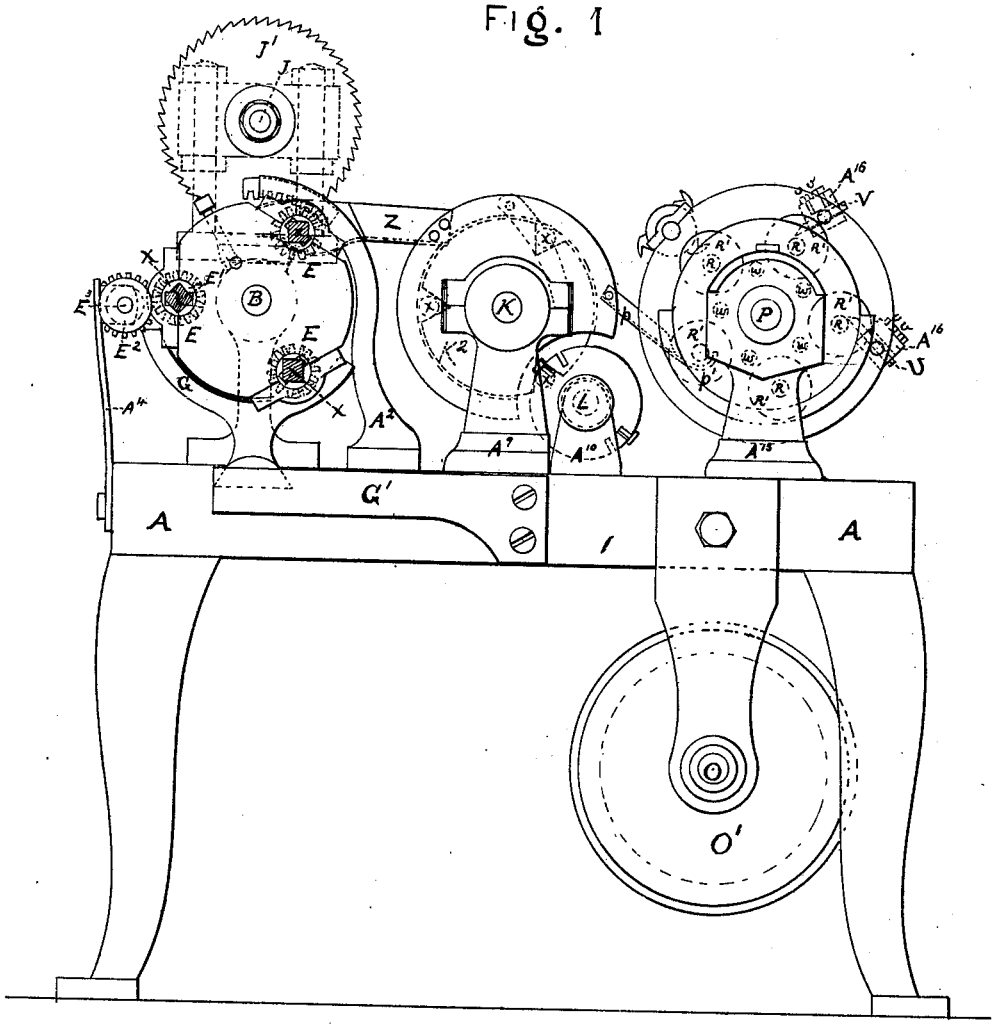
5 Sheets—Sheet 1.

H. E. KAY.

Machine for Making Spools.

No. 214,300. Patented April 15, 1879.

