L. D. HAMBLETON.

WOOD TURNING MACHINE.

APPLICATION FILED NOV. 27, 1914.

1,286,299.

Patented Dec. 3, 1918.

9 SHEETS—SHEET 1.

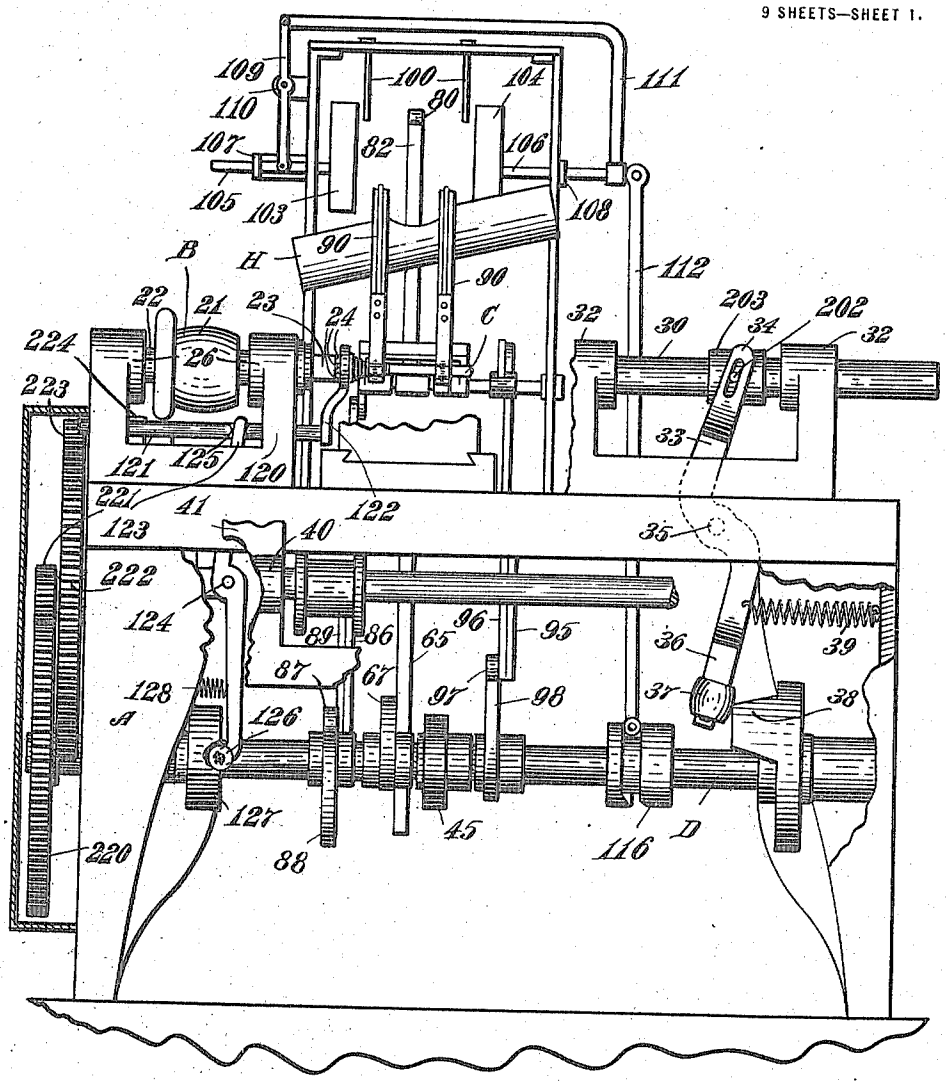


Fig. 1.

WITNESSES:

Lindsley A. Nicol.

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INVENTOR.

Leonard D. Hambleton

BY

Gardner W. Pearson

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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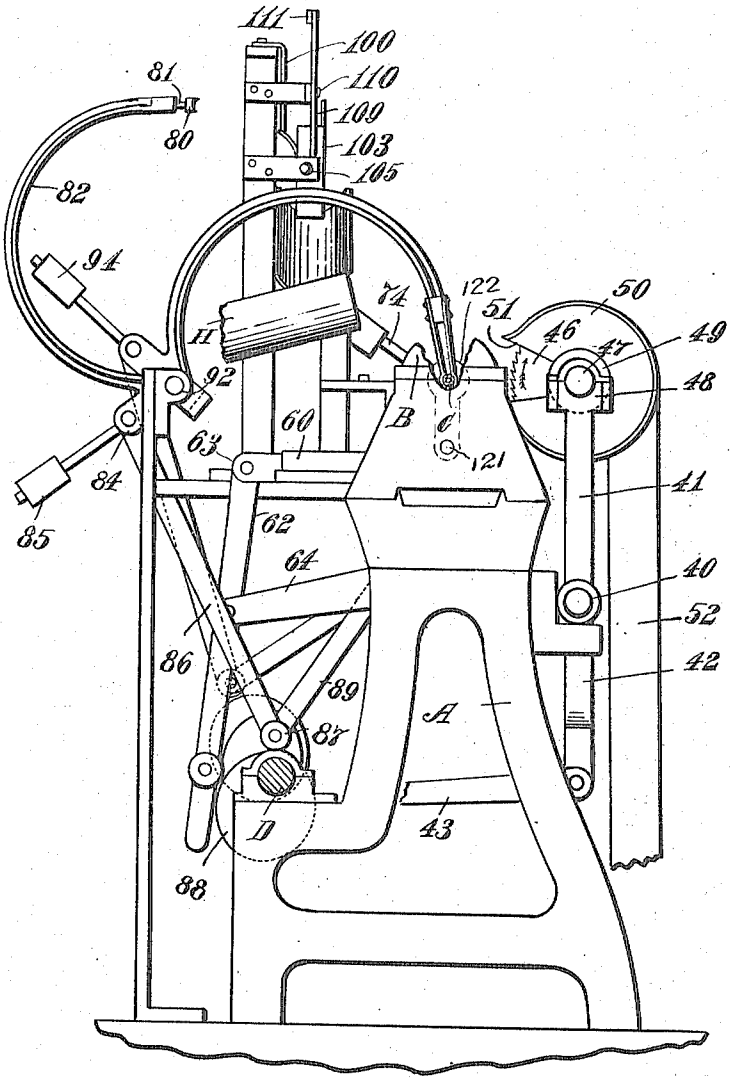


Fig. 2.

WITNESSES:

Lendger A. Nicol.

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Fig. 3.

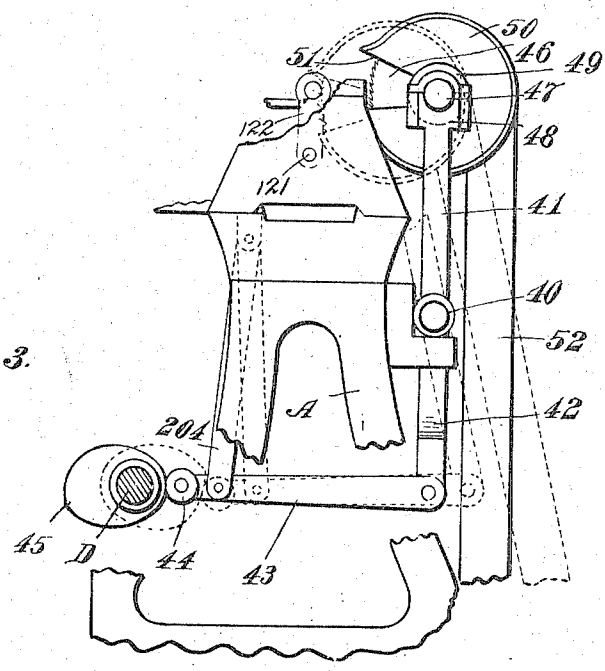
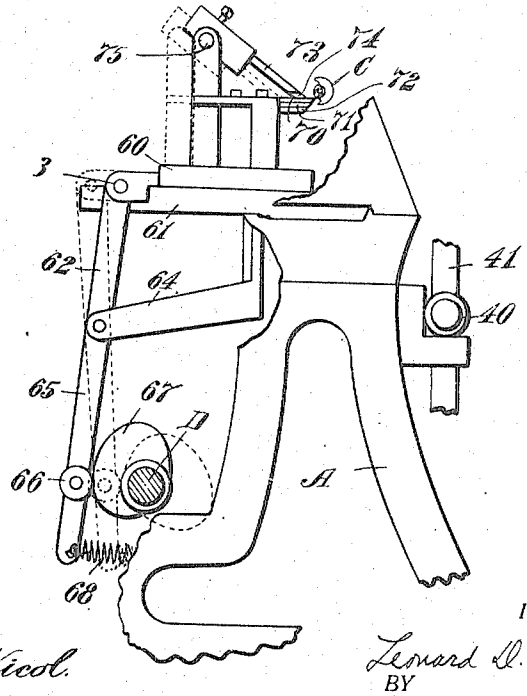


Fig. 4.



