinder a^2 and drum above it may contact through the said space, the said brake having two bars or projections 400 400, which, when the brake is interposed between the cylinder and drum, fall at opposite sides of a vertical line drawn through the journals of the drum, and as a result thereof the said brake when lifted, as will be described, brings the said bars 400 against the drum at opposite sides of the said vertical line and at two points, so that the said drum as it is lifted from the cylinder by the brake is instantly stopped, stopping the spool.

Each brake b^3 is interposed between a cylinder a^2 and a drum b, the said drum resting by gravity on the said cylinder so long as the

brake is permitted to remain in its lowest position, with its heel b^{13} resting on the lever a^8, (see Fig. 7;) but as soon as the spring-bolt f of the stop-motion mechanism is pushed out, as will be described, to release its inner end from the shoulder 8 of the lever a^8, the weight a^{10} turns the said brake-actuating lever a^8, causing its toe a^9 to act upon the heel b^{13} of and lift the brake b^3, and with it the drum above it, thus removing the latter from contact with the cylinder a^2, which continues to run at speed.

Lifting the drum from the cylinder immediately disconnects the drum from its source of motion, and at the same time the device which so lifts the drum acts as a brake to instantly stop the rotation of the drum, overcoming all its tendency to move by reason of momentum, and as the drum stops the spool stops.

The frame, as herein shown, has extended longitudinally thereof from end to end three permanent rails g, having at their longitudinal edges (see Fig. 2) flanges or upright portions which act as stops for stand-rails g', adjustably secured by bolts g^2, extended through slots in the said stand-rails g and entering the permanent rails g'. The stand-rails g' have secured to them by bolts 14 the feet of the spool-stands h h', the lower portions of the stands having vertical grooves 15 (see Fig. 1) for the reception of the journals 16 (see right of Fig. 3) at the opposite ends of the drums b. By adjusting the stand-rails g' or the permanent rails g all the bearing or spool stands h and all the stands h' may be moved away from or toward each other in the direction of the width of the machine to enable spools and drums of different lengths to be used, as desired, in the same machine.

The upper portions of the spool-stands h h' have slots, as 17, which receive the bearing means for the spools, the said bearing means, as herein shown, being the journals h^2 of the weighted cheek-pieces h^3, between two of which the heads or ends of the spools b' are clamped, the inner sides of the said cheeks, (see Fig. 5, where one of the cheeks is shown enlarged) having a boss 50 to enter the usual recess at the center of the spool-head. Some classes of spools now employed in spooling and doubling machines have, as has been stated, metallic hollow journals extended outwardly from their heads, and to adapt this class of spool for use in my improved machine it is only necessary to omit the boss 50, and instead provide the cheek with a recess 58, to receive the journal extending from the spool-head. This is shown in Fig. 6.

The friction between the spool and cheek pieces is sufficient to rotate both of the cheek-pieces in unison with the spool as the latter is driven by the drum, the journals h^2 turning in the slots 17, and at the same time rising therein as the spool is filled with yarn, and as soon as the spool has been completely filled the said journals meet the overhanging edges or flanges 51 at the upper ends of the said stands 17, the flanges referred to extending substantially across the said slots 17, and the said journals thereafter pass laterally from the position shown by the first spool at the right in Fig. 2 into the pockets 18, which are slots in communication with the slots 17, the said spool, the said journal having entered the pocket 18, assuming the dotted-line position, as shown by the second spool from the right of Fig. 2, and the full line-position, Fig. 5, the rotation of the spool stopping as soon as the journals h^2 enter the pockets. After this the spool is removed from contact with the drum. As soon as the rotation of the full spool ceases the yarn becomes slack and lowers the drop-wire m^3, just as when a thread breaks, and the drop-wire effects the stopping of the drum.

