

D. S. COURTNEY.
WOOD TURNING MACHINE.
APPLICATION FILED SEPT. 22, 1911.

1,046,149.

Patented Dec. 3, 1912.

7 SHEETS-SHEET 1.

FIG. 1-

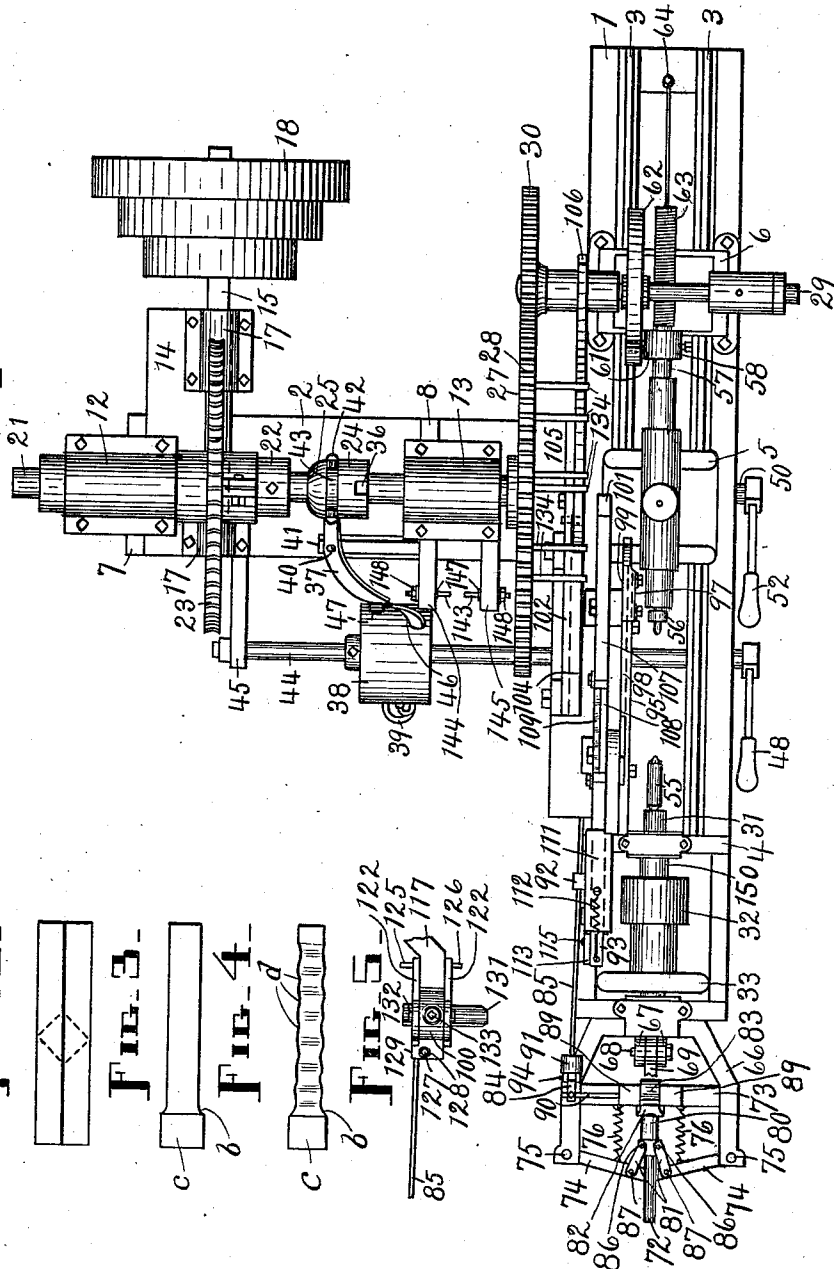


FIG. 2-



FIG. 3-



FIG. 4-

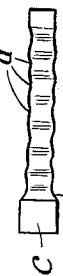


FIG. 5-



WITNESSES:

A. C. Fairbanks.
J. M. Davenport.

INVENTOR.

Dana S. Courtney,

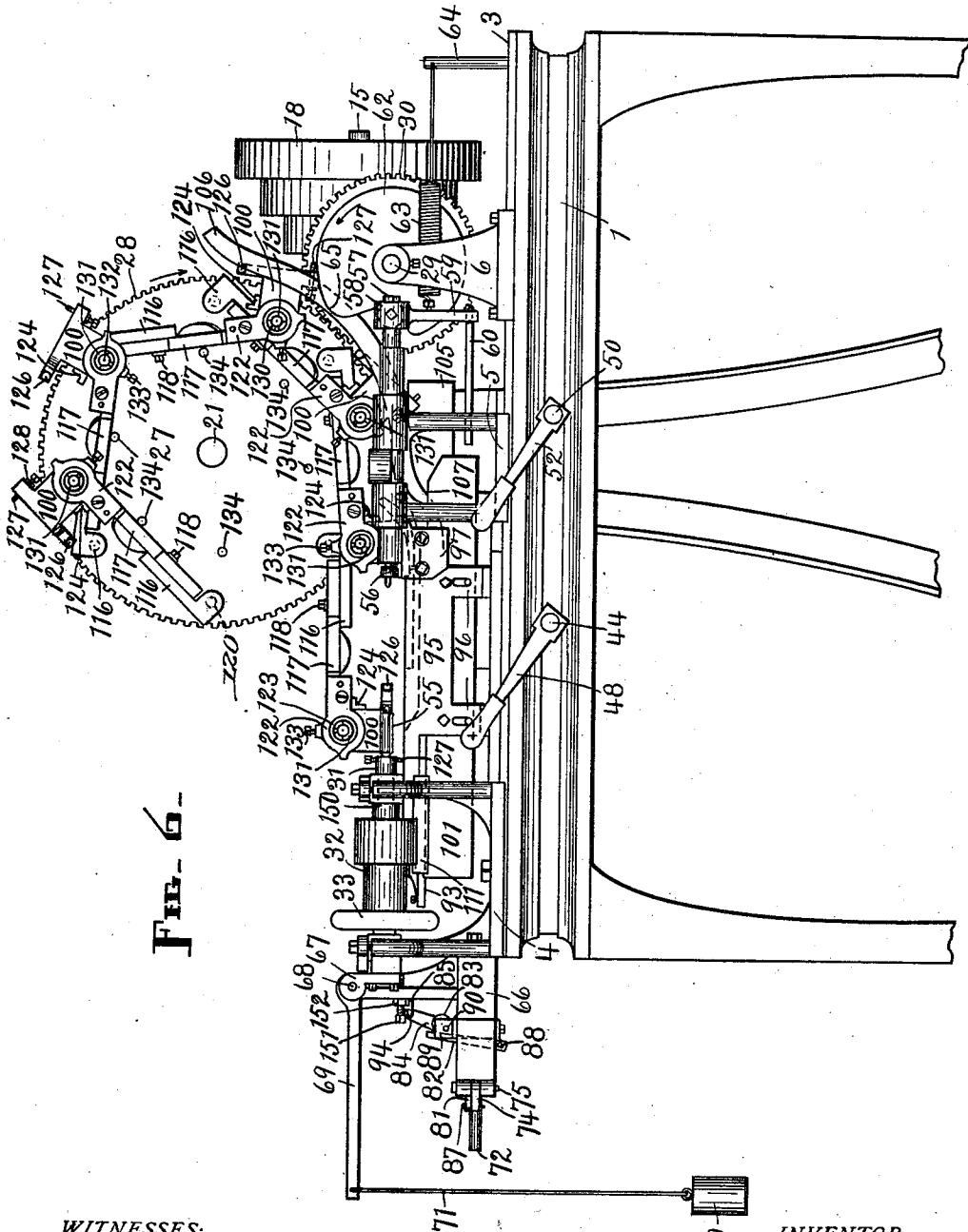
BY

Webster & Co.,
ATTORNEYS.

D. S. COURTNEY.
WOOD TURNING MACHINE.
APPLICATION FILED SEPT. 22, 1911.

1,046,149.

Patented Dec. 3, 1912.
7 SHEETS—SHEET 2.



WITNESSES:

A. C. Fairbanks.
J. M. Davenport.

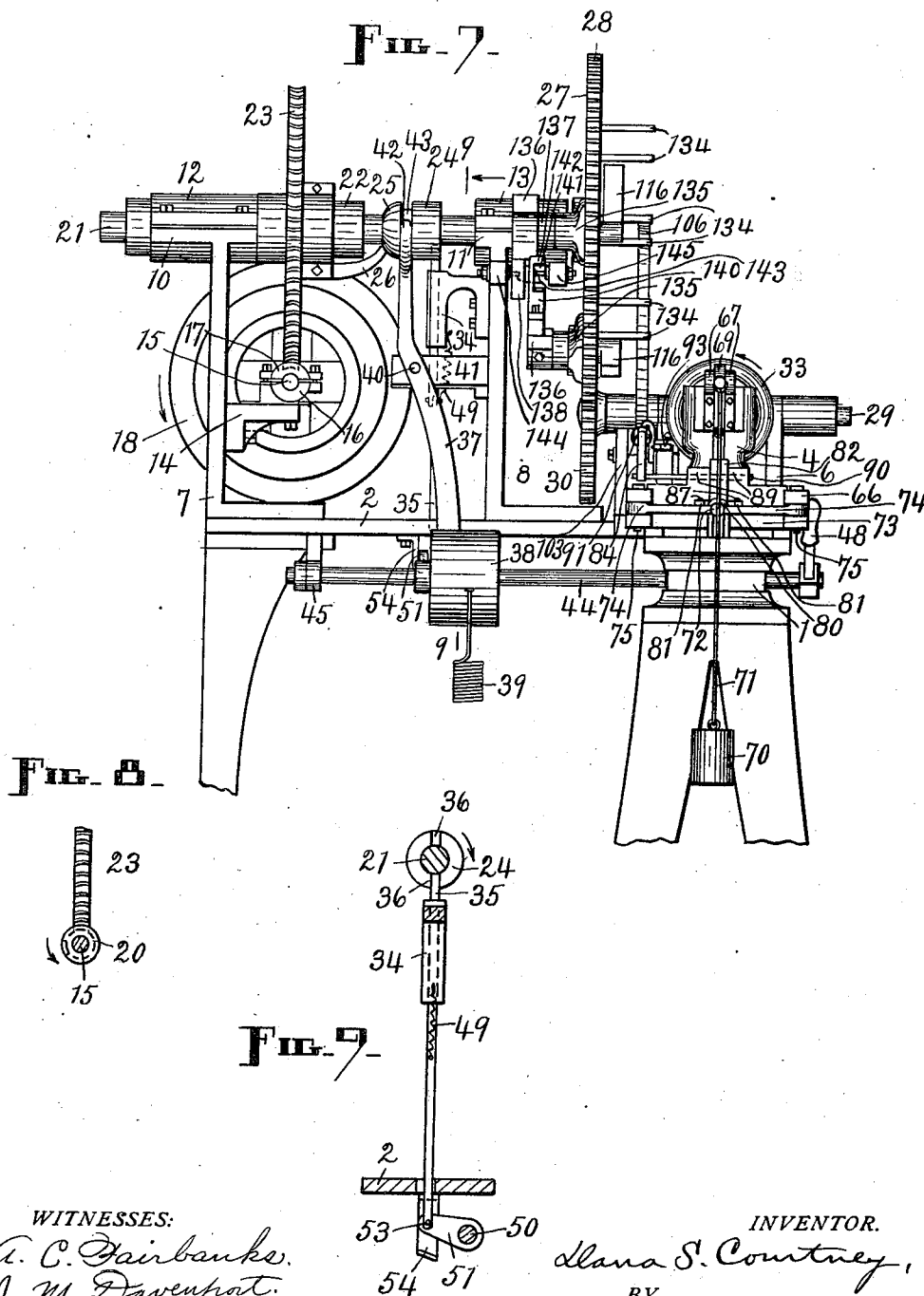
INVENTOR.