Fig. 1



Witnesses:
W. C. Brookes
C. C. Stetson

Inventor:
H. E. Kay
by his attorney
C. C. Stetson

5 Sheets—Sheet 2.

H. E. KAY.

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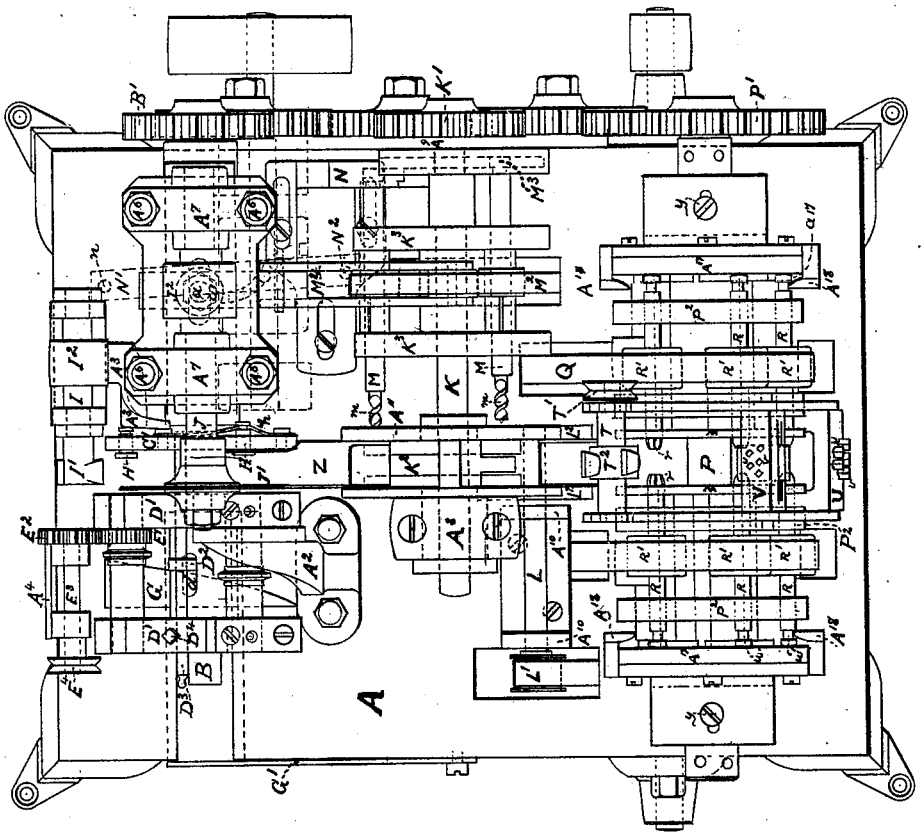
FIG. 2



WITNESSES:

W. C. Brookes

Chas. C. Stetson

INVENTOR:

H. E. Kay

by his attorney C. C. Stetson

H. E. KAY.

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Fig. 3

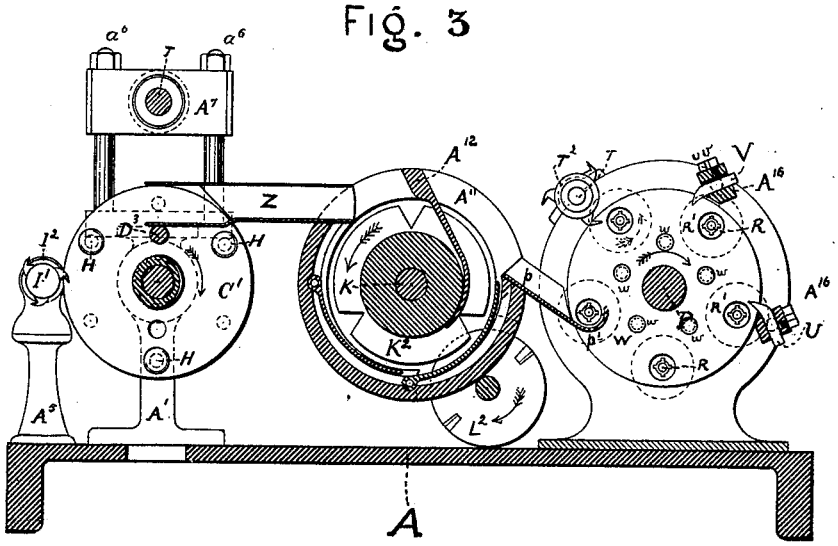
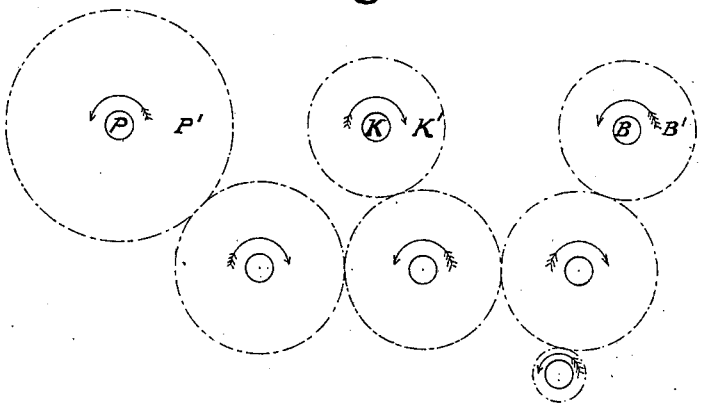


Fig. 7



WITNESSES:

W. C. Brookes

C. C. Stetson

INVENTOR:

H. E. Kay

by his attorney

C. C. Stetson

H. E. KAY.

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Fig. 4.