By an inspection of the drawings, especially Fig. 2, it will be seen that the slot 17 is inclined from a perpendicular, and that the slot 18, forming the pocket, is nearly or substantially at right angles to it; and it will also be noticed that the slot 17 is of such inclination and depth that when the bearing means for the spool (as the said journal h^2) is in the lower end of the said slot (as when the yarn is first applied to the spool) the said journal occupies a position at the right of the center of rotation of the drum, in which position the drum exerts its greatest leverage upon the spool; and it will be noticed that as the spool is gradually filled the bearing means therefor is gradually forced upwardly in the slot 17, the point of contact between the drum and the mass of yarn upon the spool gradually approaching a line perpendicular to the axis of rotation of the journals, and by the time that the spool is filled the bearing means for the spool arrive at the junction of the slot 17 and the pocket 18, and are immediately forced, as it were, into the pocket 18 through the agency of the overhanging flange 51, covering the slot 17 and forming part of the pocket 18.

The spool-stands h, or the outermost stand of each pair of stands h h', are made in two parts, connected or hinged together by a pin, as 19, which permits the upper portion 20 of the said stand h to be turned outwardly, with its attached check-piece, when it is desired to remove a spool from or to replace a spool between the two cheek-pieces carried by the said stand h h', the pivoted or hinged portion 20 being normally held in upright position, with its cheek-piece against one head of the spool, by a strong spiral spring 22, connected to a stud near the foot of the stand and to a stud near the slot 18. (See Fig. 1.)

The yarn to be wound upon each spool b' is taken from one or more bobbins, as m', or it may be spools, according to the work to be done, and passed over first a guide-rail m^2, thence through an eye 23 at the upper end of a drop-wire m^3, (shown enlarged in Fig. 4,) thence over a sheave, as m^4, on a bracket m^5,

at the end of the cross-arm m^6 at the top of the frame, through the eyes 24 of the wave-motion rods, and to the spools.

The lower end of the drop-wire, it having, as shown, two parallel legs, is guided by a guide 25, composed, as shown, of a metal plate attached to a block 26, secured in suitable manner to the under side of a plate 64, resting on the top board *n*.

The spring-bolt *f* of the stop-motion has suitable bearings near each end, in which the said bolt is free to slide, one of the said bearings being in a stand 27, while the other bearing is in a hole in the stand a^3. (See Fig. 8.) The bolt *f* is normally pressed forward, so that its inner end engages the shoulder 8 of the lever a^8 by a spiral spring, as n', surrounding the bolt between the stop-lug 29 and the stand 27. (See Fig. 1, at left.)

The bolt has a second stop-lug 30 and a lug 31 to contain a pin on which is pivoted and is very nearly balanced the tipping-lever 32 of the stop-motion, the inner end of the said lever being but the least trifle heavier than its outer end, so that the lever normally rests with its inner end upon the stop 30, and at such time the inner end of the said lever is out of range of the ratchet-wheel 33 of the stop-motion, there being one such ratchet for each lever 32, the series of ratchets being connected to the stop-motion shaft 34. The machine has at each side a like shaft 34, each shaft having at its outer end a sprocket-wheel 52, which is connected by a chain 53 with one of the two sprocket-wheels 54 or 55, one 54 being on the shaft B′, just outside the frame, the other 55 being on the hub of a pinion 56, driven by the pinion 57 on the shaft B′, (see detail, Fig. 11,) the shafts 34 being rotated constantly, so that whenever a drop-wire for any cause descends upon the outer end of the lever 32 the said lever is tipped to strike the stop 29, and in so doing the rear or inner end of the lever 32 is acted upon by the ratchet 33, which pushes the bolt *f* longitudinally outward, releasing its end from the shoulder 8 of the lever a^8, permitting the weight a^{10} to move the lever, as described, and lift the brake. The lever having been liberated, the weight brings the shelf 9 of each lever a^8 against the toe of a starting-lever 36, pivoted at 37 on a bracket 38, the said starting-lever being connected by a link 39 to a hand-piece 40, having a knob 41 extended through a slot in the board *n*, the operator, to start any drum, pulling the knob outward, causing the toe of the lever 36, acting on the shelf 9, to turn the lever a^8 until the shoulder 8 is again caught and held by the bolt *f*, such movement of the lever lowering the brake and permitting the drum *b* to rest on and be rotated by the cylinder a^2.