Dana S. Courtney,
BY
Webster & Co.,
ATTORNEYS.

D. S. COURTNEY.
WOOD TURNING MACHINE.
APPLICATION FILED SEPT. 22, 1911.

1,046,149.

Patented Dec. 3, 1912.
7 SHEETS—SHEET 3.



WITNESSES:
A. C. Fairbanks.
J. M. Davenport.

INVENTOR.
Dana S. Courtney,
BY
Webster & Co.,
ATTORNEYS.

D. S. COURTNEY.
WOOD TURNING MACHINE.
APPLICATION FILED SEPT. 22, 1911.

1,046,149.

Patented Dec. 3, 1912.

7 SHEETS—SHEET 4.

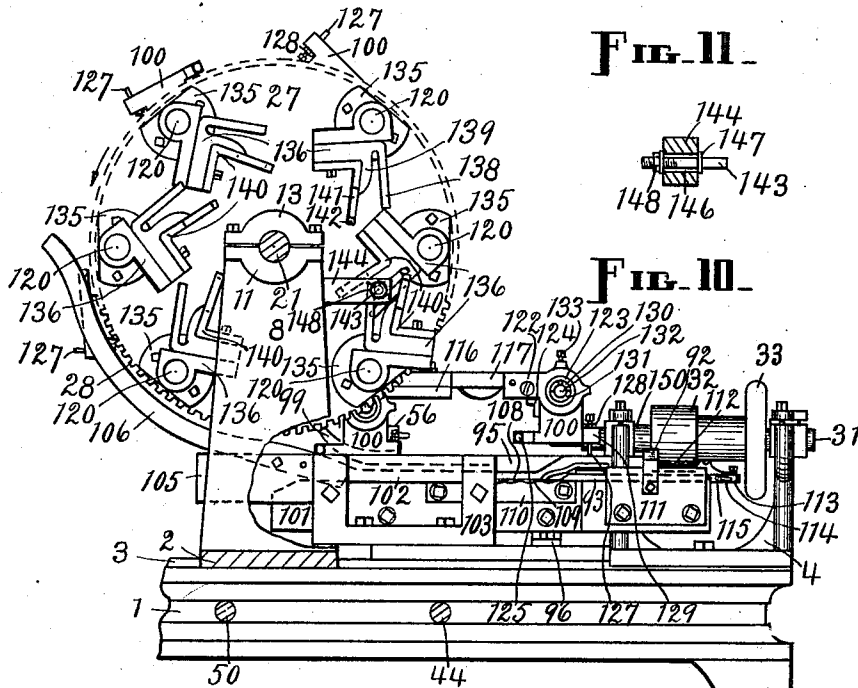


FIG. 12.

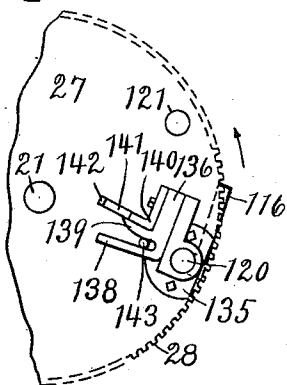


FIG. 13.

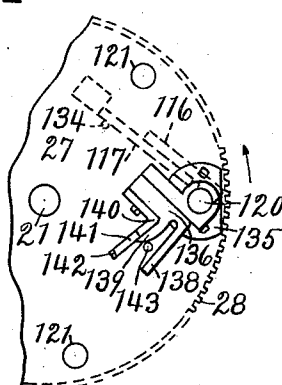
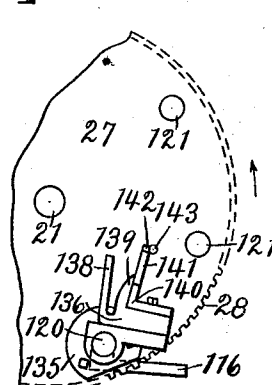


FIG. 14.



WITNESSES:

A. C. Fairbanks.
J. M. Davenport.

INVENTOR.

Dana S. Courtney,

BY

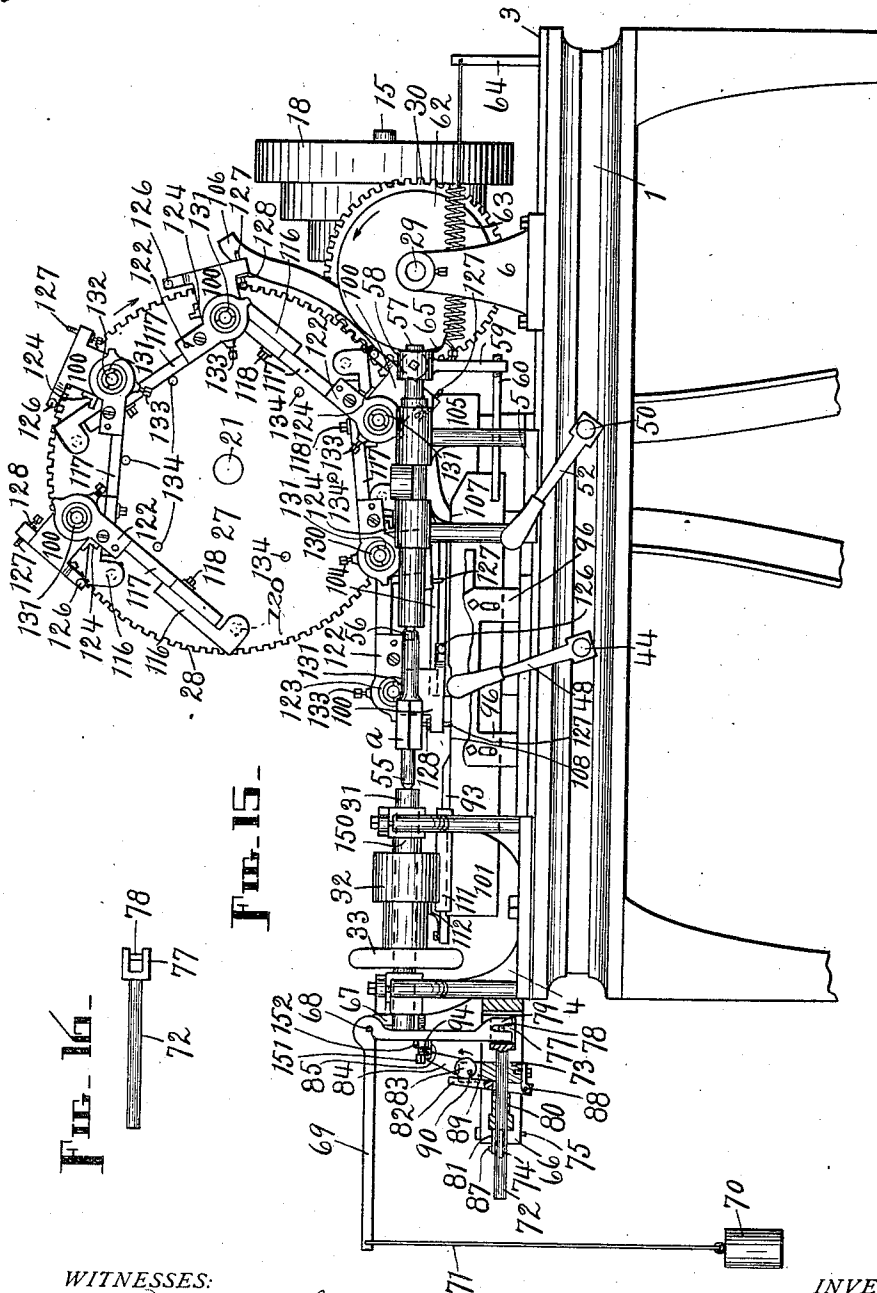
Webster & Co.,
ATTORNEYS.

D. S. COURTNEY.
WOOD TURNING MACHINE.
APPLICATION FILED SEPT. 22, 1911.

1,046,149.

Patented Dec. 3, 1912.

7 SHEETS—SHEET 5.



WITNESSES:

A. C. Fairbanks.
J. W. Davenport.

INVENTOR.

Dana S. Courtney,

BY

Webster & Co.,
ATTORNEYS.

D. S. COURTNEY.
WOOD TURNING MACHINE.
APPLICATION FILED SEPT. 22, 1911.

1,046,149.

Patented Dec. 3, 1912.

7 SHEETS—SHEET 7.

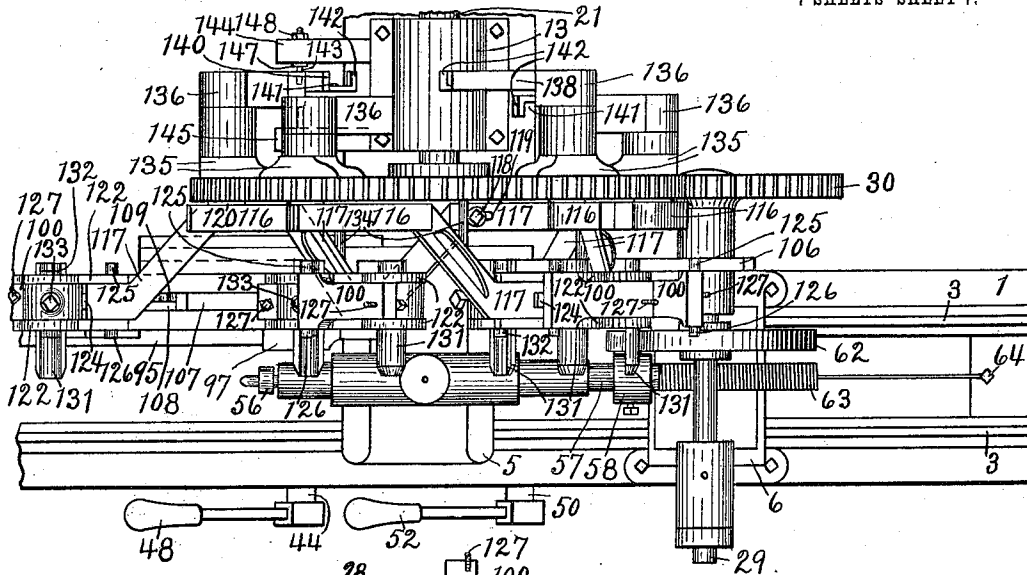


FIG. 23.