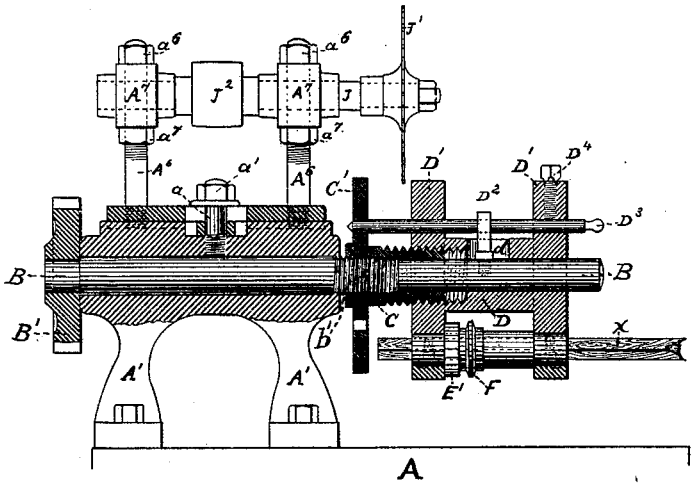


Fig. 8

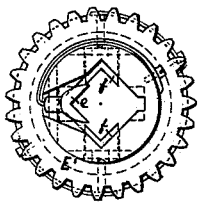


Fig. 9

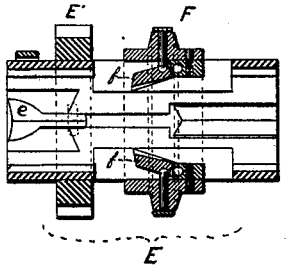
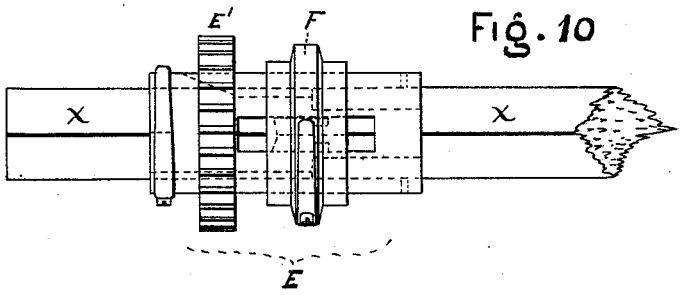


Fig. 10



WITNESSES:

W. C. Brookes

Chas. C. Stetson

INVENTOR:

H. E. Kay

by his attorneys

Stetson & Stetson

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Fig. 6

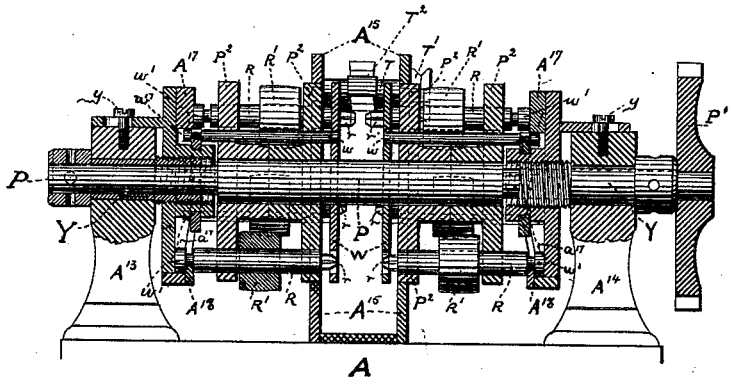
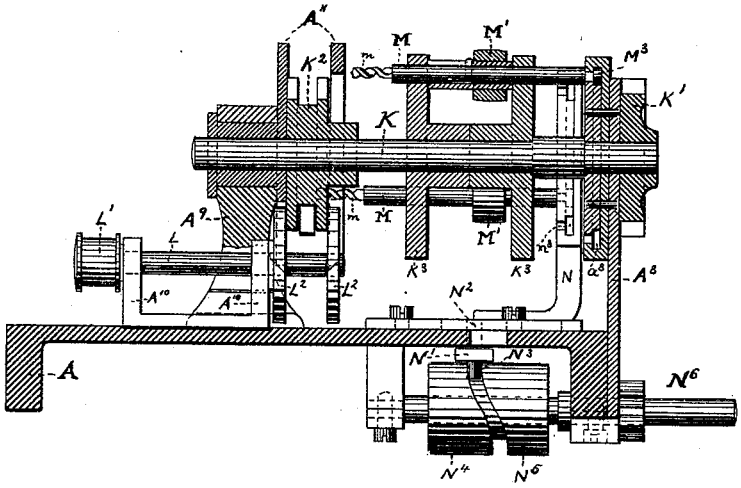


Fig. 5



WITNESSES:

W. C. Brookes

Chas. C. Stetson

INVENTOR:

H. E. Kay

by his Attorney C. C. Stetson

UNITED STATES PATENT OFFICE.