WITNESSES:

Sudger A. Nicol.

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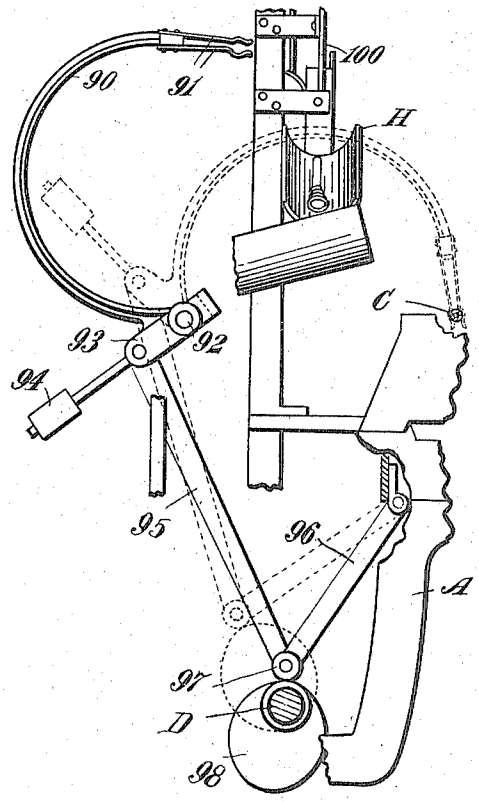


Fig. 5.

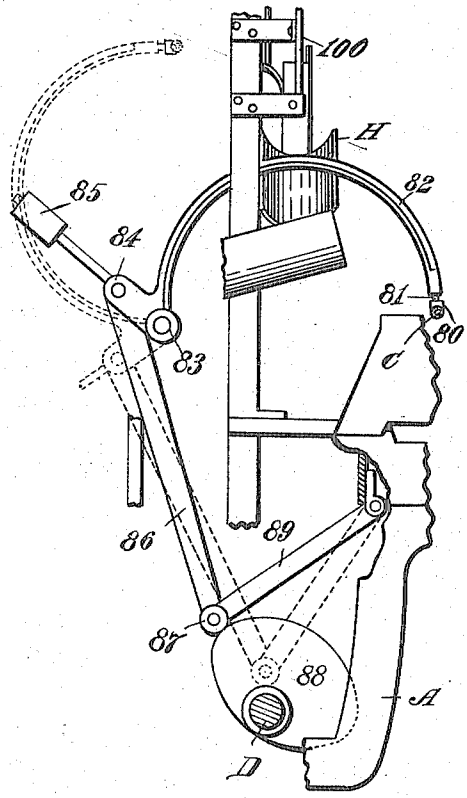


Fig. 6.

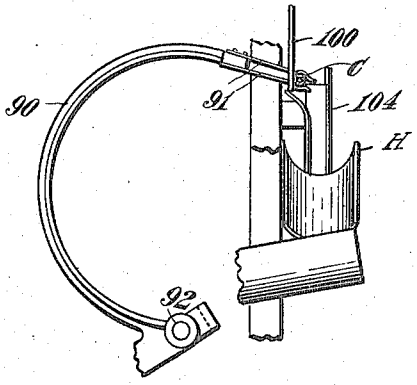


Fig. 7.

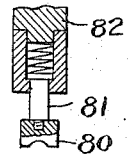


Fig. 13.

WITNESSES:

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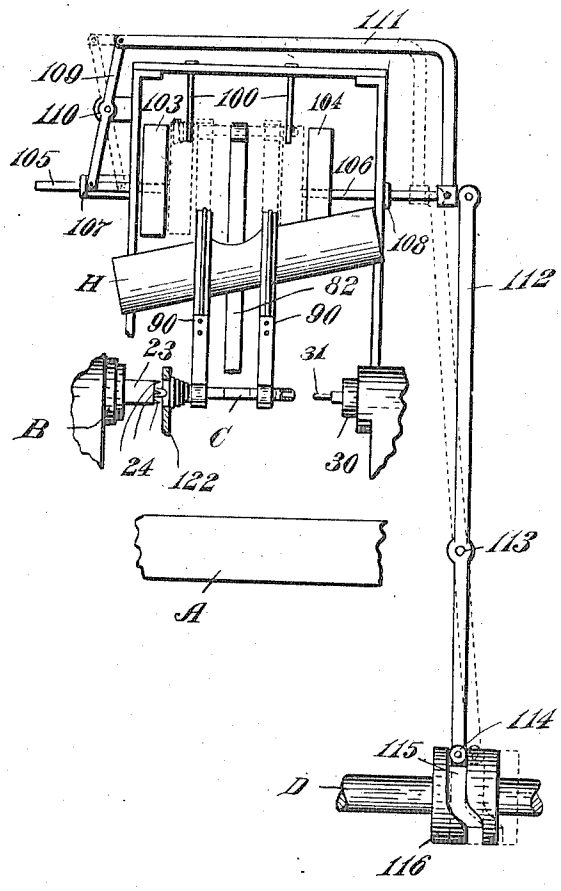


Fig. 8.

WITNESSES:

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WOOD TURNING MACHINE.

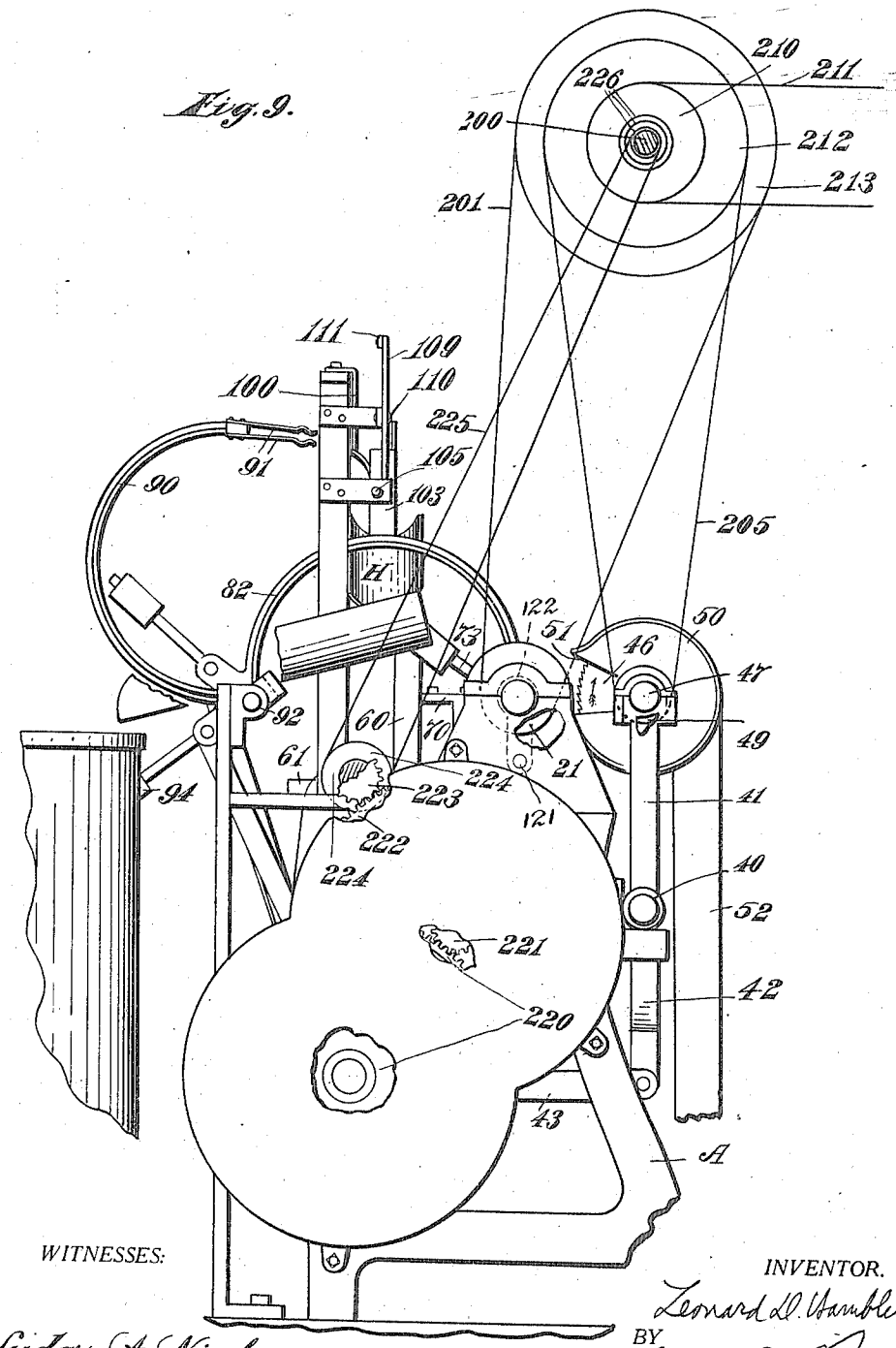
APPLICATION FILED NOV. 27, 1914.