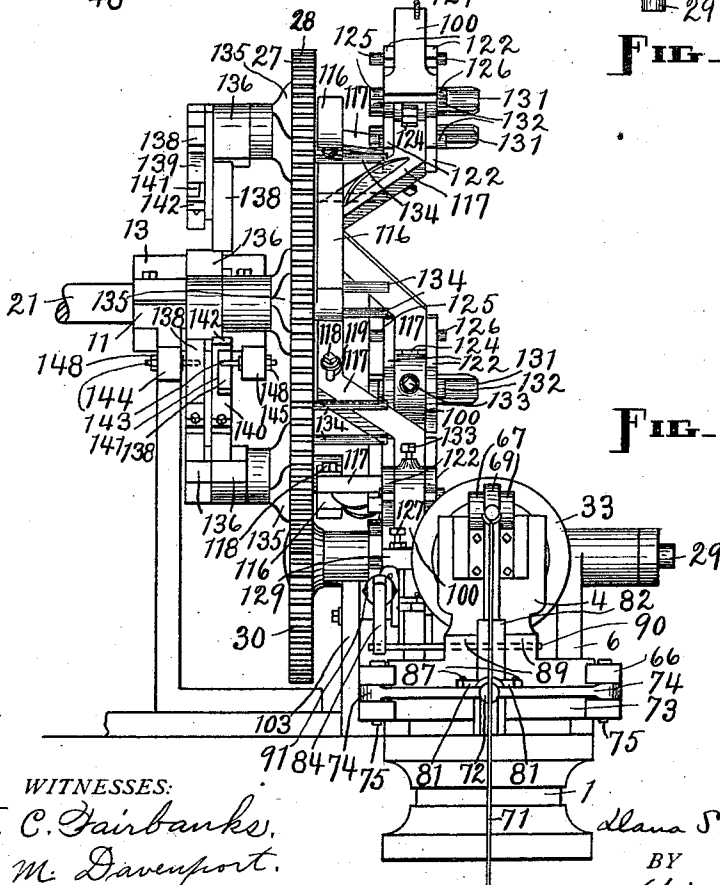


FIG. 24.

WITNESSES:

A. C. Fairbanks,
J. M. Davenport.

INVENTOR.

Dana S. Courtney,
BY
Webster & Co.,
ATTORNEYS.

UNITED STATES PATENT OFFICE.

DANA S. COURTNEY, OF CHICOPEE, MASSACHUSETTS.

WOOD-TURNING MACHINE.

1,046,149.

Specification of Letters Patent.

Patented Dec. 3, 1912.

Application filed September 22, 1911. Serial No. 650,667.

To all whom it may concern:

Be it known that I, DANA S. COURTNEY, a citizen of the United States of America, residing at Chicopee, in the county of Hampden and State of Massachusetts, have invented a new and useful Wood-Turning Machine, of which the following is a specification.

My invention relates to improvements in the art of wood-working machinery and more especially to automatic turning machines, and resides in new and novel cutter mechanism, in certain peculiar means for handling the work before, during and at the end of the turning operation, such means including a relief device for the live center when the work exceeds the normal in length, and in certain peculiar starting and stopping mechanism, together with such other auxiliary and subsidiary parts and members as may be needed to make the machine complete and render it effectual in every particular, all as hereinafter set forth.

In this machine I employ, with work-revolving means, one or more cutter arms each of which is pivotally mounted at one end to a rotary carrier and arranged to travel around with such carrier and at a certain stage in each revolution to have the end which is opposite the pivotally-mounted end travel in a path which is tangential to the orbital path of said pivotally-mounted end or approximately so. These arms are equipped with swinging cutter heads at their free ends, and there are suitable guiding and directing means in the machine for these heads. Intimately associated with the cutter arms and the carrier therefore are means to lift the free terminals of said arms from the above-mentioned tangential path, and to turn them on their pivots over into inverted positions so as to enable them to be carried around by and with the carrier for subsequent active operation, without shock or jar, it being understood that the cutters attached to said arms are active only while the cutter heads are in the aforesaid tangential path, being inactive at all other times. Without making provision for the proper amount of flexibility on the part of the cutter mechanism, in the manner just referred to, such mechanism would be so stiff, cumbersome and unwieldy as to lose much of its practicability and efficiency. As it is I am able to make the machine com-

pact and to derive all of the benefits accruing from cutters moving in an approximately straight line against a rapidly revolving piece of work. This construction will be subsequently described in detail and these advantages brought out more fully.

In the manufacture of various kinds of spindles, shuttle bobbins in particular, more or less of the work has been done by hand heretofore, and more or less skilled labor has been employed from necessity, but with this machine all of such work is performed automatically and very much faster and with greater precision than by the old means and in the old way, and the primary object of my invention is found in these advantages.

A further object is to produce a strong, durable, accurate, and quick-acting wood-turning machine, which is automatic in operation, can be controlled easily, is capable of handling work which varies in length, has the necessary amount of adjustment, and is withal entirely practicable and highly efficient.

Other objects will appear in the course of the following description.

I attain the objects and secure the advantages of my invention by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a top plan of a machine in which is embodied a practical form of the invention, with the mechanism initially disposed and at rest, the cutter arms and their operating dogs and lifters being omitted and the weighted arm of the relief device being broken off; Fig. 2, an enlarged side elevation of a piece of work which this machine is adapted to handle; Fig. 3, a similar elevation of such piece after the first operation; Fig. 4, a similar elevation showing the finished piece at the end of the last operation; Fig. 5, a fragmentary detail, in top plan, of the knock-off elements which release or unlock the relief device; Fig. 6, a front elevation of said machine, the same being complete with the exception of the bottom parts of the legs, and the mechanism being at rest in initial position as before; Fig. 7, a left-hand end elevation of the machine, portions of two of the cutter arms only and the operating parts therefor being shown, and the mechanism being somewhat differently disposed than it is in

Figs. 1 and 6, for the sake of illustrating to better advantage the relationship between adjacent dogs and lifters and between such dogs with their lifters and the abutment pins; Fig. 8, a fragmentary detail of the worm and worm-wheel; Fig. 9, a detail of the stop device, taken on lines 9—9, looking in the direction of the associated arrow, in Fig. 7; Fig. 10, a rear elevation, without the extension at the back and the mechanism supported thereby and without the relief device, of the machine as it stands in Fig. 6, a portion of the upright herein shown being broken out to disclose parts that would otherwise be hidden; Fig. 11, a detail of one of the abutment pins for the dogs and lifters and of the lug therefor, the latter being in section to show how said pin can be adjusted; Fig. 12, a rear elevation of part of the rotary carrier for the cutter arms and of attached and associated parts, including one of the dogs with attached lifter and one of the abutment pins, also a portion of the cutter arm operated by said dog and lifter through the medium of said pin, such view being illustrative of the operation of the cutter mechanism; Fig. 13, a view similar to the preceding view but illustrating an additional step in the operation, more of the cutter arm being here shown, together with the rest pin therefor; Fig. 14, still another view illustrative of the operation, the same parts being shown as in Fig. 12; Fig. 15, a front elevation of the machine as it appears in operation, the front guide being broken away to show in full the tangential path and other parts or members, and the relief device being shown in section; Fig. 16, a top plan of one of the relief device members, namely, the releasing plunger; Fig. 17, an enlarged top plan of one of the cutter arms, including the head and cutter; Fig. 18, an enlarged end elevation of said arm, looking toward the head; Fig. 19, a section on lines 19—19, looking in the direction of the associated arrow, Fig. 17; Fig. 20, an enlarged bottom plan of said arm and parts; Fig. 21, an enlarged bottom plan of another head and attached parts, showing such head widened at the front end; Fig. 22, a rear elevation of the machine somewhat similar to Fig. 10, but showing the machine in operation and illustrating a modification in such operation, all excepting one of the cutter arms and operating parts therefor being omitted; Fig. 23, an enlarged front elevation of the cutter mechanism, and Fig. 24, an enlarged left-hand end elevation of said mechanism.

Similar reference characters indicate similar parts throughout the several views.

Although I have, for the purpose of this application, illustrated and will describe in detail my invention as embodied in a machine for turning spindles or bobbins, it is

to be understood that the invention may be applied to machines designed for other kinds of work, and that this machine even may be so adjusted or modified as to make it capable of acting successfully on work which, strictly speaking, might not be classed under either of the above heads. It is plain, therefore, that I do not desire or intend to be restricted in the use or application of my invention. In this connection I desire to state, furthermore, that numerous modifications and changes in the construction, arrangement and combination of parts, and other details of my invention, such as will occur to one skilled in the art which embraces said invention, may be made without violating the spirit or departing from the nature thereof.

For the sake of economy in construction and operation this machine is equipped with double sets of cutter members and operating parts therefor, and with means to stop the cutter mechanism at each half revolution of the driving shaft therefor, so that the machine turns out two bobbins at each complete revolution of said mechanism, or, to state it differently, each cycle of the cutter mechanism involves only one-half of a revolution of said mechanism, there thus being two cycles at every revolution. But without material change the machine can be arranged so as to employ a single set of cutters and have the cutter-mechanism cycle equal to a full revolution of such mechanism, and it is conceivable that by employing more than two sets of cutters, with a less number in a set perhaps, one revolution might represent more than two cycles. As intimated above, the number of cutters in a set, as well as the number of sets, may be varied. Although for the work which this machine is especially well adapted to perform three cutters and their appurtenances are needed in order to obtain the best results, for work of a different nature such number might be increased or decreased. The operation of any one group of cutter elements is the same in every essential particular as that of any other cutter-element group, hence the number of such groups does not make any vital or material difference so far as the invention itself is concerned.

In the drawings of the machine illustrated in connection herewith, arrows are employed to designate the directions of moving parts, such arrows being associated with the parts to which they relate.

The aforesaid machine comprises several mechanisms which are separate and distinct from each other to a greater or less degree, and the following description will first deal with these several mechanisms under their appropriate heads and in the order named. Such heads taken in their proper sequence are as follows: the driving or actuating

mechanism, with which may be included the frame of the machine and other supporting parts and members, which latter should, of course, have precedence in the description over the other elements; the controlling mechanism for such driving or actuating mechanism; the work-holding and operating mechanism, and with that the relief device for the work; and the cutter mechanism.