HENRY E. KAY, OF FALL RIVER, MASSACHUSETTS.

IMPROVEMENT IN MACHINES FOR MAKING SPOOLS.

Specification forming part of Letters Patent No. **214,300**, dated April 15, 1879; application filed July 18, 1878.

To all whom it may concern:

Be it known that I, HENRY E. KAY, of Fall River, in the county of Bristol and State of Massachusetts, have invented certain new and useful Improvements relating to Machines for Making Spools; and I do hereby declare that the following is a full and exact description thereof.

The machine is more particularly adapted for manufacturing the small spools used for containing fine silk, cotton, and other threads for sewing. The wood is supplied in long sticks, and is turned out in the form of perfectly-finished spools.

I combine three sets of mechanism. The wood, which should be clear stuff of a proper character, is previously reduced by sawing, or otherwise, to sticks of a uniform square section. These are introduced in square holes in revolving holders. The machine subsequently takes care of the whole. The holders contain feeding-clamps and holding-clamps. The feeding-clamps reciprocate and move the sticks through the holding-clamps. A movement of the stop against which the end of the stock abuts induces a slight return motion of the stick, which causes the holding-clamps to gripe very firmly. At one point in the revolution of the wheel the holder is engaged with a gearing, which causes it to revolve. At this period a cutter revolved alongside reduces the protruding square part to a cylinder a little longer than the blank required. At another point in the revolution of the wheel each holder presents its stick to the action of a circular saw, which severs it. The separated blank is held between guides, one or both of which should spring so as to clamp it with just sufficient force. Each blank as it arrives pushes forward the blanks previously held. The blanks are thus delivered successively, and are received in deep notches in a revolving carrier. As they are carried around they are held firmly by an inclosing-cage. A suitable boring device is mounted and revolved alongside, and is operated with an end motion, which causes it to bore the proper hole longitudinally through the center of each blank and retire. Further motion of the wheel carries the blank between two planing-disks, which are firmly set on a single shaft at the proper distance apart, and rapidly revolved. These planers take off a little from each end, and leave the blank with both ends smoothly finished.

The continued motion of the notched carrier causes each blank to be lifted out of its notch by the action of an inclined piece which roots under it and sets it free to descend easily in a plane and rest in a hook at the lower end thereof. Here it is seized by the third set of apparatus. Two winged mandrels are protruded simultaneously, one at each end, from the third set of revolving apparatus, and the mandrels being acted on by a belt cause the blank to be rapidly turned. Thus conditioned it passes first in contact with a revolving cutter, which removes the wood down to the size and style of spool required.

It will be understood that the cylinder in the first instance should be a little larger than the rims of the spool, so that this cutter removes a little from the whole exterior, and gouges out the cavity to receive the thread, all nearly to the proper form. The progressive movement of the carrier, with the spools rapidly revolving, carries them near one or more stationary cutters, which give the perfect form, after which the withdrawal of the winged mandrels sets the finished spool free and allows it to drop.

The operations are performed with a high degree of perfection; the parts are few, the motions simple, and the work is so distributed that all the parts are likely to be durable.

The following is a description of what I consider the best means of carrying out the invention.

The accompanying drawings form a part of this specification.

Figure 1 represents an end view, Fig. 2 a plan, Figs. 3, 4, 5, and 6 represent sectional views, of apparatus constructed according to my invention. Fig. 7 represents a diagram of the gearing. Figs. 8, 9, and 10 represent detailed views of parts on a larger scale.

Similar letters of reference indicate like parts in all the figures.

A is a fixed frame-work of cast-iron or other suitable material, certain parts being designated by additional marks, A^1, &c., when necessary. The motive power may be commu-

nicated to all the parts from a single belt, if desired; but I will describe them as received through separate belts.

