(No Model.) 6 Sheets—Sheet 1.

C. E. BICKFORD.

AUTOMATIC WOOD PLANING AND DRILLING MACHINE.

No. 385,835. Patented July 10, 1888.

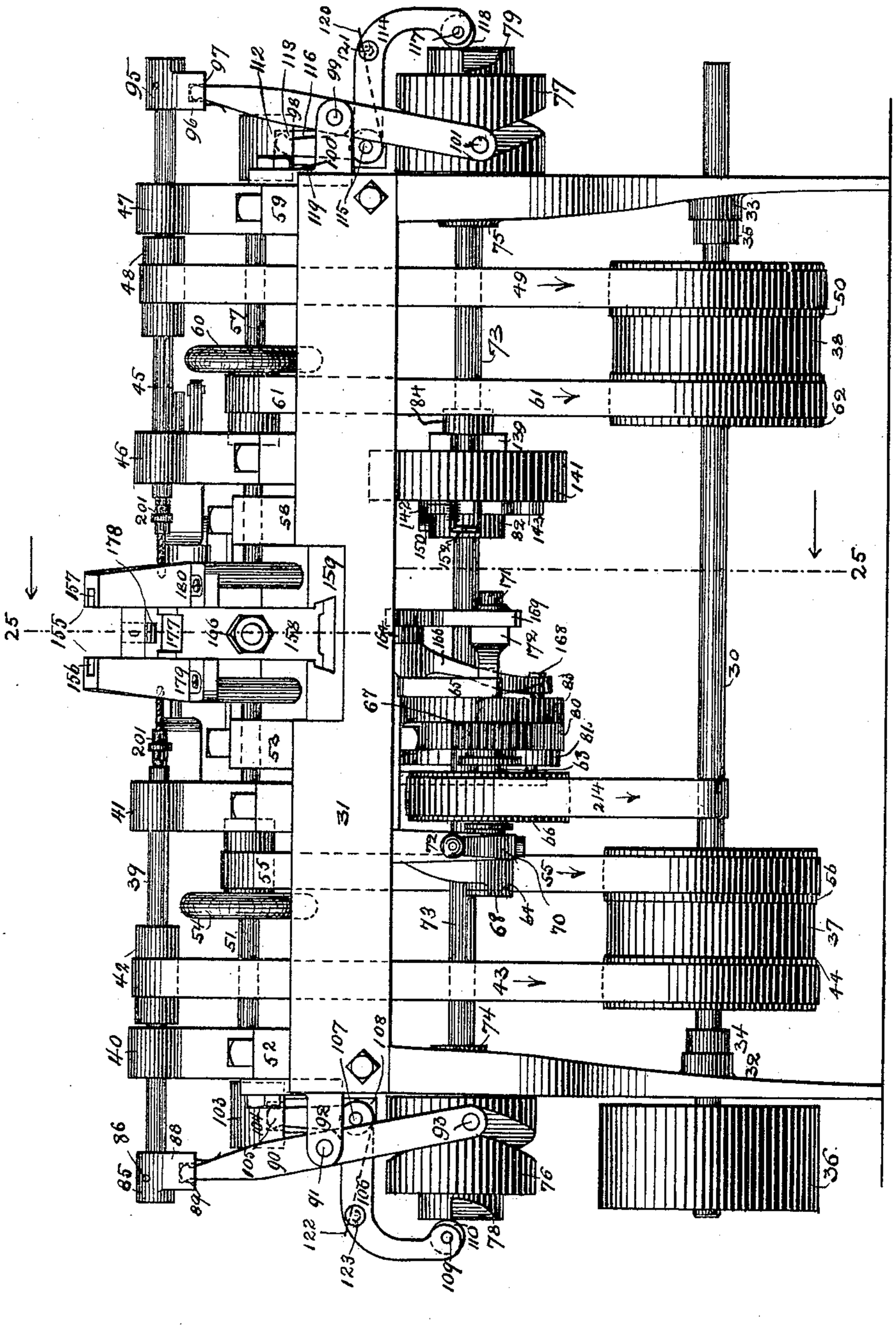


Fig. 1.

WITNESSES:

J. Naschold.

Paul Dietrick

INVENTOR.

C. Elmer Bickford.

BY

E. Frank. Woodbury.

ATTORNEY.

(No Model.) 6 Sheets—Sheet 2.