For the supporting frame of the machine I employ a bed 1 and a back extension 2, both of which are upheld by any suitable style of legs or other means. The extension 2 is at right-angles to the bed 1, and the front end of said extension joins said bed at a point intermediate of the ends of the same. On top of the bed 1 are two longitudinal tracks 3 upon which are mounted a head-stock 4 and a tail-stock 5, the two latter being adjustably held to said tracks in the usual manner. The head-stock 4 is at the left-hand end of the bed 1 while the tail-stock 5 is located intermediate of the ends of said bed. Secured to the bed 1 at the right of the tail-stock 5 is a bearing bracket 6. Rising from the extension 2 are uprights 7 and 8 which are respectively provided at their top ends with bearings 10 and 11. The upright 8 is in front of the upright 7. At 12 and 13 are caps for the bearings 10 and 11, respectively.

A bracket 14 extends forward from and also beyond the right-hand edge of the upright 2, and upon this are two bearings for a horizontal driving shaft 15, one of such bearings appearing at 16, in Fig. 7. Caps 17—17 for the bearings 16 are shown in Fig. 1. The shaft 15 is parallel with the bed 1, and has a speed-pulley 18 at its right-hand terminal and a worm 20 (Fig. 8) at its left-hand terminal.

Journalled in the bearings 12 and 13, above the shaft 15 and at right-angles thereto, is a shaft 21. Mounted loose on the shaft 21, but adapted to be rotatably secured to said shaft by a clutch 22, is a worm-wheel 23. The worm-wheel 23 is situated over and in mesh with the worm 20, as shown in Fig. 8. The clutch 22 is in front of the worm-wheel 23, and mounted on the shaft 21 in front of said clutch is a sleeve 24 which constitutes part of the clutch mechanism. The sleeve 24 is keyed or otherwise attached to the shaft 21 so as to enable it to slide on said shaft and at the same time rotate therewith, and said sleeve has a part 25 to act on a clutch finger 26 for the purpose of operating the clutch. The clutch mechanism thus briefly described is of ordinary and usual construction and application. Secured to the shaft 21 at the front end thereof is a disk or carrier 27 which has a toothed periphery 28.

Journalled in the bearing bracket 6 is a shaft 29 arranged crosswise of the bed 1.

Mounted fast on the shaft 29 at the rear end is a gear 30 which meshes with the toothed part or gear 28 of the carrier 27.

A shaft 31 is journalled in the head-stock 4, and has a speed-pulley 32 and a hand-wheel 33 secured thereon. The speed-pulleys 18 and 32, in practice, will be belted in the usual manner to main or countershafts, or they may be otherwise driven.

While the machine is in operation the shaft 15, the worm 20 and the worm-wheel 23 revolve continually, but, since it is not desired to operate the cutter mechanism continually, the clutch 22 is provided, and some means must be provided for operating said clutch to throw the cutter-mechanism shaft 21 into and out of action. Such means is described below.

A bracket 34 is fastened to the back side of the upright 8, and this bracket has a vertical passage therethrough to receive a stop bar 35 which extends above and below said bracket and is designed to slide up and down therein. The upper terminal of the bar 35 is in front of the sleeve 24, and said sleeve has two oppositely-disposed recesses 36 in its front face to receive such terminal, as clearly shown in Fig. 9. Thus the movement of the sleeve 24 away from the finger 26 is limited by the bar 35, although there are two points or degrees of such limitation, namely, one when the front face of said sleeve bears against said bar, and the other when said bar is received in either recess 36 and that part of such recess which is parallel with said front face bears against the bar. The sleeve is yieldingly held against the stop bar by means of a lever 37, a cam 38 and a spring 39. The lever 37 is pivotally attached at 40 to a bracket 41 which extends rearwardly from the upright 8, and the upper terminal of said lever is forked at 42. The sleeve 24 has an annular groove 43 therein to receive the fork 42. The cam 38 is secured to a rock-shaft 44 which is journalled parallel with the shaft 21 in the bed 1 and a bracket 45, the latter extending to the left from the extension 2. The cam 38 has a cam-groove 46 in its right-hand side, into which a projection (represented by dotted lines 47 in Fig. 1) extends, and the upper end of the spring 39 is fastened to the opposite side of said cam. The spring 39 is fastened at the bottom to the floor or some other convenient medium for attachment. An operating lever or handle 48, for the clutch-operating lever 37, is rigidly attached to the rock-shaft 44 in front of the bed 1.

It is now clear that, by throwing the handle 48 upward into the position shown in Fig. 15, the rock-shaft 44 and the cam 38 are partially rotated against the resiliency of the spring 39, and that, by reason of the relationship which exists between said cam and the lever 37, the latter is rocked on its

pivot 40 in such a way as to slide the sleeve 24 rearwardly. The result of this is that the clutch 24 is actuated into locking engagement with the shaft 21, and the latter is
 5 caused to revolve with the worm-wheel 23, because said clutch is rigidly attached to said worm-wheel. In being thus moved backward, the recessed part of the sleeve 24 which is in engagement with the stop bar 35
 10 leaves said bar, and the front face of the now revolving sleeve bears against said bar, being forced against the same, upon the release of the handle 48, by the spring 39 acting through the cam 38 and the lever 37 and
 15 tending always to cause said lever to actuate said sleeve toward said bar. The shaft 21 and the members rotated or actuated thereby continue to revolve or operate until the recess 36, which is opposite that in which
 20 the upper end of the bar 35 was first located, comes into position directly behind such end, and then the sleeve 24 slips forward with said bar end in the newly presented recess, and brings about the instant stopping of said
 25 shaft and members by releasing the clutch or disengaging it from said shaft. Thus it is that the shaft 21 is automatically stopped at each half revolution.

The stop bar 35 is pressed upwardly
 30 against the shaft 21 by means of a spring 49 which has its upper end attached to the bracket 34 and its lower end attached to said bar. A second rock-shaft 50, similarly journaled to and arranged parallel with the
 35 rock-shaft 44, is provided, and said rock-shaft 50 has a rocker-arm 51 mounted thereon, also an operating arm or handle 52, the latter being at the front end like the handle 48. The rocker-arm 51 projects to the left
 40 from the rock-shaft 50 and is pivoted at 53 to the bottom of the bar 35. A bracket 54 depends from the underside of the extension 2 and is arranged to limit the downward movement of the rocker-arm 51.

In the event that it be desired to stop the shaft 21, which is the cutter-mechanism shaft, at any point in either half of its revolution, it is simply necessary to grasp the handle 52 and swing it down so as to draw
 50 down the stop bar 35, through the medium of the rock-shaft 50 and the rocker-arm 51 and against the resiliency of the spring 49, until said bar is clear of the sleeve 24. The latter instantly moves forward and releases the
 55 clutch or permits the same to release the shaft 21, thus stopping the cutter mechanism. When the handle 52 is released, the spring 49 acts to raise the bar 35 against the sleeve 24 and to thrust said bar into normal
 60 position in front of said sleeve when the latter is actuated rearwardly again to throw in the clutch. Entire control of the machine is thus afforded at all times.

Passing next to the work holding and
 65 operating mechanism, it will be observed

that the shaft 31 is equipped at the inner end with a live center 55 for the work, and that there is a dead center 56 for such work at the adjacent end of a spindle 57 mounted
 70 in the tail-stock 5. The spindle 57 is mounted to reciprocate longitudinally in the tail-stock 5, but is prevented from rotating therein by means of a block 58 having a hanger 59, and a rod 60. The block 58 is
 75 mounted on the protruding rear or right-hand terminal of the spindle 57, and has, in addition to the hanger 59, a rearwardly extending stud 61, and said block may be adjustably mounted on said spindle so as
 80 to enable its stud to be properly positioned relative to a cam 62 which is secured on the shaft 29 to the right of or behind said stud. The rod 60, which is parallel with the spindle 57, has one end fastened to the
 85 base of the hanger 59 and is arranged to slide in the right-hand end of the tail-stock 5. The spindle 57, the block 58 with its hanger, and the rod 60 being thus arranged and rigidly connected, it is impossible for
 90 said spindle to turn in its bearings, although free to reciprocate therein. As previously intimated, the stud 61 is in operative relation to the cam 62, and it is so retained
 95 by means of a spring 63, which has one end fastened to the hanger 59 and the other end to a post 64 set in the bed 1 at the right-hand end.

The gears 28 and 30 are so proportioned that each half revolution of the shaft 21 imparts a complete revolution to the shaft
 100 29, through the medium of said gears, consequently the cam 62 makes a complete revolution for every half revolution of said shaft 21, and, owing to the shape of said cam, reciprocates the spindle once, or advances said spindle and then permits it to
 105 be retracted by the spring 63. The timing of the parts is such that, when a piece of work is placed on and against the dead center 56 and the handle 48 swung up to bring
 110 about the actuation of the clutch 22 and the starting of the shaft 21, the cam 62 advances the spindle 57, through the medium of the stud 61 and the block 59, and forces the piece of work with the dead center behind it against the live center 55, and said
 115 cam causes said piece to be held securely between said centers until near the end of the revolution of the cam, when the latter releases the advanced members and permits
 120 the spring 63 to assert itself and retract said members, thus releasing the piece of work. The spindle 57 is advanced with sufficient force to drive the piece of work fairly and
 125 securely into engagement with the live center or onto the spurs or other work-engaging parts with which such a center is always provided. The speed-pulley 32 is set in motion, usually before the cam 62 is started, and in turn transmits motion, through the
 130

shaft 21 and the live center 55 with which the piece of work is revolvably connected at one end, to said piece. The piece turns, at the end opposite that which is engaged by the live center, independently of the dead center (which does not revolve), although said piece is supported by said dead center. If desired, the hand-wheel 33 may be used for stopping the shaft 31, after the power has been disconnected, by bearing with the hand on said wheel until the momentum of the revolving parts is overcome.

The cam 62 is made with a high part 65, and is arranged so that said part acts on the reciprocating parts directly after said cam commences to revolve. Then the stud 61 settles back on the concentric which is a major part of the cam 62. The object of this is to reduce the friction between the dead center 56 and the work, by slightly increasing the distance between the two centers after the work has been driven into positive engagement with the live center 55.

In case the work varies slightly in length, which it does sometimes, a release device for the shaft 31 is needed, since the machine must be set to handle the shortest piece, and without such a device either would be injured itself or would injure the work when a longer piece is introduced. Such a device will be found described below.