The first set of holding and carrying mechanism is supported on a stand, A^1. B is a shaft turned slowly by appropriate gearing acting on a spur-gear wheel, B′. This shaft projects or overhangs largely at the other end. A fine screw-thread, *b*, is formed thereon. On this is engaged a sleeve, C, threaded on its exterior with threads of exactly double the pitch of the internal thread. A large wheel, C′, is fast on the sleeve C. A stout sleeve, D, carrying two wheels, D^1 D^1, is mounted on the exterior of the sleeve C. The parts C D and their connections revolve with the shaft B, except for the adjustments, to be hereinafter described.

The wheels D^1 D^1 form bearings for three hollow revolving carriers, E E E. The hollow interior of each carrier is square and a little larger than the square sticks of wood *x* which are inserted. Each carrier E has a holding-spring, *e*, formed with a sharp edge and adapted to engage strongly with the wood *x*.

F is a ring encircling each carrier E, and capable of sliding longitudinally thereon. Two sharp-edged clamps or dogs, *f f*, fixed to the ring F, extend inward through slots in the carrier E, and act on opposite sides, or rather on opposite corners, of the inclosed wood *x*.

A^2 is a cam-piece fixed on the framing A, and presenting an inclined face to the rings F, which moves them to the right. This moves the clamps or dogs *f* to take a fresh hold on the inclosed wood *x*. G is a reverse cam-piece, which, so far as it maintains a fixed position, acts on the rings E and moves them to the left. This movement feeds the wood *x* forward by the action of the clamps *f*, which engage with it.

I adapt these parts to induce an excess of feeding motion, and allow the cam-piece G to yield by the action of a spring, G′, or other suitable yielding means, for purposes which will presently appear.

The wheel C′ carries three movable stops, H, each capable of an end motion therein as it moves in contact with a cam-piece, A^3. Each movable stop H is subject to the action of a spring, *h*, which tends to move it out or away from the wood *x*, which at each feeding movement of the corresponding ring F is thrust against it.

Each movement of a ring, F, to the left, under the action of the cam G, moves the contained wood *x* until its end abuts against the corresponding stop H. When the wood is thus arrested and the ring F can no longer move to the left, the cam-piece G commences to move to the right by the yielding of its spring G′, and thus allows the revolution to proceed.

When the ring F is moved again to the right it leaves the wood *x* held lightly by the dogs *f*. At this stage the stop-piece H moves a little to the right by the action of the cam-piece A^3. This induces a slight backward movement of the wood *x*, and sets the clamp *e* into the wood *x* firmly.

There is a spur-gear wheel, E^1, on each carrier E. At one stage in its revolution this is engaged by another gear-wheel, E^2, on a separate shaft, E^3, driven by a belt from any convenient source acting on a pulley, E^4. This shaft E^3 and its connections are supported on a stand, A^4, and from the time it is engaged rotates each holder E in its bearing.

The inner face of the cam-piece A^2 is also toothed, and as the holders E are brought around beneath it those teeth engage with the gearing E^1 and compel the holder and its contents to rotate slowly. This enables the saw to divide the wood completely without cutting beyond the center.

A^5 is another portion of the fixed framework, which supports a shaft, I, carrying a cutter-wheel, I^1. This is nearly in line with the shaft E^3, and receives motion through a belt from any convenient source of power acting on a pulley, I^2. The cutter-wheel I^1 is a little wider than the length of a spool. It reduces the projecting end of each piece of wood to a cylindrical form.

Bearings A^7 A^7 support the arbor J of a circular saw, J^1, which is rotated by a belt from any convenient power acting on a pulley, J^2. The revolution of the wheels D^1, with their contained carriers E, subjects the several pieces of wood *x* to the action of this saw, which severs them. The saw-arbor J (made by these means) may be raised and lowered by the nuts a^6 a^7 on the bolts A^6 to adjust the work, or to allow for the gradual contraction of the diamter of the saw with each successive sharpening. The saw, with its supporting parts, may be adjusted to the right or left by slacking the nut a^1 on the bolt *a*, tightening it again after the desired position is attained, as will be obvious.

The length of the spools may be varied within narrow limits by trimming off more or less at a subsequent stage of the operation. When it is desired to make great changes I set the sleeve C free, and turn it more or less relatively to the other parts, and again secure it. By this means I move the sleeves C and D relatively to each other, moving the sleeve D to the right to exactly the same extent that I move the wheel C′ to the left, or the reverse. This follows from the relation of the screw-threads, as above described. One complete revolution of the sleeve C moves it to the left to the extent equal to the pitch of the small threads by which it engages with the shaft B, while it moves the sleeve D to the right to an equal extent, by reason of the greater pitch of the threads by which it engages therewith.