The shaft B′ at that end of the machine opposite the fast and loose pulley has a pinion C, (see Fig. 2,) which engages and rotates a large toothed gear C′, loose on a stud C^2, the hub of the said gear having a sprocket-wheel C^3, which engages and moves a chain *d*, extended over a sprocket-wheel C^4, fast on the heart-shaft C^5 of the wave-motion, the said shaft having secured to it at suitable intervals one or more heart-cams, as C^6, one only of which is shown, each heart in its rotation acting on the studs 2 3 of a carriage D, provided with rack-teeth 4, and adapted to slide in a guideway D′, fixed to an upright D^2, erected on the frame-work.

The stud 2 is fixed to the said carriage; but the stud 3 is projected from a block 5, held to the carriage loosely by a screw 6, extended through a slot in the said block, the outer end of the block being acted upon by a strong spiral spring 7, located between the block and an ear or lug on the carriage D, the said spring serving to always keep the stud 3 in contact with the heart.

The teeth 4 of the carriage engage the toothed end of a sector-lever d', the hub of which surrounds a stud d^2, the latter serving as a fulcrum for the said sector-lever. The lower end of the sector-lever is slotted (see Fig. 2) to receive within it an adjustable roller or other stud *p*, the latter entering an elongated slot in a stand p', (shown in Fig. 2, and also separately in Fig. 13,) the said stand being connected by screws 44 to the main bar p^2 of the wave-motion carriage, the said carriage being composed, essentially, of the bar and suitable blocks or shoes, as p^3, arranged at right angles thereto, and adapted to slide in guideways p^4, secured to suitable uprights, the sector-lever d' in its movements causing the wave-motion carriage to be reciprocated in a straight line transversely across the machine.

The wave-motion carriage has erected upon it at suitable distances apart lugs p^5, which receive a rod p^6, upon which at suitable intervals, by set-screws p^7, are clamped arms p^8, which at their outer ends have screwed into them the eyes or guides 24, the said eyes or guides, as herein shown, being composed of wire screwed therein at one end, so as to be screwed out from or into the said arms p^8, as may be desired, the eyes being held in adjustable position by set-nuts 45, there being one such bar for every spool.

The slot in the sector-lever enables the roller or other stud *p* to be adjusted therein up or down, according as a short or long spool is to be wound.

In my first experiment I employed a true heart-cam—that is, a heart-cam of established shape—to actuate the carriage D, and toothed sector d' to reciprocate the wave-motion carriage; but I found in practice that the movement of the sector was so rapid immediately before its arrival in vertical position, as in Fig. 1, and immediately after passing from its vertical position, that the coils or turns of yarn wound upon the central part of the spool, considered with relation to its length, were not as closely laid as when the yarn was being wound upon the spool near its ends, and

as a result of this too great speed in the sector d' when near its vertical position the diameter of the wound spool was not as large at and along its central part as at and near its ends. To overcome this difficulty and insure a uniform even winding of the yarn from end to end of the spool, I added to the edge of the regular heart-cam between its heel and point a quantity of metal, the amount of metal so added being that designated in Fig. 1 outside the dotted lines, near the periphery of the heart-cam C^6. This addition of metal to the usual heart made it more nearly a true circle in certain diameters, and therefore the speed of movement of the carriage D, and consequently of the sector d', was decreased, for it is obvious that the more nearly circular the part of the heart which acts upon the usual stud 2 of the carriage D the slower the speed of the said carriage at such time.

It will be noticed that the sets of spools driven by the cylinders of each separate shaft a' actuate spools so arranged with relation to each other that their axes of rotation substantially coincide, one spool being, however, at one and the other at the opposite side of the longitudinal center of the machine. This arrangement of the spools, and consequently of the driving drums and cylinders, the drums being on top of the cylinders, enables me to employ one wave-motion rod for two sets of spools arranged at opposite sides of the machine.

I am also aware that a series of drums having their axes arranged in the direction of the length of the frame and having their journals in a pivoted frame have been employed to rotate spools resting on the said drums, the said drums at opposite sides the frame being rotated by a long cylinder extended longitudinally of the frame from end to end, a series of brakes arranged at one side the said drums acting to check the rotation of the drums when the latter are turned aside from contact with the driving-cylinder by a rocking movement of the frame carrying the drums.