Securely attached to the outer end of the head-stock 4 is a horizontal double-arm bracket 66, also twin lugs 67, the latter being above the former. Pivotaly mounted at 68 between the lugs 67 is an angular arm 69. The arm 69 has a vertical part which extends downward between the arms of the bracket 66 and a horizontal part which extends outwardly, and a weight 70 is suspended by means of a cord 71 from the free end of such horizontal part. The shaft 31 projects beyond the outer end of the head-stock 4 and the vertical branch of the arm 69 bears against such protruding end of said shaft. Thus the weighted arm 69 has a constant tendency to force the shaft 31 inwardly. The inward movement of the shaft 31 must be limited by some means, as by a shoulder 150 on said shaft situated so as to contact with the left-hand face of the inner bearing for said shaft. Normally the shaft 31 is retained in its innermost position by means of the weighted lever 69, and when so positioned the machine is adapted to handle or is set to handle the shortest piece of work. In the event, however, that a piece of work is inserted which is longer than the normal length, when the cam 62 operates to drive such piece into engagement with the live center 55 the arm 69 yields and permits the shaft 31 to move outwardly to whatever extent may be necessary for the accommodation of the longer piece. This movement in any event is very slight. The weight 70

must be heavy enough to prevent the arm 69 from yielding to the shaft 31 when a piece of work of normal length is driven into engagement with the live center 55 by the cam 62. When the shaft 31 is forced outwardly in the manner above described it is necessary that the parts be locked to relieve said shaft 31 from the force of the weight 70, otherwise such force would be transmitted through the intervening parts to the dead center 56 and create too much friction and burn the work at that point, and besides would otherwise interfere with the proper operation of the machine. To this end I employ a horizontal plunger 72 which is slidingly mounted in the center of a cross-piece 73, the latter extending between the arms of the bracket 66 about half way between the body part of said bracket and the free ends of said arms; and two horizontal locking jaws 74 which have their outer ends pivoted at 75—75 to the aforesaid free ends, and are arranged so that their inner ends may bear against or grip said plunger, on opposite sides, at the left of a line connecting said pivotal points, to prevent said plunger from moving inwardly, springs 76—76 being employed normally to retain said jaws in gripping engagement with said plunger. Each of the springs 76 is attached at one end to the cross-piece 73 and at the other end to one of the jaws 74. There are a cross-head or yoke 77 and a pin 78 at the inner end of the plunger 72, and the base of the vertical part of the arm 69 is provided with a finger 79 to engage said pin, the latter being received in the space between said base and said finger. When the arm 69 is rocked against the force of the weight 70, the plunger 72 is forced outwardly, by reason of the connection between the parts at the yoke 77, the springs 76 yielding and the jaws 74 loosening their grip upon said plunger at this time, but as soon as said arm is released to its weight said springs draw said jaws tightly against said plunger and so prevent the same from moving inwardly. The high part 65 of the cam 62, acting through a piece of work which exceeds the normal length, causes the plunger 72 to be moved outwardly to its maximum extent for such piece, and said plunger is gripped by the jaws 74 and held in that position, when said high part, as said cam continues to revolve, moves away from the stud 61. The work is then held between the centers without undue friction.

The plunger 72 must be unlocked at the end of the operation on a piece of work which is responsible because of its length for the outward displacement of said plunger, so that the live center 55 can be returned to normal position in readiness to receive the next piece of work, which latter may or may not exceed the minimum length, and if it does may not be as long as was the

other piece. To accomplish the release of the plunger 72, I mount a sleeve 80 to slide on said plunger, connect such sleeve at its outer end by means of two horizontal links 81 with the jaws 74, and provide an up-
 5 standing knock-off lever 82, an eccentric 83 for said lever, a rocker-arm 84, and a horizontal operating rod 85, and arrange for operating these members. The links 81
 10 have their inner ends pivotally attached at 86—86 to the adjacent or outer end of the sleeve 80, and their outer ends pivotally attached at 87—87 to the jaws 74. Thus, when the sleeve 80 is actuated outwardly on
 15 the plunger 72, the inner ends of the jaws 74 are forced away from said plunger by the links 81, the resistance offered by the springs 76 being then overcome. The knock-off lever 82 is forked at the bottom to straddle the
 20 plunger 72, and the base of said lever or of this forked part is pivotally connected at 88 with the cross-piece 73. The lever 82 is located behind the sleeve 80. Two lugs 89 rise from the cross-piece 73 both sides of its
 25 transverse center, and a shaft 90 is journaled in said lugs. The shaft 90 extends rearwardly from the lugs 89 and has the rocker-arm 84 secured thereto and rising therefrom at the back end thereof. The eccentric 83
 30 is secured to the shaft 90 between the lugs 89. Said eccentric is in contact with the upper end portion of the knock-off lever 82. The rod 85 is slidably mounted in a bearing 91, on the rear arm of the bracket 66,
 35 and a bearing 92, on the back side of the part of the machine in which is mounted a track slide 93 yet to be described, and the left-hand end of said rod is pivotally attached at 94 to the upper end of the rocker-
 40 arm 84, while the opposite end of said rod extends a little way into the path of travel at one end of two of the cutter heads, as will be more clearly explained hereinafter. This unlocking device is operated as fol-
 45 lows: When the rod 85 is actuated to the left it partially rotates the eccentric 83, in the direction of the associated arrow in Fig. 15, through the medium of the rocker-arm 84 and the shaft 90, and said eccentric is so
 50 mounted on said shaft that it then swings the knock-off lever 82, on its pivot 88, to the left, and said lever carries with it the sleeve 80 and the links 81. The links 81 force the jaws 74 away from the plunger 72 and so
 55 release said plunger and the arm 69 to the weight 70. The arm 69 is then rocked by the weight 70 to return both the shaft 31 and the plunger 72 to normal positions. As soon as the rod 85 is freed the springs 76
 60 contract to close the jaws 74 and force back the sleeve 80, through the medium of the links 81. The sleeve 80, in its backward or inward movement on the plunger 72, rocks the lever 82 in the same direction, and said
 65 lever, now bearing as it does on the eccen-

tric at a point well above the shaft 90, actuates said eccentric into its former position, the rocker-arm 84 and the rod 85 each being restored to initial position at the same time. When thus rocked to the right, the rocker-
 70 arm 84 comes to rest at its upper end against the adjacent edge of the lug 91, whereby the return movements of the eccentric 83 and the rod 85, as well as the return movement of the rocker-arm, are limited.

I will now take up the cutter mechanism which includes the carrier 27, certain guides and tracks which will first receive attention, and the track slide 93.

A horizontal guide member 95 is sup-
 80 ported from the bed 1 behind the vertical plane and below the horizontal plane of a line connecting the centers 55 and 56 and parallel therewith, on two vertical legs 96 which are securely attached to said bed, and at the right-hand end of said member is a
 85 guide member 97. These two guide members have rearwardly-extending top lips or flanges 98 and 99, respectively, the latter extending beyond the body part of the member
 90 97 and curving upwardly. The flanged members 95 and 97 constitute the front guide of the cutter mechanism or the front guide for cutter heads 100 at the free ends of the cutter arms of such mechanism. The member 97 is secured to a bed-plate 101, and the latter is secured to the member 95 be-
 95 hind.

A horizontal guide member 102 is sup-
 100 ported from the bed 1, behind the bed-plate 101, by an upstanding bracket 103 which is secured to said bed. The member 102 is parallel with the member 95 and has a forwardly-extending top lip or flange 104
 105 which is on the same level with the flange 98. Secured to a part 105 that projects to the right from the member 102 is a segmental guide member 106. The member 106 is concentric with the carrier 27, although with the rest of the back guide is some dis-
 110 tance in front of the front face or of the plane of such face of said carrier, and said member terminates at the left at a point below the right-hand end of the flange 104, the arrangement being such that a member
 115 traveling down said member 106 enters beneath said flange before running off of said member 106. The members 102 and 106 constitute the back guide just referred to of the cutter mechanism or for the cutter heads
 120 100. The left-hand end of the flange 104 is in the same line, transversely of the bed 1, with the corresponding end of the flange 98.

To all intents and purposes each of the guides described above is a single element
 125 and might be constructed as such. One is a complement of the other, although the back guide has the segmental part that is not necessary for both.

On top of the bed-plate 101 is a horizontal
 130

track 107 which is situated in the space between the vertical planes of the adjacent edges of the guide flanges 98 and 104, but below the level of said flanges. The track 107 drops a little at its left-hand end to a lower level where are to be found arranged side by side a plain horizontal track 108 and a pattern track 109. The track 108 is on top of the bed-plate 101, like the track 107, while the track 109 is on top of a bar 110 that is set into the back side of said bed-plate and bolted thereto. The track 108 is flat and unbroken and is in front of the track 109. The latter is undulating and forms a pattern which corresponds with the grooves around the bobbin when finished, and is responsible for the formation of such grooves, as I will explain later. The pattern track 109 can be readily removed and another put in its place, whenever it is desired to change the arrangement, size, depth, etc., of the bobbin grooves.

The slide 93 is mounted on the bed-plate 101, at the left-hand terminal thereof, and the under surface of said slide is in the same horizontal plane with the track 108, and also in the same general horizontal plane with the track 109. The slide 93 is arranged to reciprocate on the bed-plate 101 in a housing 111 which is attached to said bed-plate. A spring 112 has one end attached to the top of the housing 111 and the other end to that part of the slide 93 which protrudes from the left-hand end of said housing, and so tends to actuate said slide toward the right, the amount of such movement being limited by means of a stop 113. The stop 113 is attached to the back edge of the slide 93 beyond the outer end of the housing 111 and limits the inward movement of said slide by contacting with said housing. The stop 113 has a lateral slot 114 extending through the same to receive a set-screw 115, which screw is tapped into the slide 93. By means of this set-screw and slot the stop can be adjusted so as to increase or decrease the amount of inward movement of the slide, accordingly as said stop be set farther to the left or farther to the right.

In this case the carrier 27 is provided with six cutter arms and appliances. Each of said arms consists of two sections 116 and 117 which are fastened together by means of a bolt 118 that passes through a slot 119 in said section 117 into threaded engagement with said section 116. Thus the arm can be lengthened or shortened if necessary. A fixed pivot pin 120 projects rearwardly from each section 116 at the end which extends beyond the attached section 117, and said pin is journaled in an opening 121 in the carrier 27. The six openings 121 for the same number of pins 120 are concentrically arranged at proper distances from each other in the carrier 27. The sections 117 are angu-

lar so that their free ends are offset from the front face of the carrier. They are thus offset so as to enable them to pass by each other and overlap when turned over in front of the carrier, and the vertical plane of the forward ends of the sections 117 coincide with the vertical plane of the tracks 107, 108 and 109. Rigidly attached to the front and back sides of the forward and free end of each section 117 are two plates 122, and one of the cutter heads 100 is received between said plates. Each head 100 has front and back side hubs 123—123 which are received in openings in each pair of plates 122, whereby said head is supported and enabled to swing between said plates. An angle-iron 124 is secured to the side or end of each head 100 that is adjacent to the arm section 117 which carries said head, and the purpose of this angle-iron is to limit the swing of the head toward said section, without interfering with the swing away from the same of said head. In other words, the angle-iron 124 permits the head to assume a right-angular relation to its arm, under pressure which tends to swing said head toward said arm, but does not permit further swing in that direction, and as noted said angle-iron interposes no obstruction to the movement of the head in the other direction. Extending rearwardly and forwardly from the heel of the base of each head 100 are pins or followers 125 and 126, respectively, said follower 125 being designed to travel down the guide member 106 and under the guide flange 104, and said follower 126 being designed to pass under the guide flanges 99 and 98. Tapped into the nose of the base of each head 100 is a bolt 127 which constitutes an adjustable rider for said head and its arm. The rider 127 is designed to travel on the track 107 and on either the track 108 or 109 according to the position of said rider. In this way and by these means the cutter heads are guided to, through, and over their course while doing the work required of them, the followers and the guides preventing said heads from getting out of such course laterally and in an upward direction, while said riders are traveling over the path of the course provided by said tracks. A set-nut 128 is provided for each rider 127 with which to secure the same after it has been properly adjusted.