It is important to hold these parts very firmly relatively to each other, except when they are required to be moved for this adjustment. I make a slot, *d*, of sufficient length in the sleeve D, and insert an eyebolt, D^2. I then introduce a longitudinal bolt, D^3, through

this eyebolt D^2 and through holes provided in the wheels D^1 D^1. I also extend this longitudinal bolt across the space between these wheels and the wheel C′, and engage it in a hole in the wheel C′. So long as this bolt is in place the parts are firmly held. A pinching-screw, D^4, may be inserted to hold the bolt D^3 securely.

When it is desired to adjust for a different length of spool, the screw D^4 is partially removed and the bolt D^3 drawn out. That leaves the eyebolt D^2 at liberty to be removed by any suitable wrench, and when this is done the adjustment may be effected by turning the wheel C′ and consequently the sleeve C, as many revolutions as may be desired. In case it is ever required to stop with a half or quarter turn of the parts, additional holes must be tapped to receive the eyebolt D^2. In other respects all will be secured as before.

The provision by the yielding cam-piece G, for feeding or trying to feed twice as much as the length of the longest spool, is important when the last end of a stick is being used up. It will be understood that the square sticks, in which form the wood is introduced, will never cut up, except by accident, into an exact number of spools with no remainder. There will usually occur a piece at the end which is too short to make a spool. The sticks of wood follow each other, and as the front end of the next stick pushes out from the carrier E the short piece which remains from the last stick, the latter will drop down idly, and then the advantage of the double-length feed becomes available by feeding the new stick forward enough to compensate for the loss of that piece. The machine will always, in such cases, feed the new stick forward enough to thrust its front end against the stop H, and a good spool will be made every time.

The main portion of what I term "the second set of mechanism" is supported on a shaft, K, which is mounted in bearings on stands A^8 A^9, fixed on the main frame A. It is turned by the aid of the gear-wheel K^1, and has a motion uniform with the shaft B. The attached mechanism carries the spools and bores the holes. An auxiliary part which planes the ends is mounted on a shaft, L, supported in bearings A^{10}.

K^2 is a deeply-notched wheel, keyed on the shaft K, and adapted to receive the blanks *x*, and to carry them around within a fixed casing, A^{11}, which I have, in my experiments, formed separately from the stand A^9, close by, but rigidly secured thereto, so that it, in effect, forms a part thereof. This cage incloses the wheel K^2 so closely as to press constantly on the outer side of the spool-blanks *x* in being traversed around with it. This insures that they are held with firmness to allow the boring and planing operations.

The shaft K carries two firmly-fixed wheels, K^3 K^3, which form bearings for boring-arbors M, which carry boring-bits *m*, and are driven by the aid of a cross-belt, M^2, from the driving-pulleys O′ on the main driving-shaft O. This belt runs on the small pulleys M^1 of the several arbors, imparting a rapid rotatory motion.

A tightener, M^4, mounted as shown, may be employed, and may be adjusted as required, to aid in maintaining contact of the belt M^2 with the several pulleys M^1 as they are carried slowly around by the revolutions of the wheels K^2.

I provide means for imparting an endwise motion at the proper time to each boring-arbor M. The end of each farthest from the bit *m* is turned to produce a button, M^3, which slides around in a concentric undercut groove, a^8, in the stand A^8. This groove extends more than half-way around, and so long as a given button, M^3, is in groove a^8 there will be no longitudinal motion of the corresponding bit.

N is a movable piece which is reciprocated transversely of the machine, and which has a groove, n^8, corresponding to the groove a^8. At certain periods this piece N is in such position that its groove n^8 forms a continuation of the groove a^8, and in effect the two form a continuous circular groove in one plane; but so soon as a button, M^3, has been fairly received in the groove n^8 the entire piece N is moved to the right, inducing a corresponding axial motion of the connected arbor M and its bit *m*. This effects the boring.

The motion of the piece N is effected by the aid of a lever, N^1, which turns on a center, *n*, below the main platform A, and is engaged with the piece N by the aid of a suitable pin, N^2. A projection, N^3, on the under face of this lever is engaged by two face-cams, N^4 N^5, fixed on the shaft N^6, which, by the ratio of the gearing, makes three revolutions for every one revolution of the shaft K.