C. E. BICKFORD.

AUTOMATIC WOOD PLANING AND DRILLING MACHINE.

No. 385,835. Patented July 10, 1888.

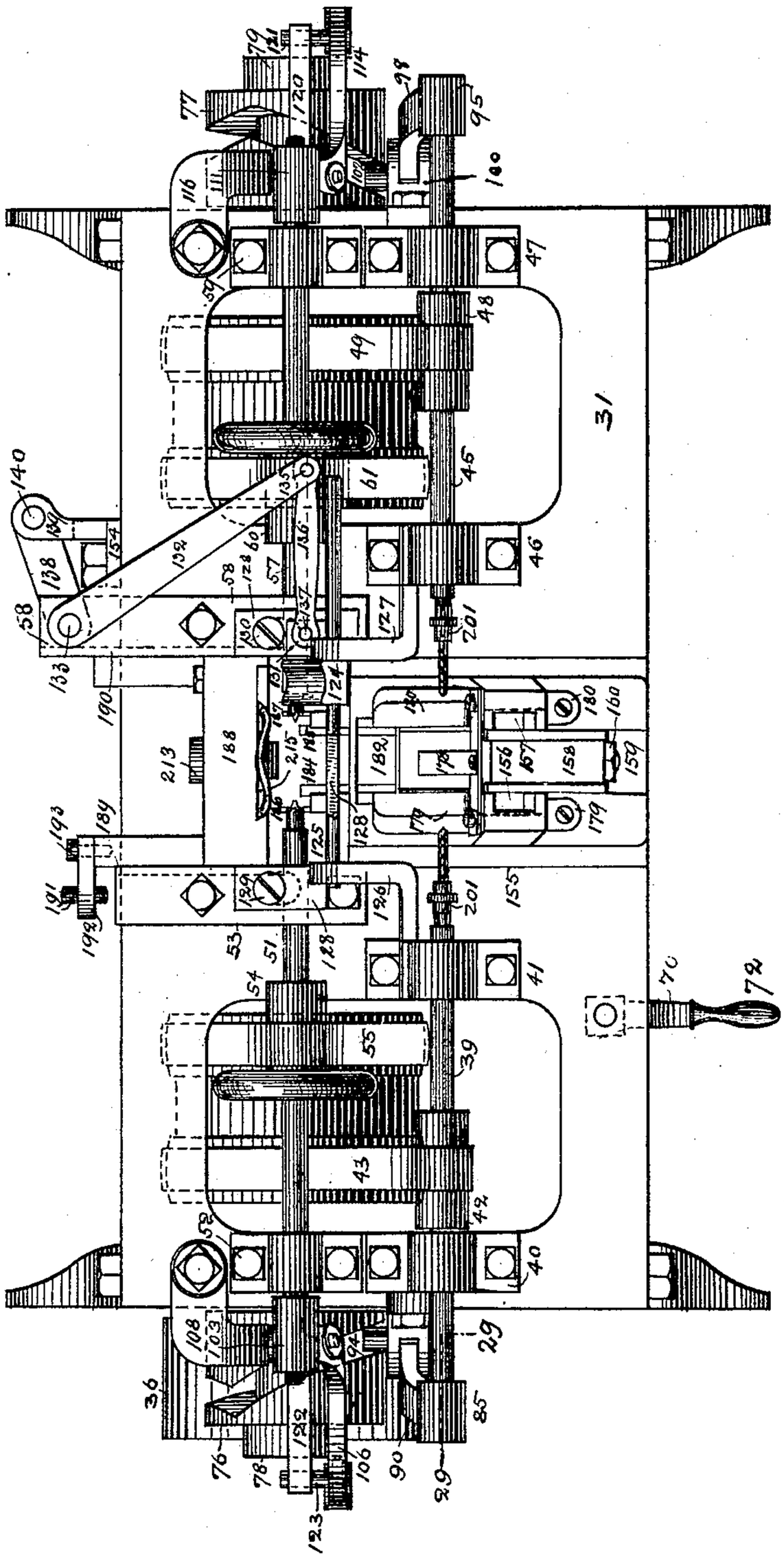


Fig. 2.

WITNESSES:

T. Naschold.

Paul Dietrich,

INVENTOR.

O. Elmer Bickford.

BY

E. Frank. Woodbury.

ATTORNEY.

(No Model.) 6 Sheets—Sheet 3.