Each of two of the six heads 100, with two heads intervening in either direction, has a widened nose or a projecting part 129 at the back, as shown in Figs. 5, 10 and 21, to accommodate its rider 127, which in each of these cases is set nearer the back side or edge of the head so as to be able to travel on the track 109, and it is the front end of said projecting part that encounters the rod 85 and brings about the unlocking of the plunger 72, for the purpose hereinbefore ex-

plained. The rider 127 in each of the other four cases is positioned to travel on the track 108.

Each head 100 has a bore or passage 130 extending therethrough laterally or from front to back side, and secured within such passage is a cutter 131, such cutter being held in place by means of a cylindrical plug 132 and a bolt 133. The plug 132 is of less diameter than that of the passage 130, and the bolt 132 is tapped into the head 100 from above and extends through into said passage to engage said plug on top. The shank of each cutter 131 is curved in cross-section to fit the passage 130 and to receive the plug 132. Upon loosening the bolt 133 the cutter 131 can be readjusted so that its edge, which is at the front end, shall assume any desired relation to the work, then said bolt is retightened, or the cutter can be removed and another substituted for it before retightening said bolt.

Six rest pins 134 are set concentrically in the front face of the carrier 27, there being one for each cutter arm. The pins 134 are nearer the axis of the carrier 27 than are the openings 121, and said pins are long enough to receive the arm sections 117. The cutter arms are turned on their pins 120 over onto the pins 134, at certain stages in the operation of the machine, and said pins 134 then assist said pins 120 in supporting said arms. Each arm after being turned over onto its rest pin is supported thereby until said arm is carried by the member 27 into position where said arm is brought under the influence of or actuated into engagement with the guide member 106. This will be more fully explained subsequently.

Hubs 135 are bolted to the back side of the carrier 27 for the pins 120 to afford more substantial bearings for said pins. Secured to the pins 120 behind the hubs 135 are dogs 136. Since the dogs 136 on adjacent pins 120 must pass each other as the members turn, it is necessary to increase the length of every other pin, and to introduce, between the dog 136 on such pin and the supporting hub 135, a sleeve 137. Each dog 136 has a longer finger 138 and a shorter finger 139, the former being behind the latter in the direction of rotation of the carrier 27. Securely attached to the dog 136 is a lifter 140, which is slotted at 141 to form a horizontal finger 142 at its free end and also to enable said lifter to clear an abutment pin 143. Each finger 142 is in advance of the associated finger 139 in the direction of rotation of the carrier. There are two abutment pins 143, one for the rearmost dogs 136 and lifters 140 carried by the longer pins 120, and one for corresponding members carried by the shorter pins 120 nearer the member 127. These abutment pins are arranged horizontally and in line with each other in

two lugs 144 and 145, the former extending from the left-hand edge of the upright 8 and the latter from the bearing 11. One abutment pin is directly behind the other, and the adjacent and free ends of the pins are separated sufficiently to permit the slotted parts of the lifters 140 to pass between them. The pins 143 are in the paths of travel of the dogs 136 and the lifters 140 as they are carried around by the member 27, first the longer finger 138 and then the shorter finger 139 in each case encountering the abutment pin that is in their paths, and finally the finger 142 that is associated with the other pair of fingers in each case encountering said pin and riding off of the same. The inner or adjacent faces of the dog fingers are the ones that contact with the abutment pins, and the dogs ride clear of said pins by passing away from them without traversing paths at the inner ends thereof, but the lifter fingers ride over said pins and must, therefore, traverse such paths, which they can do because of the slots 141.

From the foregoing it is plain that every other dog and the attached lifter encounter one abutment pin, the rear one for example, and that those between encounter the other abutment pin, the front one. The slots 141 are in the back edges of the rearmost lifters and in the front edges of the lifters which are nearer to the carrier 27. Attention is called to Fig. 7 for a clear understanding of the relationship between the abutment pins and the front and back sets of alternately arranged dogs and lifters.

To enable the point of contact between either abutment pin 143 and a lifter 140 which is operated thereby to be changed, so as to cause such contact to occur earlier or later in the travel of said lifter as carried around by the member 27, and thus hasten or retard the effect produced on the work by the action induced by such contact, provision must be made for adjusting either said pin or said lifter, or both. I have shown in Fig. 11 one means of adjustment whereby the desired result can be obtained. In that view it will be observed that the lug 144 has a vertical slot 146 therein to receive the back pin 143, and that said pin has a shoulder 147 to bear against the front side of said lug and is screw-threaded at its rear end to accommodate a nut 148 which is adapted to bear against the back side of said lug. After the pin is located at the required height relative to the dogs and lifters into the paths of which said pin extends, the nut 148 is tightened and said pin is securely clamped to the lug 144. The lug 145 is slotted in the same way as is the lug 144, and the front pin 143 is adjustably secured to said lug 145 just as the back pin 143 is secured to said lug 144.

The object of the dogs 136 is to swing up the cutter arms on their pivotal points, one after another, and lay them over on the rest pins 134, each of such arms overlapping the next adjacent arm in advance in the direction of rotation of the carrier 27, and the purpose of the lifters 140 is to raise each arm, the arm turning on its pivotal point, as it approaches the end of its tangential or horizontal travel, to tilt up the head 100 of such arm from the track 108 or the track 109, accordingly as the rider 127 which supports said head is traveling on one of such tracks or the other, and then permit the head to come down with said rider on the track slide 93.

The slide 93 is provided to receive and support the aforesaid rider 127, when it comes down after being raised as it approaches the end of the horizontal travel, and enables the cutter 131, which is subject to the action of the rider in question, to complete its operation. The slide 93 is first pushed outwardly, against the resiliency of the spring 112, by the advancing rider 127, then the latter is raised and said spring acts to throw said slide to the right again under said rider, and lastly the latter descends onto the slide and finishes its advance stroke thereon. Before the clutch 22 operates to stop the cutter mechanism, the head is elevated to raise its rider from the track slide, so that the parts are left standing above and clear of said slide when the cutter mechanism stops.

Starting with any given cutter arm in the position of the most advanced arm shown in Fig. 6, wherein such arm is at the extreme left-hand end of its horizontal travel, the complete operation of such arm, from the time it leaves such position until it arrives there again, is as follows: The finger 138, of the dog 136 that operates the arm now under observation during a portion of the operation of the same, is in contact with one of the abutment pins 143 and has already raised the free end of said arm, as explained in the preceding paragraph, therefore, as soon as the carrier 27 starts to revolve, the arm not only moves with said carrier at its pivotal point at 120, but is also swung upward with said point as a center, as said finger slides under the abutment pin—see Fig. 12. As the rotation of the carrier continues, the operating dog 136 changes its position until the finger 139 of said dog bears on the abutment pin—see Fig. 13. The upwardly swinging motion imparted to the arm by the finger 138 is now continued by the finger 139 until said last-mentioned finger rides off of the abutment pin, but before this occurs the arm is laid over gently on the rest pin 134 which is in the path thereof. The arm is now resting with what was its upper side on the rest pin, and in this

position moves with the carrier 27 toward the right and downward until the follower 125 on the head 100 which is attached to the arm comes into contact with the guide member 106. Said follower then slides down the member 106 and passes under the flange 104. The companion follower 126 enters beneath the flange 98 at about the same time that the rear follower enters beneath the flange 104. The rest pin which supported the arm has by this time passed away from said arm. The angle-iron 124 prevents the head 100 from swinging under the advancing arm, and by the time the followers 125 and 126 pass under the flanges 104 and 99 the rider 127 descends onto the track 107. As the carrier continues to advance the arm, the rider passes off of the track 107 and onto either the track 108 or the track 109, as the case may be, while the followers travel forward under the flanges 104 and 99 and 98. If the rider is on the track 108 a straight cut is made by the cutter with which the head is equipped, but if the rider is on the track 109 an uneven cut is made by said cutter. As soon as the rider encounters and forces outward the track slide 93 the head is lifted at the front end and then allowed to descend on said slide, said head turning in the plates 122 and fulcruming on said flanges as the arm is raised and lowered. This tilting of the head is due to the fact that, at the proper time, the lifter finger 142 encounters the abutment pin 143 which is in its path and rides over such pin in such a way as to momentarily swing the arm upward—see Fig. 14. The carrier is still rotating and before it stops advances the rider to the end of its travel on the track slide, brings the dog into engagement again with the abutment pin, and thereby causes the arm to be swung upwardly clear of everything below it. The followers do not clear the guide flanges 104 and 98 until the work of the cutter is done and it is time to elevate the head bodily at the end of the forward movement of the arm. It will be remembered that the carrier 27 stops at every half revolution, hence the operations of the cutter mechanism above described are not continuous, there being an interval at the end of the half revolution when the moving parts are stationary.

For a clear understanding of the operation of the machine as a whole, which will next be explained, the most advanced cutter arm, in Fig. 6, will be designated as the sixth, the one to the right of that as the first, the next in the direction opposite the direction of rotation of the carrier 27 as the second, and so on. It is assumed that the shaft 15 and the worm 20 are driving the worm-wheel 23, and that the live center 55 is revolved, but that all of the other parts are idle. In the first place, the operator