The form of the casing A^{11} is indicated in the drawings. It is nearly a complete disk on the right-hand side and nearly a complete ring on the left-hand side, these parts being rigidly connected at a few points. Considerable portions of the disk and ring, respectively, are cut away, as shown, to accommodate the planing-wheels L^2 L^2. These wheels, properly provided with plane-irons and passages for the chips, as will be understood, are rigidly set on the shaft L, at just the required distance apart. They are revolved constantly by a belt from any convenient power running on the pulley L^1. They remove a small quantity of the wood by a clean-cutting action, and leave the ends of the spools nicely finished.

A^{12} is a lifter or tongue, which I sometimes term a "plow." It is a fixed piece which extends down into a deep circumferential groove formed around the wheel K^2. When, by the rotation of the wheel K^2, a blank, *x*, has been carried around to the proper point, the tongue A^{12} forces it out from its proper notch, and leaves it at liberty to be taken to the next set of mechanism.

The third and last set of mechanism reduces the yet cylindrical mass of wood to a finished

spool. It operates by the aid of a shaft, P, turned by a gear-wheel, P^1, which latter is larger than the gear-wheels B' K^1. This has a slower motion than the other sets of mechanism.

The shaft P is supported on stands A^{13} A^{14}, which are provided with adjustable attachments to control the mandrels, as will presently appear. The shaft P carries two sets of firmly-fixed wheels, P^2, which form bearings for two sets of mandrels, R. These mandrels are each provided with pulleys R', which receive motion from belts Q, leading from the driving-pulleys O'. On the inner end of each mandrel R is a center, *r*, having sharp wings, which, when the centers are thrust into the hole in a spool, one center, *r*, in one end and the opposite in the other end of the same spool, take a firm hold and compel the spool to revolve rapidly therewith. The mandrels R have an end motion. They close together and engage their respective centers *r* in the ends of each spool as it lies in the hook-formed lower end of the inclined trough or guide *p p'*. This trough stands in a proper position to receive the spool-blank when it is gently expelled from the previous set of mechanism. The blank on being expelled by the plow A^{12} enters this short slide *p*, and descends freely until it rests against the hook *p'*. Here it stands favorably to receive the centers *r* as they are thrust inward. After a pair of the centers *r* have moved inward and engaged with and lifted a spool, they enter farther and obtain a very firm hold, all the time turning rapidly, and causing the spool to revolve with them.

A skeleton framing, A^{15}, in the form of a double fixed ring encircles the central portion, as represented.

T is a cutter-shaft, supported on the framing A^{15}, turned rapidly by a belt from any convenient power working on a pulley, T^1. It carries a cutter-wheel, T^2. As the spools held and rotated by the centers *r* are traversed past this point the cutter-wheel T^2 excavates the cavity which is to receive the thread. The spool is now in the right shape, with its hole and the outer faces of each end finely finished, but the remaining surfaces are a little too large and are rough.

Two fixed cutters or sets of cutters, U and V, are mounted in bridge-pieces A^{16}, which are firmly fixed on the framing A^{15}. The cutters are held by pinching-screws *u r*. They are kept very sharp, and are adjusted in such position that they successively remove thin shavings from the rapidly-revolving spools as they are, by the slow rotation of the shaft P and wheels P^2, traversed past them. In passing the cutters U the spool is finished. A withdrawal of the winged centers *r r* now liberates the spool, and it falls into a spout, (not represented,) to be conducted away ready for use.

The endwise movements of the mandrels R are effected by guides A^{17} A^{17}, which in succession engage with a groove in each mandrel R. The guides A^{17} stand at the proper inclination to cause the mandrels R to move together. This inserts the winged centers *r* into the spool. While the mandrels are traversing around about half the circle each mandrel R finds a fixed plane surface, that of the adjustable piece A^{17} pressing against its outer ends to hold it engaged with the spool. Afterward the inclined guide A^{18} engages in its groove, draws the mandrel from its mate, and forcibly removes its winged center, leaving the spool free.

All ordinary means should be adopted to provide for lubrication and other matters generally known to pertain to rapidly-working mechanism.

Tubes may be applied for blowing air to remove chips. Large tubes with a proper exhausting-fan or analogous means may be used for removing the chips or shavings by a partial vacuum.

The inclined parts A^{17} A^{18} are adapted to spring a little to allow for any displacement by imperfection of the workmanship, wear, or other cause.

It will be obvious that the cutters U V may be thrust forward or set back, made wider or narrower, or otherwise modified, to treat spools of different sizes and forms. The cutter-shaft T may be set out or in by any obvious adjustment. (Not represented.) The inclined trough *p p'* may be adjusted up and down and out and in. The inclined pieces A^{17} A^{18} may be adjusted. So also may the surfaces which bear against the ends of the mandrels R.