C. E. BICKFORD.

AUTOMATIC WOOD PLANING AND DRILLING MACHINE.

No. 385,835. Patented July 10, 1888.

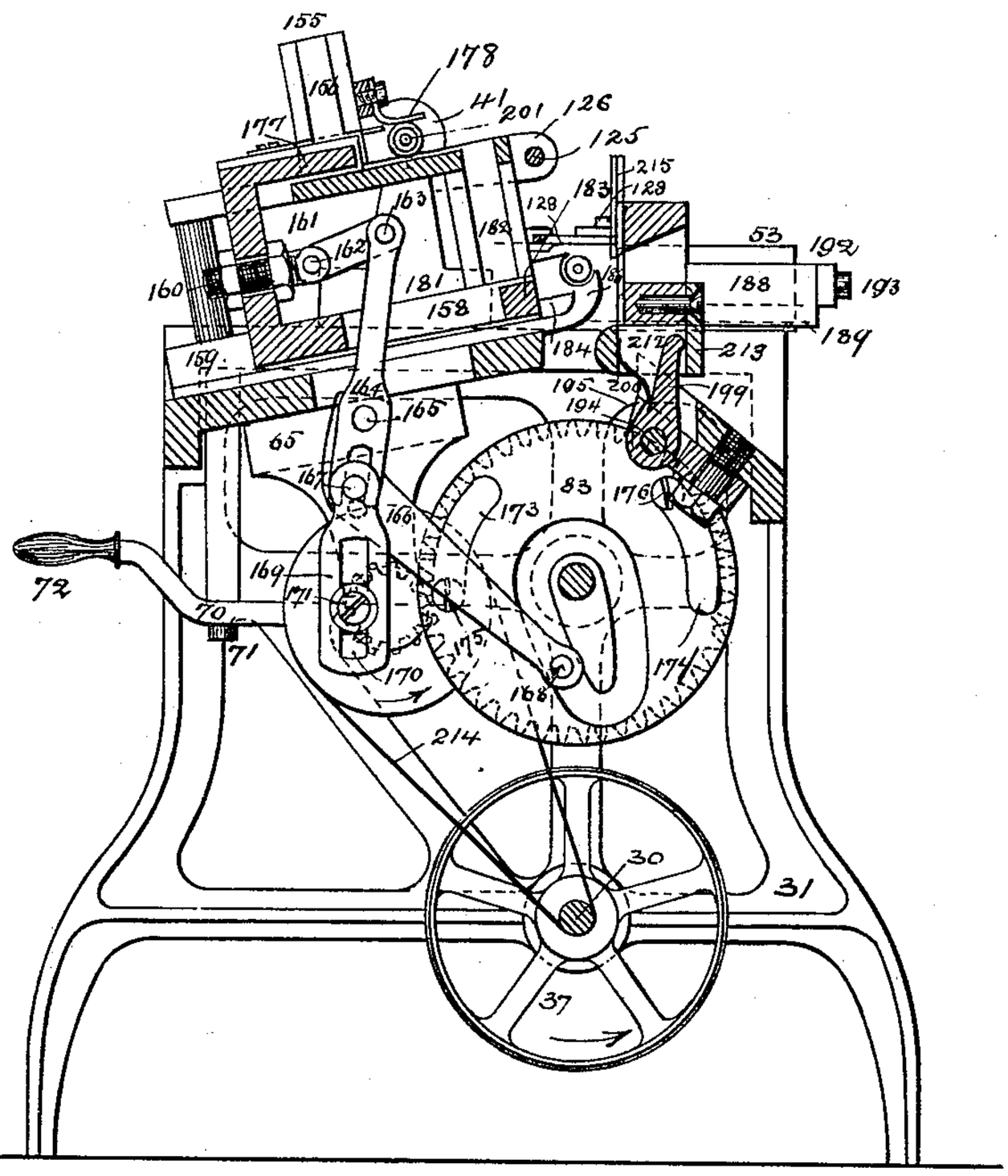


Fig. 3.