I have herein shown one very simple form of stop-motion mechanism or devices; but I desire it to be understood that I do not desire to limit my invention to the exact form of stop-motion devices shown, as instead of the said devices I might use any other suitable well-known form of stop-motion devices, and so, also, while I prefer the form of connecting mechanism herein shown between the heart-cam and the wave-motion carriage, yet I may employ other well-known forms of devices commonly employed for such purposes.

In may invention the stop-motion devices for all the spools, one at each side of the frame, are controlled by a single positively-driven shaft which, through, a ratchet-wheel thereon, acts upon any one of the spring-bolts forming part of the stop-motion device for each spool.

The spaces below the flanges 51 and termed the "pockets" 18, in which pass the bearing means for the spools, are in practice contracted at the outer end of the pockets by bending the flanges 51 down at their free ends or between the points 200 and 201, (see Fig. 5,) so as to prevent the said bearing means from passing out of the said pockets in the direction of the arrow 203, except by considerable strain exerted by the operator, so that the said bearing means when the part 20 is tipped over remain in the stand. The bearing means when passed into position under the flanges 51 have to be pushed through the contracted space between the points 200 and 201 with considerable force; but, once in, the bearing means will not be forced out of the spool-stands by any force due to the strain exerted on the spool.

The stop-motion devices, cylinders, drums, spools, and their supporting mechanism are alike at both sides the frame, and I have therefore considered it unnecessary to duplicate all the said parts, as from the parts shown any one conversant with doubling or spooling machines will readily understand my invention.

I claim—

1. The series of horizontally-placed driving-cylinders having their axes of rotation substantially at right angles to the frame, means to rotate them, and the series of drums resting thereon and adapted to rotate a series of spools by frictional contact, combined with a series of open-centered brakes, as b^3, interposed directly between the said driving-cylinders and drums, each brake having bars, as shown, extended in the direction of the length of the drum and at opposite sides of the axis of rotation of the said drum to thereby engage and instantly lift the drum above it from contact with the cylinder driving the said drum, the contact of the brake with the drum to lift the same from the cylinder acting instantly to check the rotation of the drum, substantially as described.

2. The cylinder a^2, the drum resting thereon, the slotted spool-stands to receive the journals of the said drum, and bearing means for the spool, also guided between and held by the said spool-stands, combined with the brake b^3, having an open center and interposed directly between the cylinder and drum, the bars or projections 400 400 of the brake acting upon the drum at the opposite sides of a vertical line drawn from the journals of the drum, whereby the drum is lifted vertically and is supported by the brake at each side, the said line thus instantly stopping the rotation of the spool, substantially as described.

3. The driving-cylinder, means to rotate it, the drum resting on and rotated by the said cylinder, the slotted spool-stands, and cheek-pieces to hold frictionally between them and clamp the spools, and having journals free to enter and rotate and slide vertically in the

slots in the said spool-stands, substantially as described.

4. The driving-cylinder, means to rotate it, the drum resting thereon and rotated by the said cylinder and adapted to rotate a spool lying thereon, and spool-stands provided with slots and overhanging flanges 51 to form pockets, as 18, combined with bearing means, substantially as described, for the spools, the said bearing means consisting of independent cheek-pieces and journals, the latter entering the said pockets automatically when the spool has been filled, substantially as described.

5. The driving-cylinder, combined with slotted spool-stand adapted to receive between them the spool to be rotated, one of the said stands being made movable in a direction from and toward the other, substantially as described.

6. The series of driving-cylinders arranged across the machine in the direction of its length, drums resting on the said cylinders, and spool-stands slotted, as at 17 18, to leave flanges 51 overhanging the slots 17, combined with independent cheek-forming bearing means for both ends of the spools, the said bearing means, as the spools fill, rising and rotating in the said slots 17 until the bearing means meet the said flanges, the latter, as the yarn on the spool increases in diameter, acting on the bearing means to force the same into the slots 18 to stop the spool, substantially as described.

7. The driving-cylinder, means to rotate it, the spool-stands, the drum resting thereon, and the brake, combined with the brake-actuating lever, the spring-actuated bolt of the stop-motion, and means to actuate it, substantially as described.