I provide wheels W, through which the winged centers *r* work. Their inner faces are very truly and smoothly finished to apply closely to the ends of the spools. These rings W are held by sliding bolts or guide-rods *w*, lying parallel to the shaft P, and extending through the wheels P^2. On the outer end of each rod *w* is a button, *w'*. These buttons are received in the annular undercut grooves a^{17} in the adjustable pieces A^{17}. They thus control the position of the wheel W. The pieces A^{17} perform this function of controlling the position of the wheels W in addition to the function before described of controlling the end movements of the arbors R. The pieces A^{17} are adjustable toward and from each other by means of threaded sleeves Y, which pass through the stands A^{13} A^{14}. The sleeves Y are turned at will by inserting a suitable pin in holes provided.

It will be understood that the shaft P turns smoothly in bearings in the interior of the threaded sleeves Y. When the wheels W are by this means adjusted in the right positions, the pieces A^{17}, and consequently the rods *w* and wheels W, are firmly set by tightening the pinching-screws.

I esteem it an important advantage in my machine that the wheels do not require to be stopped to allow any of the operations. Their motion is continuous.

I claim as my invention—

1. In a spool-machine, the carriers E, having

interior cavities of rectangular section, in combination with the wheels D^1, adapted for use, with suitable feeding and cutting mechanism, as herein specified.

2. The gear-wheel E^2, revolved as shown, in combination with the holders or carriers E, having the gearing E^1 on their exterior, and with the carrying-wheels D^1, adapted for use in a spool-making machine, as herein specified.

3. The moving dog or dogs *f*, with their operating means, in combination with the holding-dog *e* and the series of holders or carriers E, carried around in the carrying-wheels D^1, as herein specified.

4. The movable cam G and the provision G′, for allowing it to yield when required, in combination with the rings F, moving dog or dogs *f*, holding-dog *e*, holders or carriers E, and carrying-wheels D^1, as herein specified.

5. The adjusting-sleeve C, threaded as shown, to engage both with the shaft B and sleeve D, in combination with the wheels C′ D^1, and with suitable holding, dressing, and separating means, as herein specified.

6. The spring guides H, in combination with the saw J^1, and with suitable feeding, holding, and carrying means, adapted to receive the blank *x* before it is severed, and to hold and conduct it away after it is severed, as and for the purposes herein specified.

7. The inclosing-cage A^{11}, in combination with the notched wheel K^2, receiving-guide Z, delivering-guide *p p′*, and boring-bits *m*, as herein specified.

8. The inclosing-cage A^{11}, in combination with the notched wheel K^2, receiving-guide Z, delivering-guides *p p′*, and end-planing devices L^2, as herein specified.

9. The combination of the end-planing devices L^2, axial boring devices *m*, carrier-wheel K^1, holding-cage A^{11}, and clearing-plow A^{12} with each other, and with means for guiding the blanks in their reception and delivery, substantially as and for the purposes herein specified.

10. The moving grooved piece N, in combination with the boring-arbors M, rotated, as shown, on their own axes, and carried around by the wheels K^3, and with means K^2 for holding the blanks, as and for the purposes herein specified.

11. The trough *p* and hook *p′*, in combination with the carrying-wheel K^2 and its connections, and with one or more pair of centers, *r*, and mandrels R, arranged and adapted to serve as and for the purposes herein specified.

12. The cutter-wheel T^2, in combination with the winged centers *r* and endwise-moving mandrels R, as herein specified.

13. The adjustable stationary cutters U V, in combination with the centers *r*, mandrels R, and carrying-wheels P^2, as and for the purposes herein specified.

14. The combination of the roughing cutter-wheel T^2 and stationary finishing-cutters U V with each other, and with the centers *r*, mandrels R, and carrying-wheels P^2, as herein specified.

15. The movable wheels W, adjustable as shown, in combination with the centers *r*, mandrels R, carrying-wheels P^2, and mechanism for receiving, roughing, finishing, and delivering the spools, as herein specified.

16. The threaded sleeve Y, in combination with the adjustable pieces A^{17}, adapted to perform the two functions of imparting and controlling the endwise movements of the centers *r* and of holding the wheels W to press closely against the finished ends of the spools, as herein specified.

In testimony whereof I have hereunto set my name in presence of two subscribing witnesses.

HENRY E. KAY.

Witnesses:
R. M. WINSLOW,
B. F. WINSLOW.