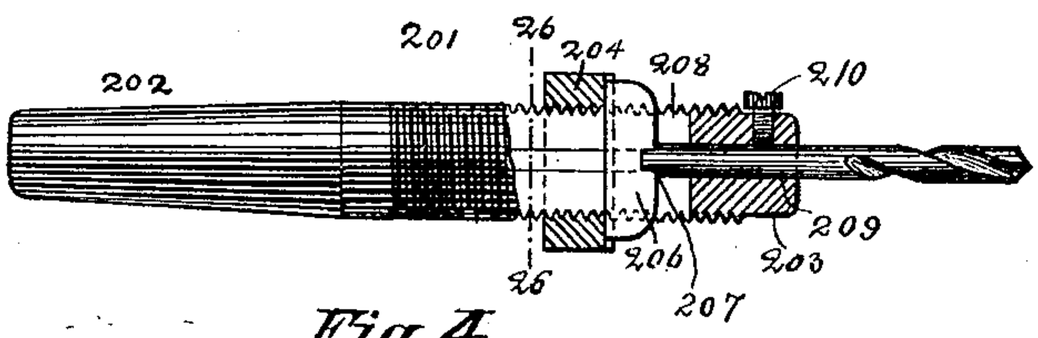


Fig. 4.

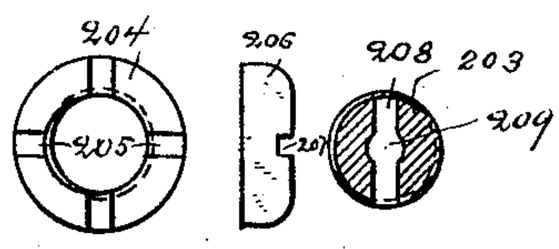


Fig. 6. Fig. 7. Fig 5.

WITNESSES:

J. Naschold.

Paul Dietrich.

INVENTOR,

C. Elmer Bickford.

BY

E. Frank. Woodbury.

ATTORNEY.

(No Model.) 6 Sheets—Sheet 4.

C. E. BICKFORD.

AUTOMATIC WOOD PLANING AND DRILLING MACHINE.

No. 385,835. Patented July 10, 1888.