takes a block, similar to that shown in Fig. 2 and having a longitudinal bore through the center thereof, introduces such block between the centers 55 and 56, forces the right-hand end of said block onto the dead center, which it fits quite snugly, and starts the cutter mechanism and the cam 62 by throwing up the handle 48 from the position which such handle occupies in Fig. 6 to the position which it occupies in Fig. 15. Almost instantly the cam 62 operates to drive the block into engagement with the live center and secures said block in operative position by and between the live and dead centers. The manner in which this is done and the manner in which the cutter mechanism and cam are started when the handle is thrown up have previously been fully explained. If the block is longer than normal, the relief mechanism or device operates, as has already been fully explained. The block thus centered and held now revolves rapidly, and is ready for the application thereto of the first set of cutters 131, there being three in such set. The now slowly rotating carrier 27 first finishes swinging the sixth cutter arm up and lays it over on the rest pin 134 provided to receive the same, and at the same time advances the first cutter arm, which at the start has its head 100 already between the guides and its rider 127 almost down on the track 107, to bring the cutter 131 carried thereby into the field of operation, such field being reached when said rider leaves said track for the track 108. Further movement of the parts causes said cutter to turn off the longitudinal edges of the block, as shown at *a* in Fig. 15, and make the major portion of the first cut. When the active cutter arrives at the proper point in its travel toward the end of its stroke, the lifter 140 that controls the first arm encounters the front abutment pin 143 and swings up the forward end of the head 100 in which said cutter is mounted to form the concave neck *b*, Figs. 3 and 4, of the bobbin, or rather to commence to form the same. Next said lifter clears said abutment pin and the arm swings down again with the front end of the head, still advancing, with the rider on the track slide 93, and completes its stroke on said slide to allow the cutter to make the first cut required to form the cylindrical head *c*, Figs. 3 and 4. A spindle substantially like that which appears in Fig. 3 is the result of the first complete cut made by the cutter which the first arm carries. The arm having finished its work is turned over onto its rest pin like the sixth cutter and overlapping the same. The second cutter arm follows immediately behind the first and its cutter 131 makes the second cut in precisely the same way as did the cutter of the first arm, only in this operation the cutter is set forward a little farther than was the other so as to take off an additional portion of the spindle. When the second arm has completed its operative stroke the spindle resembles what is shown in Fig. 3, but the diameters of said spindle are smaller. In the present construction the back abutment pin 143 is the one against which the lifter 140 and the dog 136, that control the second arm, act. Finally the third cutter arm comes into action, makes the third cut and finishes the bobbin shown in Fig. 4. This time the rider 127 of the operating arm travels on the uneven track 109, whereby the head 100 of said arm is caused to rise and fall or to oscillate, with its followers 125 and 126 which are beneath the guide flanges serving as the axis and the arm swinging freely on the hubs 123, as is also the case when the parts are operated by the lifter, and so to produce the grooves *d*, Fig. 4, in the bobbin. The third arm cutter also takes out a little more from the neck *b* and reduces the head *c* to its proper size or diameter for the finished bobbin. The last two results are produced in the same manner as were similar results when each of the other two arms was advanced through the turning field, that is, the third arm is swung upward at its front end when its rider arrives at the end of the stroke 109 and forces the track slide 93 outwardly, and then allowed to come down on said slide and caused to finish its course thereon. Since this is one of the two arms that have the widened heads, the other being the sixth arm, the rod 85 is encountered by the part 129 and actuated to release the plunger 72 from the gripping jaws 74 upon the arrival of the now most advanced head at the end of its horizontal stroke. It has been explained how the release of the plunger 72 is effected when the rod 85 is forced outwardly. The third arm is next swung upwardly on its pivotal point 120 to lift its head from the horizontal path, and finally the clutch is automatically released, by reason of the fact that at this time one of the recesses 36 arrives in exact alinement with the upper terminal of the bar 35 and allows the sleeve 24 to move out of confining relation to the clutch, and the cutter mechanism is stopped. The cam 62 stops with the cutter mechanism, after having made one revolution, and comes to rest with its low part to the left and with the stud 61 bearing against such part, so that the dead center 56 is in its retracted position. The retraction of the dead center releases the finished bobbin, and the latter drops or is taken from the machine. Thus one cycle of the operation of the machine is completed, and a finished bobbin is turned out. Another block is centered as before and the handle 48 thrown up again to start the cutter mechanism and the cam. This time the fourth, fifth and sixth cutter arms

are brought into active operation in the order named, and their cutters turn out the second bobbin in precisely the same way as the cutters of the first, second and third arms turned out the first bobbin. At the end of the second cycle the second bobbin is produced in its finished state. These cycles can be repeated indefinitely and an unlimited number of bobbins produced, the work being done with great rapidity, accuracy and facility generally.

The various adjustments provided, together with a plurality of different pattern tracks 109, render the machine capable of turning bobbins of different diameters and lengths of bodies and heads, and which have differently arranged grooves; and also of turning up other articles besides bobbins.

In the event it be desired to make the neck, of the spindle, bobbin or other article turned, conical instead of concave, I fasten the track slide 95 rigidly to the bed-plate 101, by means of a bolt 149, so that the riders 127 travel up the nose of said slide, which is beveled, on to the top thereof—see Fig. 22. The result of this is to cause the cutters 131 to move upward gradually in a slanting path, instead of being almost instantly drawn out of engagement with the work by the action of the lifters 140 when they encounter the abutment pins 143, as in the other case. In this case the lifters must be removed or at least adjusted so that they clear the abutment pins. Before the slide 93 is secured by the bolt 149, it is adjusted to locate the sharp edge at the working end of the same at precisely the right point to receive the riders and through them cause the cutters to begin the formation of the conical neck at the predetermined place on the block, spindle, or other piece. In adjusting the slide it may be necessary to change the position of the stop 113 which is held by the screw 115. It should be observed, perhaps, that the weight of the arms and their heads is sufficient to cause said heads to track properly with their riders when in the tangential path.

As shown in Figs. 6, 7 and 15 a set-screw 151 may be tapped into the vertical part of the arm 69 to bear against the adjacent end of the head-stock 4 and thus relieve the shoulder 150 from the force of the weight 70. The set-screw 151 thus affords an adjustable stop for the arm 69, and a set-nut 152 is employed on said screw to lock the same after adjustment.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a wood-turning machine, an arm having a cutter-carrying head, means to cause said arm to move bodily in an orbital course, and a track tangential to said course, for the head of such arm, and means to re-

move said head from contact with said track and to restore it to such contact.

2. In a wood-turning machine, an arm having a cutter-carrying head, means to cause said arm to move bodily in an orbital course, and an undulating track tangential to said course, for the head of such arm.

3. In a wood-turning machine, a plurality of arms having cutter carrying heads, means to cause such arms to move bodily in an orbital course, and a compound plain and undulating track tangential to said course, for the heads of such arms.

4. In a wood-turning machine, a rotary carrier, a cutter arm pivotally attached to said carrier, and means to swing said arm on its pivot out of the cutting path and over into position to reënter said path at a certain stage in the rotation of said carrier.

5. In a wood-turning machine, a rotary carrier, a cutter arm pivotally attached to said carrier, a dog rigidly attached to the arm pivot, and a fixed abutment in the path of said dog to cause said arm to be swung on its pivot out of the cutting path and over into position to reënter said last-mentioned path, at a certain stage in the rotation of said carrier.

6. In a wood-turning machine, a rotary carrier provided with a rest, a cutter arm pivotally attached to said carrier, a dog rigidly attached to the arm pivot, and an abutment in the path of said dog to cause said arm to be swung on its pivot and turned over onto said rest at a certain stage in the rotation of said carrier.

7. In a wood-turning machine, a rotary carrier, a cutter arm pivotally attached to said carrier, and means to swing said arm on its pivot up, over and down as said carrier revolves.

8. In a wood-turning machine, a rotary carrier provided with a rest, a cutter arm pivotally attached to said carrier, means to swing said arm up and down on its pivot at a certain stage in the rotation of said carrier, and means to swing said arm up and lay it over on said rest at a certain other stage in said rotation.

9. In a wood-turning machine, a rotary carrier provided with a rest, a cutter arm pivotally attached to said carrier, a dog and lifter rigidly attached to the arm pivot, and an abutment in the path of said dog and lifter to cause said arm to be swung up and down on its pivot and to be swung up and turned over onto said rest at certain stages in the rotation of said carrier.

10. In a wood-turning machine, a rotary carrier, a plurality of cutter arms pivotally attached to said carrier, such carrier being provided with rests for such arms, and means adapted to swing said arms on their pivots and to lay them over on said rests in

overlapping relationship, the arms being offset to enable them to be thus disposed.

11. In a wood-turning machine, a rotary carrier, a plurality of cutter arms pivotally attached to said carrier, such pivots being parallel with the axis of said carrier, and means to swing said arms on their pivots, such means in part being relatively offset so as to enable them to pass each other.

12. In a wood-turning machine, a rotary carrier provided with rests, a plurality of cutter arms pivotally attached to said carrier, and means to swing said arms on their pivots and to lay them over on said rests in overlapping relationship, the arms being offset to enable them to be thus disposed, and said swinging means for such arms also in part being offset relatively so that they can pass each other.

13. In a wood-turning machine, a rotary carrier provided with rests, a plurality of offset cutter arms provided with pivot pins which are journaled in said carrier in parallel relation to the axis of the carrier, every other pin being longer than the next adjacent pin, dogs rigidly mounted on said pivot pins in offset relationship to each other, and abutments in the paths of said dogs to cause said arms to be swung upward and laid over on said rests at certain stages in the rotation of said carrier.

14. In a wood-turning machine, a rotary carrier provided with rests, a plurality of offset cutter arms provided with pivot pins which are journaled in said carrier in parallel relation to the axis of the carrier, every other pin being longer than the next adjacent pin, dogs and lifters rigidly mounted on said pivot pins in offset relationship to each other, and abutments in the paths of said dogs and lifters to cause said arms to be swung up and down and swung upward and laid over on said rests at certain stages in the rotation of said carrier.

15. In a wood-turning machine, a rotary carrier, a track arranged tangentially to said carrier, a cutter arm pivotally attached to said carrier and provided with a head to travel on said track, and means to swing said arm on its pivot to raise said head from said track at the end of the advance stroke of said arm and head.

16. In a wood-turning machine, a rotary carrier, a track arranged tangentially to said carrier, a cutter arm pivotally attached to said carrier and provided with a head to travel on said track, and means momentarily to raise said head from said track as the former travels over the latter.

17. In a wood-turning machine, a rotary carrier, a track arranged tangentially to said carrier, a cutter arm pivotally attached to said carrier and provided with a head to travel on said track, means momentarily to raise said head from said track as the for-

mer travels over the latter, and means to raise said head from said track again at the end of the advance stroke of said arm and head.

18. In a wood-turning machine, a rotary carrier, track members arranged in tangential relation to said carrier, one of such members being movable, a cutter arm pivotally attached to said carrier and provided with a head to travel on said track members, and means momentarily to raise said head to permit said movable track member to take position under the same.

19. In a wood-turning machine, a rotary carrier, track members arranged in tangential relation to said carrier, one of such members being slidably mounted and spring-pressed in one direction, a cutter arm pivotally attached to said carrier and provided with a head to travel on said track members, said sliding member being in the path of said head, and means momentarily to raise said head to permit said sliding member to move into supporting position relative thereto.

20. In a wood-turning machine, a rotary carrier, stationary track members in tangential relation to said carrier, one of such members being an undulating or pattern track, and two or more cutter arms pivotally attached to said carrier and provided with heads to travel on said track members as said carrier revolves, one of such heads at least traveling on said pattern track.

21. In a wood-turning machine, a rotary carrier, a stationary track in tangential relation to said carrier, and a cutter arm pivotally attached to said carrier and provided with a head, which head in turn is provided with an adjustable member to ride on said track as said carrier revolves.

22. In a wood-turning machine, a rotary carrier, stationary track members in tangential relation to said carrier, one of such members being an undulating or pattern track, two or more cutter arms pivotally attached to said carrier and provided with heads, and adjustable riders connected with said heads to travel on said track members as said carrier revolves, one at least of such riders being positioned to travel on said pattern track.