1,286,299.

Patented Dec. 3, 1918.

9 SHEETS—SHEET 6.

Fig. 9.



WITNESSES:

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9 SHEETS—SHEET 7.

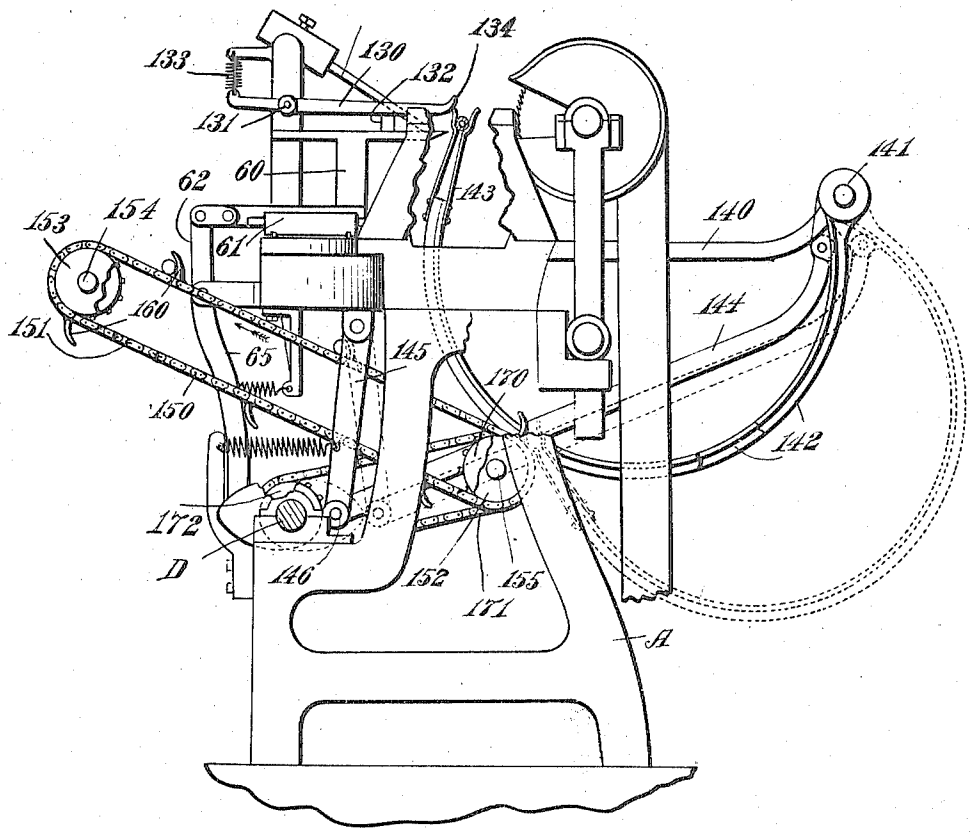


Fig. 10.

WITNESSES:

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WOOD TURNING MACHINE.

APPLICATION FILED NOV. 27, 1914.

1,286,299.

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9 SHEETS—SHEET 8.

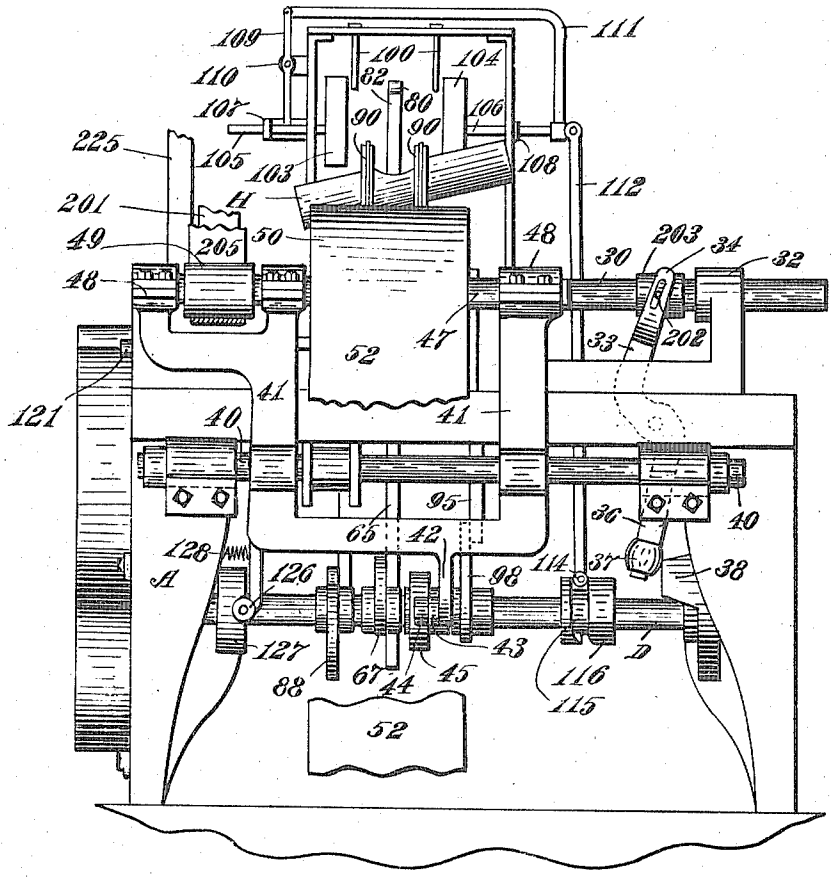


Fig. 11.

WITNESSES:

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WOOD TURNING MACHINE.

APPLICATION FILED NOV. 27, 1914.

1,286,299.

Patented Dec. 3, 1918.

9 SHEETS—SHEET 9.

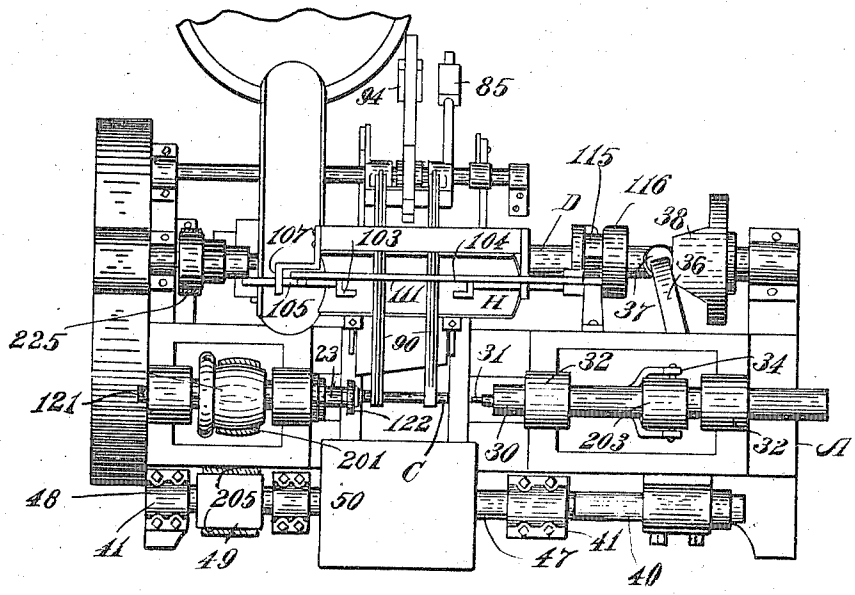


Fig. 12.