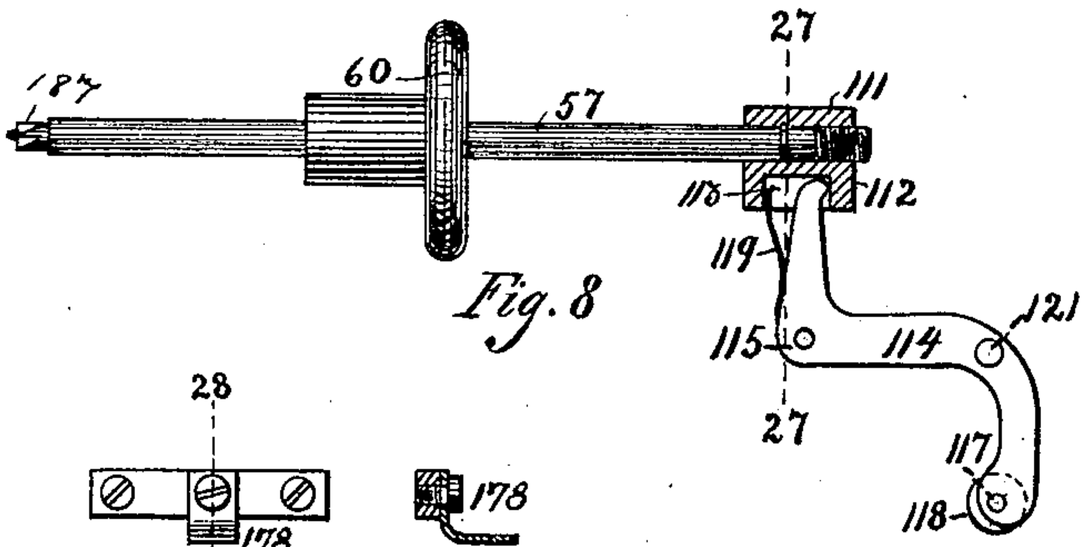


Fig. 8

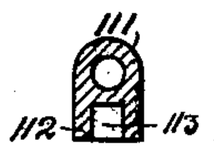


Fig. 9

Fig. 10

Fig. 11

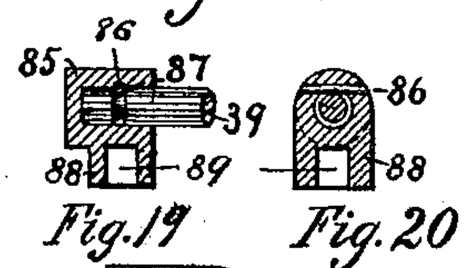


Fig. 19 Fig. 20

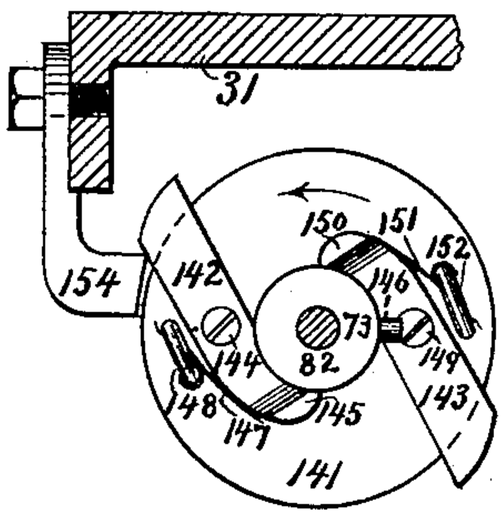


Fig. 13

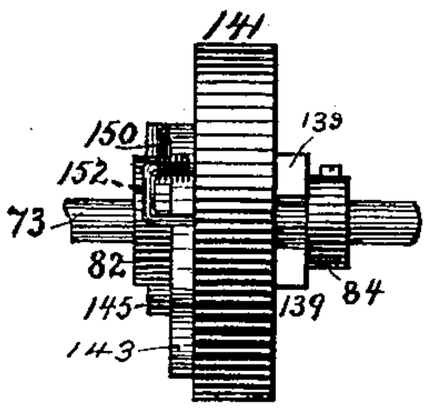


Fig. 12

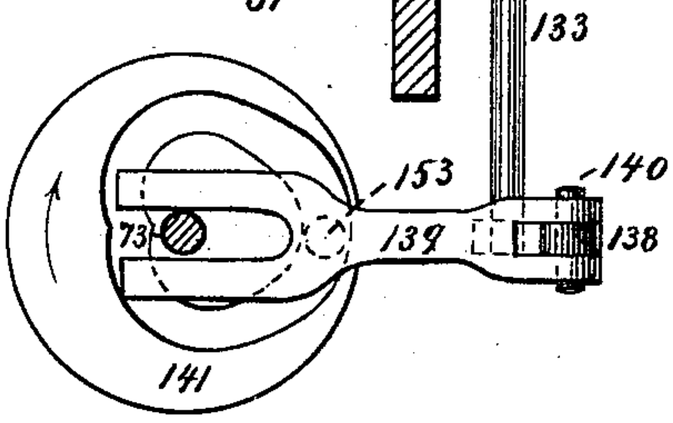


Fig. 14

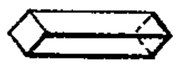


Fig. 15

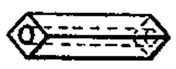


Fig. 16

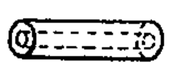


Fig. 17

Fig. 18

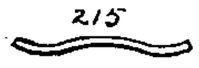


Fig. 21

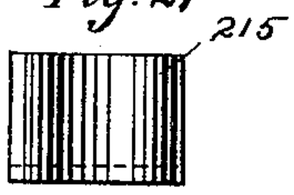


Fig. 22

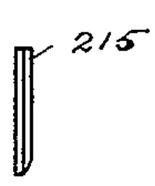


Fig. 23

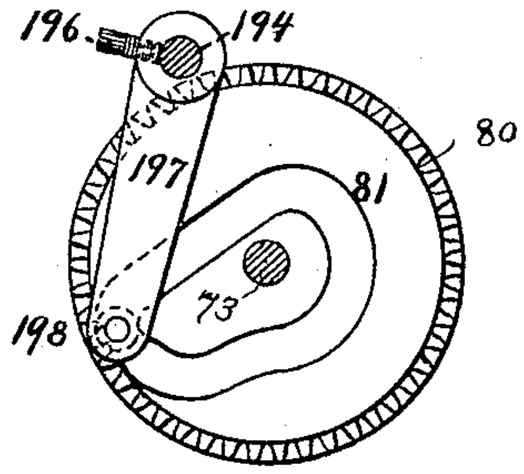


Fig. 24

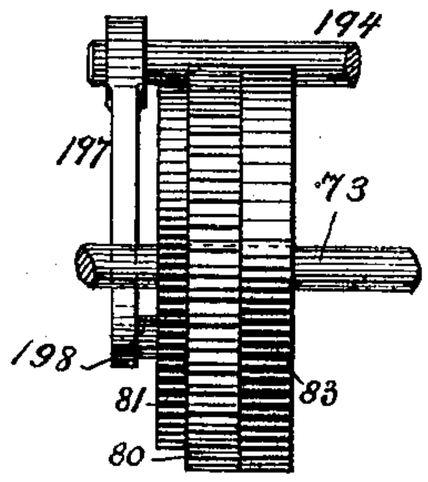


Fig. 25

WITNESSES:

T. Naschold.

Paul Dietrich.