8. The driving-cylinder, the intermediate drum adapted to support the spool, and the slotted spool-stands, one of which is movable upon a pivot in a direction from and toward the other, combined with a spring adapted to hold in operative position the pivoted portion of the spool-stand, substantially as described.

9. In combination, the revolving ratchet-wheel 33, the spring-operated bolt *f*, the lever pivoted thereon, and the drop-wires, substantially as described.

10. The driving-cylinder, means to rotate it, the drum, the brake, and the brake-actuating lever provided with the shelf, combined with the starting-lever to move the brake-actuating lever, to operate substantially as described.

11. The heart-cam shaft, the heart-cam thereon, the horizontally-sliding carriage D, and the wave-motion carriage, combined with the sector-lever actuated by the said carriage and connections, substantially as described, between it and the said wave-motion carriage, as set forth.

12. In a spooling-machine, two series of driving-cylinders arranged transversely of the machine and having their axes substantially in line, two series of drums parallel therewith and resting thereon, and two series of spool-stands, combined with bearing means, substantially as described, for the said spools, and with the open-center brakes interposed directly between the said cylinder and drum and having parallel bars acting upon opposite sides of the axis of the drum to lift each drum from each cylinder, and with means to actuate the said brakes, substantially as described.

13. In a spooling-machine, two sets of driving-cylinders at opposite sides of the frame, with their axes at right angles to the length of the frame, two sets of spool-stands, stand-rails to which they are bolted, rails on which the stand-rails rest, and means to adjustably connect the stand-rails with the said rails, combined with two sets of drums *b*, for rotating the spools *b'*, and bearing means for the spools, whereby the spool-stands may be simultaneously adjusted to adapt the frame for the reception of spools of different lengths, substantially as described.

14. Two sets of driving-cylinders, one at each side of the frame, the axes of the said cylinders being arranged transversely of the frame, two sets of slotted spool-stands, and bearing means for the said spools between the said stands and above the said cylinders, combined with the wave-motion carriage located above the spools and having arms p^8, and thread-guides, as 24, for the yarns going to both sets of spools, and with means to rotate the said cylinders and actuate the wave-motion carriage, to operate substantially as described.

15. The slotted spool-stands, driving-cylinder, and drum, combined with metallic cheek-pieces, shaped substantially as described, at their inner side for engagement with the spool and provided at their outer side with journals entering the slots of the said stands, substantially as described.

16. The cylinder a^2, the drum, the brake, and the brake-actuating lever having a toe and a shoulder 8 and weight to move the said lever, combined with the spring-actuated bolt, its attached lever, drop-wire, and ratchet, and means to move it, substantially as described.

17. In a spooling-machine, two sets of driving-cylinders at opposite sides of the frame, the said cylinders having their axes coincident, or substantially so, two sets of slotted spool-stands having flanges, as 51, to leave pockets 18 below them, two sets of drums having their axes parallel to the axes of and resting on the said cylinders, and bearing means for the spools, combined with the wave-motion carriage, and means, substantially as described, to reciprocate it transversely of the frame, the said wave-motion carriage and its actuating cam-shaft being located above the said drums and spools thereon, substantially as described.

18. In a spooling-machine, two series of driving-cylinders, one at each side of the frame, the said cylinders having their shafts

or axes of rotation arranged transversely of the frame, means to rotate the said cylinders at uniform speed, two sets of slotted spool-stands, bearing means for the spools to be held by the said slotted stands and to be rotated between the said stands, a wave-motion carriage having yarn-guiding eyes to guide the yarn going to the said spools, and means for actuating the said wave-motion carriage, substantially as described.

19. In a spooling-machine, two sets of driving-cylinders at opposite sides of the frame, the said cylinders having their axes coincident, or substantially so, two sets of slotted spool-stands having flanges, as 51, to leave pockets 18 below them, two sets of drums having their axes parallel to the axes of and resting on the said cylinders, and bearing means for the spools, combined with the wave-motion carriage, means, substantially as described, to reciprocate it transversely of the frame, the said wave-motion carriage and its actuating cam-shaft being located above the said drums and spools thereon, a series of brakes, brake-actuating levers, stop-motion devices, and with means for moving the said stop-motion devices on the breaking of a yarn, 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:
G. W. GREGORY,
C. M. CONE.