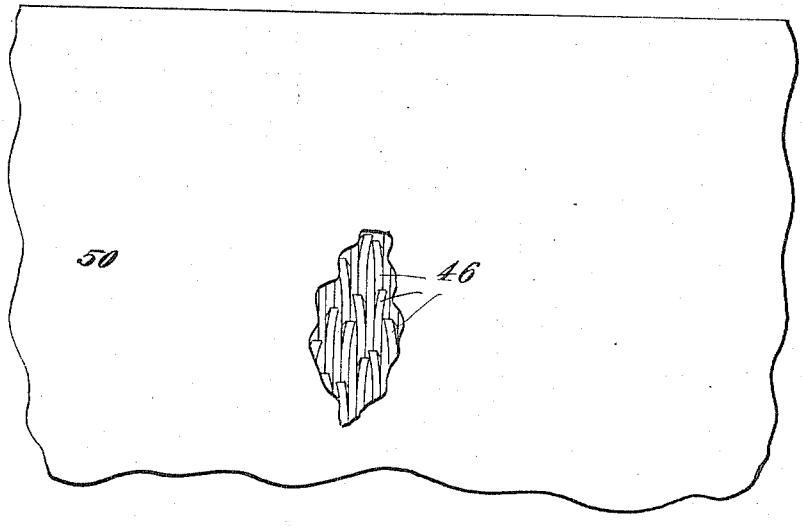


Fig. 14.

WITNESSES:

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INVENTOR.

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BY

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UNITED STATES PATENT OFFICE.

LEONARD D. HAMBLETON, OF LOWELL, MASSACHUSETTS, ASSIGNOR TO WALTER L. PARKER, OF LOWELL, MASSACHUSETTS.

WOOD-TURNING MACHINE.

1,286,299. Specification of Letters Patent. Patented Dec. 3, 1918.

Application filed November 27, 1914. Serial No. 874,270.

To all whom it may concern:

Be it known that I, LEONARD D. HAMBLETON, a citizen of Canada, residing at Lowell, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Wood-Turning Machines, of which the following is a specification.

My invention relates to automatic wood turning lathes and is particularly adapted for the roughing and finishing of bobbins, such as are used in spinning textile materials, or other articles of a similar character and form.

My machine is adapted for taking the blank which usually has a longitudinal centering hole at one or both ends and cutting it down or roughing it to a size and shape which nearly corresponds with the finished product, and of immediately thereafter finishing the blank so that it becomes a substantially perfect bobbin.

It is customary now to use two machines one for the roughing and another for the finishing.

The principal purpose of my machine is to reduce the number of operators, to do better work, and to turn out a greater number of finished bobbins in a given space of time.

The invention resides in the selection and combination of parts of which some are new but some are old.

The stationary rotative head stock is used in connection with a tail stock which is not rotative but has a spindle capable of being advanced and retracted in direct line on the rotative axis of the head stock. This tail stock spindle, together with pins which project from the head stock, allows blanks to be rapidly fed by hand.

I may use on my machine round, square or other shaped blanks and while I prefer to use round or substantially cylindrical blanks with an axial hole in each end I may use blanks with an axial hole in only one end to fit over the spindle of the tail stock. I prefer to have the advancing action of the tail stock so arranged that it is substantially a blow which drives the other end of the blank onto the pins or spurs of the head stock.

A series of parallel circular saws of varying diameters to correspond with the shape which it is desired to cut are carried by a shaft parallel with the main axis of the machine and are so arranged as to move toward and from said main axis at exactly the right time. Around these saws is a hood open at the side next to the main axis and having a chute for carrying off the sawdust. These saws engage the blank as soon as it is in position and rotating, on a horizontal line midway between its top and bottom.

As soon as the saws have done their roughing work, they are withdrawn and at the same instant or before, a finishing knife is advanced to the bottom line of the blank and begins finishing the blank with no loss of time whatever.

These relative positions of the roughing saws and finishing knife especially in connection with the feed of the tail stock spindle allow a great increase in speed, which could not be obtained in any other position of the cutting parts without interfering with the sawdust hood over the saws.

To obtain the greatest speed, however, it is necessary to arrange for the delivery as well as the feeding and cutting and I provide for this by using a clearing arm operative by power in connection with the head stock to release the finished blank from the pins on the head stock the moment it becomes finished. This could be used alone, with some little assistance from the operator before feeding the next blank, to discharge the finished bobbin which might be allowed to drop through the machine onto the floor or into a delivery chute, but this is not desirable, however, on account of the danger and impossibility of arranging a satisfactory delivery chute without interfering with various operating arms and cams.

I therefore provide two curved delivery arms carrying at their ends spring delivery fingers which are timed to move upon and grasp the finished bobbin at the moment it is finished and just before the clearing arm has pushed it toward the tail stock. The result of this operation is that the blank slides through the fingers to clear the head stock and at the same instant, the tail stock is retracted; then the delivery arms carry off the finished blank out of the way, leaving the operator free to introduce a new blank.

These delivery fingers may be cleared from the bobbin in various ways whereby, after it is carried clear of the mechanism, it may be dropped into a convenient chute through which it passes to the desired point of delivery.

On account of the great speed of my machine, I find it desirable to use a steadying finger which is carried by an arm in position to engage and steady the blank and to prevent chattering until the delivery fingers are ready to grasp it. Then the arm and steadying finger are withdrawn while the finished bobbin is discharged. This kind of finger may be used with or without the delivery devices. If the finger is used without the delivery arms, it remains in contact with the bobbin until the clearing arm has pushed it away from the head stock and the tail stock has receded. In such case, the friction of the steadying finger prevents the bobbin from following or being carried by the tail stock spindle.

My machine is preferably so arranged that space is left for automatic feed devices if desired.

For such an arrangement, I prefer to use delivery arms which work from underneath and a steadying arm operative with the finishing carriage as shown in Fig. 10.

In handling work, such as bobbins, which are heavier at one end than the other, it is desirable that the blank and finished bobbin should be positively held at all times and that the finished bobbin should be so delivered that it may be picked up by other machines performing subsequent operations from a definite position which will always be the same.

The delivery mechanism might be dispensed with and the clearing arm might be dispensed with but in such case to prevent the finished bobbin from falling in the machinery, it would be necessary, if rapid work were desired, to feed with the right arm and remove the finished bobbin with the left. This would be dangerous on account of the proximity of the rapidly revolving series of circular saws.

In the drawings, Figure 1 is a front elevation of my machine with some parts broken away to better show the construction. Fig. 2 is a side elevation as from the left of Fig. 1 with the gears and gear covers together with some other parts omitted for clearness. Fig. 3 is a view similar to Fig. 2 showing the connections and operation of the circular saws and Fig. 4 is a similar view of the carriage for the finishing knives and tools. Figs. 5, 6 and 7 are detail side elevations showing connections and operation of the steadying finger and of one form of delivery arms. Fig. 8 is a front elevation showing the details of the clearing arm and the delivery devices. Fig. 9 is a side elevation showing the connections for driving the head stock, the cam shaft, and the circular saws from a power shaft. Fig. 10 is a side elevation similar to Fig. 2, of a modified form of my machine. Fig. 11 is a plan view of the machine shown in Fig. 1. Fig. 12 is a front view thereof. Fig. 13 is a detail of the spring plunger, and Fig. 14 of the saws.

In the drawings, A represents the frame of the machine, B indicates the head stock mechanism which comprises a spindle 22 carried by bearings 26 and a pulley 21 which is belted to power shaft 200 by means of belt 201.

22 is the head stock spindle which preferably carries spur chuck 23 having a plurality of spurs or pins 24 and a steel center of usual construction. This steel center may be dispensed with however on some classes of work.

The tail stock spindle 30 carries center 31 adapted to enter the hole in one end of the bobbin or blank C and is slidable in bearings 32 at such a position that the center 31 will move along the main axis or work axis which coincides with the center of revolution of head stock B. Tail stock spindle 30 is advanced and retracted by means of a lever 33 pivoted to the frame at 35 which carries at its other end 36 a roller bearing 37 which engages the tail stock cam 38 carried by cam shaft D. A spring 39 between the arm 36 and the frame of the machine tends to advance spindle 30, and center 31 will remain in that position until the finishing knives have done their work and the bobbin has been grasped by the delivery fingers, if such are used. Lever 33 is forked at 34 and engages pins 202 on a collar 203 carried by spindle 30.