23. In a wood-turning machine, a rotary carrier, a cutter arm pivotally attached to said carrier and provided with a head, said arm and head being adapted to be carried around bodily by the carrier, a track in tangential relation to said carrier, to and away from and along which track said head is projected by said carrier, and means to guide said head onto said track.

24. In a wood-turning machine, a rotary carrier provided with a rest, a cutter arm pivotally attached to said carrier and adapted to be supported in part by said rest, said

arm being provided with a head, a track in tangential relation to said carrier, and means to guide said head onto said track when said rest passes out of supporting relation thereto.

25. In a wood-turning machine, a rotary carrier, a cutter arm pivotally attached to said carrier and provided with a head having a guide member, said arm with its head being adapted to be carried around bodily by the carrier, a track for said head, along which track said head is projected by said carrier, and a guide for said guide member to direct said head onto and over said track, when said carrier arrives at a certain point in and while it is making a certain portion of its revolution, said track and guide being in tangential relation to said carrier.

26. In a wood-turning machine, a rotary carrier, a cutter arm pivotally attached to said carrier, an oscillatory head at the free end of said arm, said arm and head being adapted to be carried around bodily by the carrier, and a track and guide in tangential relation to said carrier, for said head.

27. In a wood-turning machine, a rotary carrier, a cutter arm pivotally attached to said carrier, an oscillatory head at the free end of said arm, said arm and head being adapted to be carried around bodily by the carrier, means to limit the oscillatory movement of said head in one direction, and a track and guide in tangential relation to said carrier, for said head, along which said head is projected by said carrier.

28. In a wood-turning machine, a rotary carrier, a cutter arm pivotally attached to said carrier and adapted to be carried around bodily thereby, a head mounted to oscillate at the free end of said arm, said head being provided with followers and a rider, a track in tangential relation to said carrier, for said rider, along which track said head is projected by said carrier, and guides for said followers, said guides also being in tangential relation to said carrier and having at one end upwardly-extending means to direct said head from its circuitous to its approximately straight course.

29. In a wood-turning machine, a rotary carrier, a cutter arm pivotally attached to said carrier, an oscillatory head at the free end of said arm and provided with guide-engaging means, a track and guide in tangential relation to said carrier, for said head, and means to swing said head upwardly while said guide-engaging means is in engagement with said guide.

30. In a wood-turning machine, a rotary carrier, a cutter arm pivotally attached to said carrier, an oscillatory head at the free end of said arm and provided with guide-engaging means, track members in tangential relation to said carrier, for said head, such members including a track slide, a guide

for said head, said guide also being in tangential relation to said carrier, and means to swing said head upwardly and permit it to come down on said slide, while said guide-engaging means is in engagement with said guide.

31. In a wood-turning machine, a rotary carrier, a cutter arm pivotally attached to said carrier, a head at the free end of said arm and provided with guide-engaging means, a track and guide in tangential relation to said carrier, for said head, and means to raise said head from said track and guide at the end of the advance stroke of said arm and head.

32. In a wood-turning machine, a rotary carrier, a cutter arm pivotally attached to said carrier, an oscillatory head at the free end of said arm and provided with guide-engaging means, track members in tangential relation to said carrier, for said head, such members including a track slide, a guide for said head, said guide also being in tangential relation to said carrier, means to swing said head upwardly and permit it to come down on said slide, while said guide-engaging means is in engagement with said guide, and means to raise said head from said track and clear of said guide at the end of the advance stroke of said arm and head.

33. In a wood-turning machine, a rotary carrier, a cutter arm pivotally attached to said carrier, an oscillatory head at the free end of said arm and provided with guide-engaging means, a track in tangential relation to said carrier, the most advanced portion of such track being higher than the portion behind, and means to cause said head to pass onto such higher portion while said track-engaging means is in engagement with said guide.

34. In a wood-turning machine, a rotary carrier provided with a swinging cutter arm which is carried around bodily by said carrier, and a guide for the free end of said arm, said guide being arranged and adapted to divert such free end from the circuitous course, which it is caused to take by said carrier, to a non-circuitous course.

35. In a wood-turning machine, a rotary carrier provided with a swinging cutter arm which is carried around bodily by said carrier, a guide for the free end of said arm, said guide being arranged and adapted to divert such free end from the circuitous course, which it is caused to take by said carrier, to a non-circuitous course, and to direct it over said last-mentioned course, and a track which forms part of said last-mentioned course.

36. The combination, in a wood-turning machine, with a rotary carrier, a plurality of cutter arms pivotally attached to said carrier, and a tangential guide and track for the free ends of said arms, of means to re-

volve said carrier, and automatic means to stop said carrier at the end of a cycle.

37. The combination, in a wood-turning machine, with a rotary carrier, a plurality, comprising more than one set, of cutter arms pivotally attached to said carrier, and a tangential guide and track for the free ends of said arms, of means to revolve said carrier, and automatic means to stop said carrier after each set of said arms has performed its work.

38. The combination, in a wood-turning machine, with a rotary carrier, a plurality of cutter arms pivotally attached at said carrier, and a tangential guide and track for the free ends of said arms, of means to revolve said carrier, automatic means to stop said carrier at the end of a cycle, and manually-operated means to stop said carrier at any intermediate stage.

39. The combination, in a wood-turning machine, with a rotary carrier, a swinging arm attached thereto and provided with a cutter, and guide means and a track for the free end of such arm, of work-holding and operating means, such means consisting in part of a cam, and means to actuate said cam simultaneously with said carrier.

40. The combination, in a wood-turning machine, with revoluble work-holding and operating means, of a rotary carrier, a swinging arm attached to said carrier and provided with a cutter, said arm being carried around bodily by said carrier, and means to cause the free end of said arm with said cutter to be driven in a course substantially parallel with the axis of said first-mentioned means, but during a part only of the revolution of said carrier.

41. The combination, in a wood-turning machine, with revoluble work-holding and operating means, of a rotary carrier, a swinging arm attached to said carrier and provided with a cutter, said arm being carried around bodily by said carrier, means to cause the free end of said arm with said cutter to be driven, during a portion only of the revolution of said carrier, in a course substantially parallel with the axis of said first-mentioned means, and means to impart an undulating motion to said cutter while passing through such course.

42. The combination, in a wood-turning machine, with revoluble work-holding and operating means, of a rotary carrier, a swinging arm attached to said carrier and provided with a cutter, said arm being carried around bodily by said carrier, means to cause the free end of said arm with said cutter to be driven, during a portion only of the revolution of said carrier, in a course substantially parallel with the axis of said first-mentioned means but at different levels or elevations.

43. The combination, in a wood-turning

machine, with revoluble work-holding and operating means, of a rotary carrier, a swinging arm attached to said carrier and provided with a cutter, said arm being carried around bodily by said carrier, and means to cause the free end of said arm with said cutter to enter a course at one end, which course is substantially parallel with the axis of said first-mentioned means, and to leave such course at the other end, during a portion only of the revolution of said carrier.

44. The combination, in a wood-turning machine, with revoluble work-holding and operating means, of a rotary carrier, a swinging arm attached to said carrier and provided with a cutter, said arm being carried around bodily by said carrier, means to cause the free end of said arm with said cutter to be driven, during a portion only of the revolution of said carrier, in a course substantially parallel with the axis of said first-mentioned means but at different levels or elevations, and means to cause said free end and cutter to leave such course at the end of the operative stroke of said arm.

45. The combination, in a wood-turning machine, with revoluble work-holding and operating means, of a rotary carrier, swinging arms attached to said carrier and provided with cutters, said arms being carried around bodily by said carrier, means to cause the free ends of said arms with said cutters to be driven, during certain portions only of the revolution of said carrier, in turn through a course substantially parallel with the axis of said first-mentioned means, and means to cause at least one of said free ends and cutters to move with an undulating motion while passing through said course.

46. The combination, in a wood-turning machine, with a rotary carrier, a swinging arm attached to said carrier and provided with a cutter, such arm being carried around bodily by said carrier, and means to direct the free end of said arm with said cutter in an approximately straight path during a portion only of the revolution of the said carrier, of a revoluble live center and a reciprocable dead center arranged in substantially parallel relation to said path, and means driven from said carrier to advance said dead center toward said live center.

47. The combination, in a wood-turning machine, with a rotary carrier, a swinging arm attached to said carrier and provided with a cutter, such arm being carried around bodily by said carrier, and means to direct the free end of said arm with said cutter in an approximately straight path during a portion of the revolution of said carrier, of work-holding and operating means adjacent to said path, and means controlled by said carrier to cause such work-holding and operating means to engage and release the work.

48. The combination, in a wood-turning

machine, with a rotary carrier, a swinging arm or arms attached to said carrier and provided with a cutter or cutters, said arm or arms being carried around bodily by said carrier, and means to direct the free end or ends of said arm or arms with said cutter or cutters in an approximately straight path during a portion of the revolution of said carrier, of a revoluble and reciprocable live center, means adapted to actuate said center inwardly, a reciprocable dead center, and means operating simultaneously with said carrier and timed in correspondence with the entrance to and exit from said path of said free end or ends of said arm or arms to actuate said dead center, said live and dead centers being substantially parallel with said path.

49. The combination, in a wood-turning machine, with a rotary carrier, a swinging arm attached to said carrier and provided with a cutter, and means to direct the free end of said arm with said cutter in an approximately straight path, of a revoluble and reciprocable live center, yielding means arranged to actuate said center inwardly, means capable of locking said actuating means in position when said center is forced outwardly, means extending into the path of said free end of the arm to operate said locking means to release said actuating means, a reciprocable dead center, and means to actuate said dead center, said live and dead centers being substantially parallel with said path.

50. The combination, in a wood-turning

machine, with a rotary carrier, a swinging arm attached to said carrier and provided with a cutter, and means to direct the free end of said arm with said cutter in an approximately straight path, of a revoluble and reciprocable live center, yielding means arranged to actuate said center inwardly, means capable of locking said actuating means in position when said center is forced outwardly, means extending into the path of said free end of the arm to operate said locking means to release said actuating means, a reciprocable dead center, and means to actuate said last-mentioned center inwardly to its full extent, then to retract it slightly, and lastly to actuate it outwardly to its full extent, said live and dead centers being substantially parallel with said path.

51. In a wood-turning machine, a rotary carrier, a swinging arm attached to said carrier and provided with a cutter, means to direct the free end of said arm with said cutter in an approximately straight path, a revoluble and reciprocable center for one end of the work, adjacent to such path, means to control the reciprocable movement of said center, such means being subject to said arm, a reciprocable center, for the other end of the work, also adjacent to said path, and means operating simultaneously with said carrier to control the reciprocable movement of said last-mentioned center.

DANA S. COURTNEY.

Witnesses:

A. C. FAIRBANKS,
F. A. CUTTER.