Pivoted on bearings 40 at the front of the machine are parallel connected saw shaft supporting arms forming part of saw frame 41. This frame 41 extends below pivot 40 at 42 and is pivotally connected with an arm 43 which carries a roller bearing 44 in engagement with the saw cam 45 carried by cam shaft D. This arm 43 is preferably hung on or pivoted to a depending arm 204 pivoted at its other end to the frame of the machine. This cam 45 is so timed that at the instant the tail stock has advanced and engaged the blank which constitutes the work to be operated on with the spur chuck of the head stock, the series of circular saws 46 carried by saw shaft 47 which is supported by bearings 48 at the top of the arms of saw frame 41 will engage the blank and begin cutting. Cam 45 should be so timed that these saws will advance rapidly until they engage the blank after which they will move at a proper cutting speed as far as is desired for roughing the blank.

These saws 46 are of varying diameters to

correspond with the shape to be given the blank before the finishing knives take up the work.

Saw shaft 47 is driven through the medium of pulley 49 driven by belt 205 from power shaft 200.

These saws should have relatively thin blades and should be set so closely together that the edges of the teeth of the adjoining saws substantially touch. They should also be driven at a very high rate of speed in the same direction in which the blank is rotating so that the relative speed at the point of contact will be as high as possible.

I prefer to use saws $\frac{1}{16}''$ thick with teeth set so that there is substantially no gap between the saws, the saws being about 11″ in diameter with teeth about $\frac{1}{2}''$ apart. So arranged, with the bobbin blanks making about 5,000 revolutions per minute and the saws about 3,000, the action of the saws is a grinding rather than a shearing action.

Surrounding the series of saws 46 and covering the ends thereof is a saw hood 50 with a narrow flaring mouth 51 which, when the saws are cutting, spreads above and below the work being operated upon. From this saw hood 50, which I will call the saw dust hood, extends a chute 52 which I will call the saw dust chute. This may be carried to any convenient place where it is desired to deliver the saw dust and moves back and forth with the hood and with the saws.

The cutting position of the saws is so arranged as to be in a line midway between the top and bottom of the blank being operated upon. Their axis is level with the work axis.

60 represents the finishing carriage which is movable toward and from the work axis in suitable ways 61. This finishing carriage 60 is operated toward and from the work axis by means of a finishing carriage lever 62 pivoted to an extension of the carriage at 63 and pivoted to a bracket 64 fixed to the frame of the machine. The other end 65 of lever 62 carries a roller bearing 66 in engagement with a finishing cam 67 carried by cam shaft D. A spring 68 between end 65 and the frame of the machine tends to withdraw the carriage from the work axis.

This finishing carriage may carry a back knife 70, a cone knife 71, a head knife 72 as well as a tipping tool 73 for finishing the tip or top of the bobbin and a cut off tool 74. These latter may be adjustable at the back part on tool bar 75 as shown, independently of the finishing knives.

Other finishing tools or knives for forming the shuttle catch, beads, grooves, etc., may be carried by the finishing carriage if desired.

It is desirable that the back knife should be in such position that it will engage the tip end of the blank near the bottom line of the barrel thereof as in this way the finishing cam 67 can be so timed that this knife with or without the other finishing tools can engage the blank at the instant the roughing saws cease cutting. A great deal of time is saved by thus positioning the finishing knives with reference to the roughing saws.

To prevent chattering, while the finishing knives and tools are cutting, I use an elastic steadying finger 80. This finger 80 is preferably shaped at its outer end to substantially fit the curve of the roughed bobbin barrel and is carried by a spring plunger 81 at the end of steadying arm 82 whereby it exerts an elastic steadying pressure on the bobbin while the knives are at work. Its pressure also tends to overcome any tendency of the blank to follow the tail stock when the tail stock is being withdrawn.

Steadying arm 82 is pivoted to the frame of the machine at 83 and preferably has an extension 84 carrying a counterweight 85. The arm 86 is pivoted to extension 84 at one end and at the other which carries the roller bearing 87, which engages the steadying cam 88 on cam shaft D, is pivoted to an arm 89 which is pivoted to another part of the frame of the machine.

Steadying cam 88 is so shaped and timed that steadying finger 80 will engage the roughed bobbin at the same time with the finishing knives and will remain in engagement until the delivery fingers grasp the finished bobbin, if delivery fingers are used; or if they are not used, until the clearing arm disengages the finished bobbin from the head stock chuck and the tail stock spindle has also been withdrawn.

Slidable horizontally in suitable bearings 120 in frame A preferably underneath the head stock mechanism and the bearings 26 is a clearing rod 121 at one end of which is carried the forked clearing arm 122. This clearing arm 122 terminates in two prongs forming a fork which extends up on both sides of head stock chuck 23. The distance between the prongs of the clearing arm fork is less than the diameter of the head of the finished bobbin whereby if it is pushed forward, it will engage such head and push the bobbin head off from the head stock chuck and center.

The clearing arm and rod are operated by means of a lever 123 pivoted to the frame at 124 one end of which extends upward into the groove 125 on rod 121 and the other end of which carries a roller bearing 126 in engagement with end cam 127 carried by cam shaft D. A clearer arm spring 128 between lever 123 and the frame of the machine tends to force clearer arm 122 toward the tail stock were it not for the action of end cam 127. End cam 127, I will call the clearing arm cam.

The delivery arms and fingers shown in Figs. 5 and 7 are positioned at the back of

the machine and are arranged to come forward and down upon the work as shown. Each delivery arm 90 carries at its end parallel fingers 91 which are of spring metal fixed at one end and having opposite concave curves adjoining each other at their free ends with the tips thereof flared so that when pressed down upon a bobbin or other work being operated upon, they will spread apart allowing the work to slip into the curves where it will be elastically held until removed therefrom by a force stronger than the springs of the fingers 91. These fingers seize the blank.

I prefer to use two arms 90 each of which is pivoted at 92 to the frame of the machine and each of which has a lateral extension toward the other which are adjustably bolted together. One arm has an extension 93 which carries a counterweight 94.

I prefer to pivot an arm 95 at one end to extension 93 and at the other end to an arm 96 the other end of which is pivoted to the frame of the machine. At the junction of arms 95 and 96 is a roller bearing 97 which engages the delivery cam 98 carried by the cam shaft D.

This cam shaft 98 is so cut and timed that the delivery fingers will start to approach the work or blank being operated on when the finishing knives have been partly moved away from the work and before the clearing arm has been brought into action. They remain stationary in engagement with the work on the work axis long enough for it to be cleared from the head stock and the tail stock, when they rise rapidly to make room for the next blank.

As the delivery arms are rising and before they reach their resting positions, they pass on each side of releasing pins 100 fixed to suitable brackets on the frame of the machine. The result of the releasing action of pins 100 is to spit or throw the finished bobbin in the opposite direction to that in which the delivery arms are moving and this would drop it into the machinery if I did not provide the directing gates 103, 104. These consist of rimmed plates with the rims broken away at the top and bottom each carried by a gate rod 105 and 106 slidable in suitable bearings 107 and 108. These are caused to advance toward each other just after the delivery arms pass by into the position as shown by the dotted lines in Fig. 8 where their rims will pass by the ends of the bobbin or work C whereby as the bobbin is removed from the delivery fingers by pins 100 it is caught by the rims of these gates and directed downward into the delivery chute H which carries it to the point desired.

To actuate the gates 103 and 104, I use an arm 109 pivoted near the middle to a bracket 110 on the frame and at one end to rod 105 and at the other end to an arm 111 which is bent downward and is carried by rod 106.

Pivoted at the end of rod 106 is a lever 112 which is pivoted at 113 to a bracket on the frame of the machine and carries at its other end a roller bearing 114 in engagement with a suitable slot 115 which forms a part of the gate cam 116 carried by cam shaft D. This cam 116 is so cut and timed as to close in the gates 103 and 104 toward each other just after the bobbin has passed and to separate them after the bobbin has been finally delivered.

I prefer to drive the various parts of my machine from the power shaft 200 which is driven by pulley 210 and belt 211 from the source of power. A pulley 212 carries belt 205 and a pulley 213 carries belt 201 for the saws and head stock respectively.

The cam shaft D is driven by gears 220, 221, 222 and 223 from a pulley 224 driven by belt 225 carried by shaft 200 or by one of the pulleys 226.

I prefer to drive all these from one power shaft and I prefer that all the operating cams should be carried by one cam shaft but it is clear that there might be two or more sources of power and two or more cam shafts if desired.

The tail stock spindle lever 33 might be connected directly with the clearing arm lever 123 to act at exactly the same time, thereby dispensing with cam 127, but it is better to have the spindle and clearing arm separately adjustable as their operations are not necessarily performed at the same time. If the blank is firmly driven on to the pins of the head stock clutch, the tail stock spindle may be withdrawn without the blank following it and if no delivery means were used, the spindle might be first withdrawn and then the clearing arm could act to push off the finished blank allowing it to drop. By using the steadying finger, however, and better by using the delivery fingers, the tail stock spindle can be withdrawn and at substantially the same time, the clearing arm can act, as the friction of the fingers prevents the blank from following the spindle. Thereby quicker action is obtained.

This machine embodies substantially the following elements. Means as the tail stock spindle, which are stationary, when they receive a blank and are adapted to support the blank while it is carried forward and forced on to the rotative receiving member such as the head stock. Means for rotating the head stock and for forcibly advancing and afterward retracting the tail stock are also required. When the blank is advanced and begins to rotate, roughing means, preferably parallel circular saws with means for rotating and for advancing and retract-

ing them, move up toward the axis of the blank instead of running along longitudinally as is customary in some machines. This gives quicker action. As soon as the roughing means have done their work and begin to be retracted together with their hood and chute, finishing means, comprising knives, tipping tools, etc. are brought up and finish the blank. A steadying finger operates at substantially the same time with the finishing knives to prevent chattering and if desired to keep the blank from following the tail stock spindle. This may or may not be used. When finished, means are provided for withdrawing the tail stock spindle and a clearing arm to remove the blank by power from the head stock thus clearing the blank of the cutting machinery. It is better to carefully remove the finished blank by grasping and withdrawing it by delivery means, carrying it to the point desired where it may be released by suitable pins or hooks to be described. I prefer to provide means for receiving and directing the delivered blank so that it will gently rest or drop at exactly the desired point. This may be the gates and chute before described or preferably the endless chain delivery means which I will now describe.

Referring to Fig. 10, the steadying finger described is replaced by a finger 130 pivoted at 131 to the finishing carriage 60 medially of its length. It normally rests on a stop 132 and is held down by a tension spring 133 so that its tip 134 which is curved will bear on the blank C while it is being operated on by the finishing knives.

I prefer this construction of steadying finger where an automatic feed with delivery at the top is to be used, and in connection therewith I prefer the delivery fingers located underneath as will be now described. A bracket 140 at the front of the machine carries the pivot 141 for the connected delivery arms 142 which carry delivery fingers 143 similar to 91. These arms are operated by a connecting rod 144 hung on a pivoted suspending link 145 and carrying roller bearing 146 in operative relation with the delivery arm cam. As will be seen in the drawing, these arms with their fingers come up from underneath and carry the finished blank down as shown by the dotted lines.

For releasing mechanism, I prefer to use parallel sprocket chains 150 and 151 carried respectively by two pair of sprockets 152 and 153 on suitable shafts 154 and 155 driven by any suitable mechanism from the cam shaft D. Each sprocket carries a plurality of hooks or pins 160 and sprockets 152 are so placed that these hooks 160 will pass on each side of the downward path of delivery fingers 143 and as they are traveling in opposite directions, these releasing hooks or pins will pick off the finished blank and carry it along to such a point as may be desired in the path of the sprocket chains.

The sprocket shaft 155 may carry a driving sprocket 170 which engages a driving sprocket chain 171 which also engages a sprocket 172 carried by cam shaft D or any other suitable driving means may be used.

As the delivery fingers come up from underneath, their free ends may be shaped so as to merely receive or take but not to seize the finished blank. As the blank is therefore not grasped but merely supported when it is cleared by clearing pins 160, it is not necessary to use any equivalent for the directing gates 103 and 104.

I claim:

1. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine, and a tail stock adapted to receive and support a blank and slidable back and forth in line with the work axis, with a series of parallel circular saws of different sizes rotative on an axis substantially level with and parallel to the work axis and movable toward and from said work axis on a horizontal level therewith, a finishing knife movable toward and from a line below said work axis which coincides with the bottom of the finished blank, means for sliding the tail stock, means for rotating the circular saws, means for moving the circular saws toward and from the work axis, and means for moving the finishing knife toward and from the line below the work as described.

2. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine, and a tail stock adapted to receive and support a blank and slidable back and forth in line with the work axis, with a series of parallel circular saws of different sizes rotative on an axis substantially level with and parallel to the work axis and movable toward and from said work axis on a horizontal level therewith, a hood which incloses the circular saws and has a flaring mouth adjoining the work axis and is movable with the circular saws, a chute connected to and movable with the hood, a finishing knife on the side of the work axis opposite the circular saws and movable toward and from a line below said work axis which coincides with the bottom of the finished blank, means for sliding the tail stock, means for rotating the circular saws, means for moving the circular saws and hood toward and from the work axis, and means for moving the finishing knife toward and from the line below the work as described.

3. In a wood turning machine, the combination of a head stock rotative on the work

axis of the machine and having receiving pins for a blank, means for rotating the head stock, a cam shaft, and a tail stock having a spindle adapted to receive and support a blank and slidable back and forth on said work axis, with a tail stock cam carried by the cam shaft, connections between the tail stock spindle and the tail stock cam, a series of parallel circular saws rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, means for rotating said saws, a saw cam carried by the cam shaft, connections between the saw cam and the circular saws, a finishing carriage with finishing tools movable toward and from said work axis on the opposite side from the circular saws, a finishing cam carried by the cam shaft, and connections between the finishing carriage and the finishing cam, said cams being so formed that the tail stock spindle will be advanced, that thereafter the circular saws will be advanced and retracted, that thereafter the finishing carriage will be advanced and retracted, and that thereafter the tail stock spindle will be retracted as described.

4. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine and having receiving pins and a blank, means for rotating the head stock, a cam shaft, and a tail stock having a spindle adapted to receive and support a blank and slidable back and forth on said work axis, with a tail stock cam carried by the cam shaft, connections between the tail stock spindle and the tail stock cam, a series of parallel circular saws rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, means for rotating said saws, a saw cam carried by the cam shaft, connections between the saw cam and the circular saws, a finishing carriage with finishing tools movable toward and from said work axis on the opposite side from the circular saws, a finishing cam carried by the cam shaft, and connections between the finishing carriage and the finishing cam, a steadying arm which terminates in an elastic steadying finger movable toward and from the work axis and to and from the blank, a steadying arm cam carried by the cam shaft, and connections between the steadying arm and the steadying arm cam, said cams being so formed that the tail stock spindle will be advanced, that thereafter the circular saws will be advanced and retracted, that thereafter the finishing carriage will be advanced and retracted, and that at the same time the steadying arm will be moved toward and from the work axis, and that thereafter the tail stock spindle will be retracted as described.

5. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine and having receiving pins and a blank, means for rotating the head stock, a cam shaft, and a tail stock having a spindle adapted to receive and support a blank and slidable back and forth on said work axis, with a tail stock cam carried by the cam shaft, connections between the tail stock and the tail stock cam, a series of parallel circular saws rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, means for rotating said saws, a saw cam carried by the cam shaft, connections between the saw cam and the circular saws, a finishing carriage with finishing tools movable toward and from said work axis on the opposite side from the circular saws, a finishing cam carried by the cam shaft, and connections between the finishing carriage and the finishing cam, a clearing arm, a clearing arm cam carried by the cam shaft, connections between the clearing arm and the clearing arm cam, said cams being so formed that the tail stock spindle will be advanced, that thereafter the circular saws will be advanced and retracted, that thereafter the finishing carriage will be advanced and retracted, that thereafter the tail stock spindle will be retracted and the clearing arm will be advanced, as described.

6. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine and having receiving pins for a blank, means for rotating the head stock, a cam shaft, and a tail stock having a spindle adapted to receive and support a blank and slidable back and forth on said work axis, with a tail stock cam carried by the cam shaft, connections between the tail stock spindle and the tail stock cam, a series of parallel circular saws rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, means for rotating said saws, a saw cam carried by the cam shaft, connections between the saw cam and the circular saws, a finishing carriage with finishing tools movable toward and from said work axis on the opposite side from the circular saws, a finishing cam carried by the cam shaft, and connections between the finishing carriage and the finishing cam, a steadying arm which terminates in an elastic steadying finger movable toward and from the work axis and to and from the blank, a steadying arm cam carried by the cam shaft, and connections between the steadying arm and the steadying arm cam, a clearing arm, a clearing arm cam carried by the cam shaft, connections between the clearing arm and the clearing arm cam, said cams being so formed that the tail stock spindle will be advanced, that thereafter the circular saws will be advanced and retracted, that thereafter the finishing carriage will be advanced and retracted, and that at the same

time the steadying arm will be moved toward and from the work axis, and that thereafter the tail stock spindle will be retracted, and the clearing arm will be advanced, as described.

7. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine and having receiving pins for a blank, means for rotating the head stock, a cam shaft, and a tail stock having a spindle adapted to receive and support a blank and slidable back and forth on said work axis, with a tail stock cam carried by the cam shaft, connections between the tail stock spindle and the tail stock cam, a series of parallel circular saws rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, means for rotating said saws, a saw cam carried by the cam shaft, connections, between the saw cam and the circular saws, a finishing carriage with finishing tools movable toward and from said work axis on the opposite side from the circular saws, a finishing cam carried by the cam shaft, and connections between the finishing carriage and the finishing cam, a clearing arm, a clearing arm cam carried by the cam shaft, connections between the clearing arm and the clearing arm cam, connected delivery arms which terminate in spring delivery fingers movable toward and from the work axis and to and from the blank, a delivery arm cam carried by the cam shaft, connections between the delivery arms and the delivery arm cam, said cams being so formed that the tail stock spindle will be advanced, that thereafter the circular saws will be advanced and retracted, that thereafter the finishing carriage will be advanced and retracted, that thereafter the delivery arms will be moved so that the delivery fingers engage the blank, and that thereafter the tail stock spindle will be retracted and the clearing arm will be advanced, and that thereafter the delivery arms will be moved away from the work axis, as described.

8. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine and having receiving pins for a blank, means for rotating the head stock, a cam shaft, and a tail stock having a spindle adapted to receive and support a blank and slidable back and forth on said work axis, with a tail stock cam carried by the cam shaft, connections between the tail stock spindle and the tail stock cam, a series of parallel circular saws rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, means for rotating said saws, a saw cam carried by the cam shaft, connections between the saw cam and the circular saws, a hood which incloses the circular saws and has a flaring mouth adjoining the work axis and is movable with the circular saws, a chute connected to and movable with the hood, a finishing carriage with finishing tools movable toward and from said work axis on the opposite side from the circular saws, a finishing cam carried by the cam shaft, and connections between the finishing carriage and the finishing cam, a clearing arm, a clearing arm cam carried by the cam shaft, connections between the clearing arm and the clearing arm cam, connected delivery arms which terminate each in delivery fingers movable toward and from the work axis and to and from the blank, a delivery arm cam carried by the cam shaft, connections between the delivery arms and the delivery arm cam, means for releasing the finished bobbin interposed in the path of the delivery fingers, said cams being so formed that the tail stock spindle will be advanced, that thereafter the circular saws will be advanced and retracted, that thereafter the finishing carriage will be advanced and retracted, that thereafter the delivery arms will be moved so that the delivery fingers engage the blank, and that thereafter the tail stock spindle will be retracted and the clearing arm will be advanced, and that thereafter the delivery arms will be moved away from the work axis and while so being moved the releasing means will release the finished bobbin from the delivery fingers, as described.

9. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine and having receiving pins for a blank, means for rotating the head stock, a cam shaft, and a tail stock having a spindle adapted to receive and support a blank and slidable back and forth on said work axis, with a tail stock cam carried by the cam shaft, connections between the tail stock spindle and the tail stock cam, a series of parallel circular saws rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, means for rotating said saws, a saw cam carried by the cam shaft, connections between the saw cam and the circular saws, a hood which incloses the circular saws and has a flaring mouth adjoining the work axis and is movable with the circular saws, a chute connected to and movable with the hood, a finishing carriage with finishing tools movable toward and from said work axis on the opposite side from the circular saws, a finishing cam carried by the cam shaft, and connections between the finishing carriage and the finishing cam, a clearing arm, a clearing arm cam carried by the cam shaft, connections between the clearing arm and the clearing arm cam, connected delivery arms which terminate each in delivery fingers movable toward and from the work axis and to and from the blank, a de-

livery arm cam carried by the cam shaft, connections between the delivery arms and the delivery arm cam, parallel endless chains, a plurality of pairs of releasing pins so carried thereby as to travel into the path of the delivery fingers, said cams being so formed that the tail stock spindle will be advanced, that thereafter the circular saws will be advanced and retracted, that thereafter the finishing carriage will be advanced and retracted, that thereafter the delivery arms will be moved so that the delivery fingers engage the blank, and that thereafter the tail stock spindle will be retracted and the clearing arm will be advanced, and that thereafter the delivery arms will be moved away from the work axis into operative relation with the releasing pins, as described.

10. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine and having receiving pins for a blank, and a tail stock having a spindle adapted to receive and support a blank and slidable back and forth on said work axis, with a series of parallel circular saws of different sizes rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, a finishing carriage with finishing tools movable toward and from the work axis, a clearing arm movable from the head stock toward the tail stock in such position as to engage the finished blank, means for advancing and retracting the tail stock spindle, means for advancing and retracting the clearing arm, means for moving the circular saws toward and from the work axis, and means for moving the finishing carriage toward and from the work axis as described.

11. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine and having receiving pins for a blank, and a tail stock having a spindle adapted to receive and support a blank and slidable back and forth on said work axis, with a series of parallel circular saws of different sizes rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, a finishing carriage with finishing tools movable toward and from the work axis, an elastic steadying finger movable toward and from the work axis at the same time with the finishing carriage, means for advancing and retracting the tail stock spindle, means for moving the steadying finger toward and from the work axis, means for moving the circular saws toward and from the work axis, and means for moving the finishing carriage toward and from the work axis as described.

12. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine and having receiving pins for a blank, and a tail stock having a spindle adapted to receive and support a blank and slidable back and forth on said work axis, with a series of parallel circular saws of different sizes rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, a finishing carriage with finishing tools movable toward and from the work axis, an elastic steadying finger movable toward and from the work axis at the same time with the finishing carriage, a clearing arm movable from the head stock toward the tail stock in such position as to engage the finished blank, means for advancing and retracting the tail stock spindle, means for advancing and retracting the clearing arm, means for moving the circular saws toward and from the work axis, and means for moving the finishing carriage toward and from the work axis as described.

13. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine and having receiving pins for a blank, and a tail stock having a spindle adapted to receive and support a blank and slidable back and forth on said work axis, with a series of parallel circular saws of different sizes rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, a finishing carriage with finishing tools movable toward and from the work axis, a clearing arm movable from the head stock toward the tail stock in such position as to engage the finished blank, spring delivery fingers movable toward and from the work axis, means for advancing and retracting the tail stock spindle, means for advancing and retracting the clearing arm, means for moving the delivery fingers toward and from the work axis, means for moving the circular saws toward and from the work axis, and means for moving the finishing carriage toward and from the work axis as described.

14. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine and having receiving pins for a blank, and a tail stock having a spindle adapted to receive and support a blank and slidable back and forth on said work axis, with a series of parallel circular saws rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, a finishing carriage with finishing tools movable toward and from the work axis, a clearing arm movable from the head stock toward the tail stock in such position as to engage the finished blank, spring delivery fingers movable toward and from the work axis, means for advancing and retracting the tail stock spindle, means for advancing and retracting the clearing arm, means for moving the circular saws toward and from the work axis,

means for moving the finishing carriage toward and from the work axis, means for moving the delivery fingers toward and from the work axis, and means for releasing the finished blank from the delivery fingers as described.

15. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine, means for continuously rotating the head stock, and a tail stock adapted to receive and support a blank and slidable back and forth in line with the work axis, with a series of parallel circular saws rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, means for rotating said saws, a finishing carriage movable toward and from said work axis, finishing tools carried thereby, means for advancing the tail stock spindle, means for thereafter moving the circular saws toward and from the work axis, means for thereafter moving the finishing carriage toward and from the work axis, and means for thereafter retracting the tail stock spindle as described.

16. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine, means for rotating the head stock, and a tail stock adapted to receive and support a blank and slidable back and forth in line with the work axis, with a series of parallel circular saws rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, means for rotating said saws, a finishing carriage movable toward and from said work axis, finishing tools carried thereby, a clearing arm movable from the head stock toward the tail stock, means for advancing the tail stock spindle, means for thereafter moving the circular saws toward and from the work axis, means for thereafter moving the finishing carriage toward and from the work axis, means for thereafter retracting the tail stock spindle, and means for then moving the clearing arm toward the tail stock as described.

17. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine, means for rotating the head stock, and a tail stock adapted to receive and support a blank and slidable back and forth in line with the work axis, with a series of parallel circular saws rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, means for rotating said saws, a finishing carriage movable toward and from said work axis, finishing tools carried thereby, an elastic steadying finger, means for advancing the tail stock spindle, means for thereafter moving the circular saws toward and from the work axis, means for thereafter moving the finishing carriage and the steadying finger toward and from the work axis, and means for thereafter retracting the tail stock spindle as described.

18. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine, means for rotating the head stock, and a tail stock adapted to receive and support a blank and slidable back and forth in line with the work axis, with a series of parallel circular saws rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, means for rotating said saws, a finishing carriage movable toward and from said work axis, finishing tools carried thereby, an elastic steadying finger, a clearing arm movable from the head stock toward the tail stock, means for advancing the tail stock spindle, means for thereafter moving the circular saws toward and from the work axis, means for thereafter moving the finishing carriage and the steadying finger toward and from the work axis, means for thereafter retracting the tail stock spindle, and means for then moving the clearing arm toward the tail stock as described.

19. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine, means for rotating the head stock, and a tail stock adapted to receive and support a blank and slidable back and forth in line with the work axis, with a series of parallel circular saws rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, means for rotating said saws, a finishing carriage movable toward and from said work axis, finishing tools carried thereby, a clearing arm movable from the head stock toward the tail stock, delivery fingers adapted to advance and take and to withdraw the finished blank, means for advancing the tail stock spindle, means for thereafter moving the circular saws toward and from the work axis, means for thereafter moving the finishing carriage toward and from the work axis, means for thereafter advancing the delivery fingers, means for thereafter retracting the tail stock spindle, means for then moving the clearing arm toward the tail stock, and means for then withdrawing the delivery fingers as described.

20. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine, means for rotating the head stock, and a tail stock adapted to receive and support a blank and slidable back and forth in line with the work axis, with a series of parallel circular saws rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, means for rotating said saws, a finishing carriage movable toward and from said work axis, finishing tools car-

ried thereby, a clearing arm movable from the head stock toward the tail stock, delivery fingers adapted to advance and take and to withdraw the finished blank, means for advancing the tail stock spindle, means for thereafter moving the circular saws toward and from the work axis, means for thereafter moving the finishing carriage toward and from the work axis, means for thereafter advancing the delivery fingers, means for thereafter retracting the tail stock spindle, and means for then moving the clearing arm toward the tail stock, and means for then withdrawing the delivery fingers, together with discharging means which then discharge the finished blank from the delivery fingers as described.

21. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine, means for rotating the head stock, and a tail stock adapted to receive and support a blank and slidable back and forth in line with the work axis, with a series of parallel circular saws rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, means for rotating said saws, a finishing carriage movable toward and from said work axis, finishing tools carried thereby, a clearing arm movable from the head stock toward the tail stock, delivery fingers adapted to advance and take and to withdraw the finished blank, means for advancing the tail stock spindle, means for thereafter moving the circular saws toward and from the work axis, means for thereafter moving the finishing carriage toward and from the work axis, means for thereafter advancing the delivery fingers, means for thereafter retracting the tail stock spindle, means for then moving the clearing arm toward the tail stock, and means for then withdrawing the delivery fingers, together with discharging means which then discharge the finished blank from the delivery fingers, and means for receiving and directing the delivered blank as described.

22. In a wood turning machine, the combination of a head stock rotative on the work axis of the machine, and a tail stock having a spindle adapted to receive a blank and slidable back and forth in line with the work axis, with a series of parallel circular saws of different sizes rotative on an axis substantially parallel with the work axis and movable toward and from said work axis, a finishing knife movable toward and from said work axis, means for advancing and retracting the tail stock spindle, means for moving the circular saws toward and from the work axis, and means for moving the finishing knife toward and from the work axis as described.

23. In a wood turning machine, the combination of a rotative head stock having receiving pins, with a slidable tail stock adapted to receive and support a bobbin blank and to force it on the receiving pins, roughing means which include a plurality of closely associated circular saws of different diameters adapted to engage the blank after it engages the head stock, finishing means adapted to engage the blank after the roughing means, delivery means for engaging the finished blank after it is finished by the finishing means, means for withdrawing the tail stock, means for clearing the finished blank from the head stock, means for withdrawing the delivery means, and means for discharging the finished blank from the delivery means as described.

24. In a wood turning machine, the combination of a rotative head stock having receiving pins, with a slidable tail stock adapted to receive and support a bobbin blank and to force it on the receiving pins, roughing means which include a plurality of closely associated saws of different diameters adapted to engage the blank after it engages the head stock, finishing means adapted to engage the blank after the roughing means, means for withdrawing the tail stock after the blank is finished, and means for clearing the finished blank from the head stock as described.

25. In a wood turning machine, the combination of a rotative head stock having receiving pins, with a slidable tail stock adapted to receive and support a bobbin blank and to force it on the receiving pins, roughing means which include a plurality of closely associated saws of different diameters adapted to engage the blank after it engages the head stock, finishing means adapted to engage the blank after the roughing means, means for withdrawing the tail stock after the blank is finished, means to prevent the blank from following the tail stock, and means for clearing the finished blank from the head stock as described.

26. In a wood turning machine, the combination of a rotative head stock having receiving pins, with a slidable tail stock adapted to receive and support a bobbin blank and to force it on the receiving pins, roughing means which include a plurality of closely associated saws of different diameters adapted to engage the blank after it engages the head stock, finishing means adapted to engage the blank after the roughing means, means for steadying the blank while engaged by the finishing means, delivery means for engaging the finished blank after it is finished by the finishing means, means for withdrawing the tail stock, means for clearing the finished blank from the head stock, means for withdrawing the delivery means, and means for discharging the finished blank from the delivery means as described.

27. In a wood turning machine, the combination of supporting means for the blank, a plurality of circular saws, means for rotating the blank, means for rotating the saws at high speed while in contact with the blank so as to rough the blank to its required shape, means for moving the saws into and out of contact with the blank, means for trimming or finishing the blank, said last mentioned means being automatically movable into and out of contact with the blank after the roughing operation, and means for thereafter automatically delivering the finished blank.

28. In a wood turning machine, the combination of end supports for the blank, a series of circular roughing saws, means for rotating the saws at a high speed while in contact with the blank whereby to shape the same, and supporting means for the saws including downwardly projecting arms pivoted intermediate their ends, an off-set arm connected to the lower end of said first mentioned arms, a hanger arm pivotally supported at its upper end and having pivotal connection at its lower end with said off-set arm, movable trimming devices, and actuating means for said devices whereby to move the trimming devices into contact with the work as disengaged by the roughing saws.

29. In a wood turning machine, the combination of end supports for the blank, a drive shaft, a plurality of circular roughing saws, trimming devices, means operatively associated with said shaft for rotating the saws, a movable carrier for the saws, a movable carrier for the trimming devices, cams on said shaft operatively associated with said carriers whereby to alternately move into operative position relative to the work the roughing saws and trimming devices.

30. In a wood turning machine, the combination with end supports for the blank, of a plurality of circular roughing saws, means for moving the saws into and out of contact with the blank to shape the same, said means including a rock arm support for the saws, and means for actuating the rock arm, a hood or housing for the saws, a discharge chute leading from said hood, and said hood and discharge chute being mounted for movement with said rock arm.

31. The process of making bobbins from blanks which consist of causing a blank to revolve with great rapidity in one direction upon a fixed axis and while so revolving to cause a large number of toothed cutters rotating in the same direction with the blank to be moved up to said blank for grinding it down, of withdrawing said cutters and immediately thereafter of bringing up to it shearing cutters for finishing.

32. In a wood turning machine, the combination of end supports for the blank with means for rotating the blank in one direction at great speed, a plurality of thin closely associated circular saws with relatively small teeth for grinding down the blanks, means for rotating the saws at great speed in the same direction with the rotation of the blank, a hood which incloses the saws and has a narrow mouth proximate the blank, means for moving the saws an hood toward and from the blank, finishing knives movable toward and from the blank and means for advancing the finishing knives to the blank after it has been ground down by the saws.

33. In a wood turning machine, the combination of end supports for the blank, with means for rotating the blank at great speed, a plurality of thin closely associated circular saws with relatively small teeth for grinding down the blank, means for rotating the saws at great speed, means for moving the saws toward and from the blank, and finishing knives movable toward and from the side of the blank opposite the circular saws, together with means for advancing the finishing knives to the blank after it has been ground down by the saws.

In testimony whereof I hereto affix my signature in presence of two witnesses.

LEONARD D. HAMBLETON.

Witnesses:
FISHER H. PEARSON,
GARDNER W. PEARSON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."