INVENTOR.

C. Elmer Bickford.

BY

E. Frank. Woodbury.

ATTORNEY.

(No Model.) 6 Sheets—Sheet 5.

C. E. BICKFORD.

AUTOMATIC WOOD PLANING AND DRILLING MACHINE.

No. 385,835. Patented July 10, 1888.

Fig. 26.

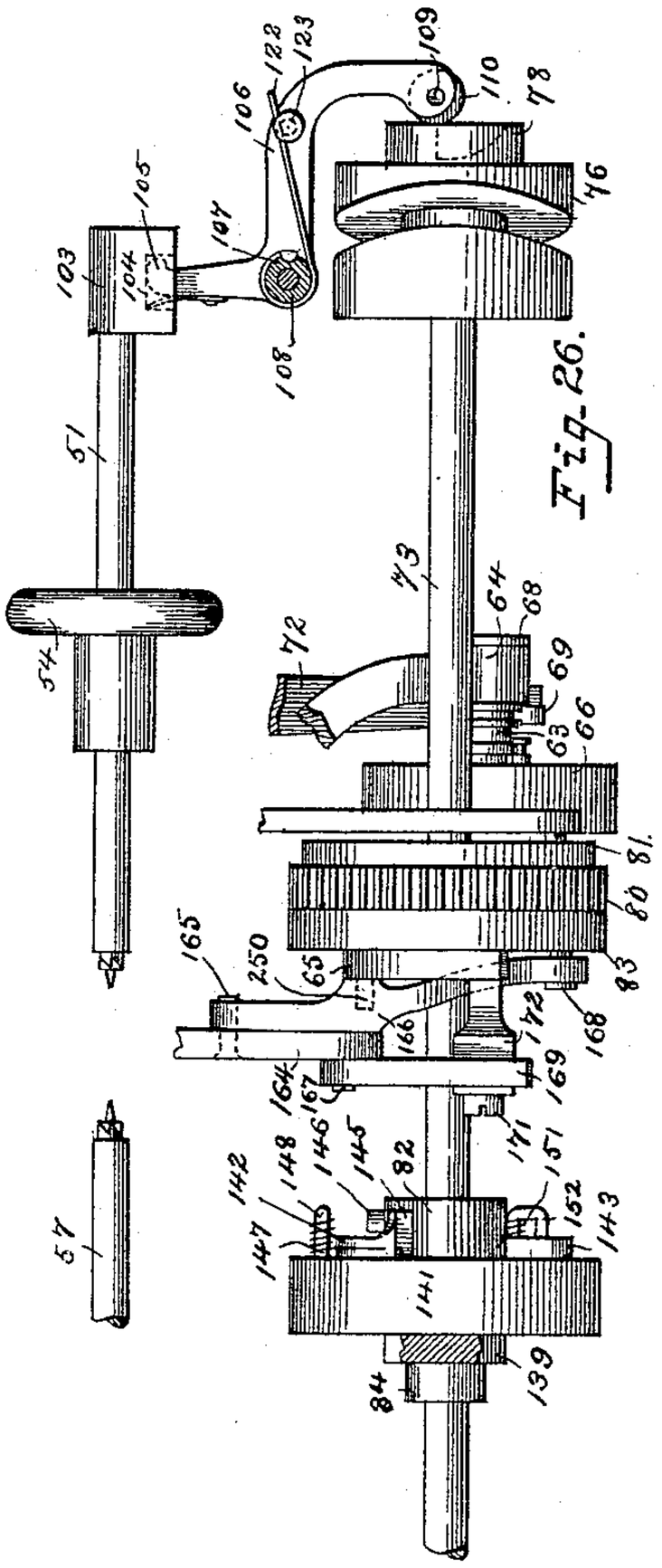


Fig. 27.

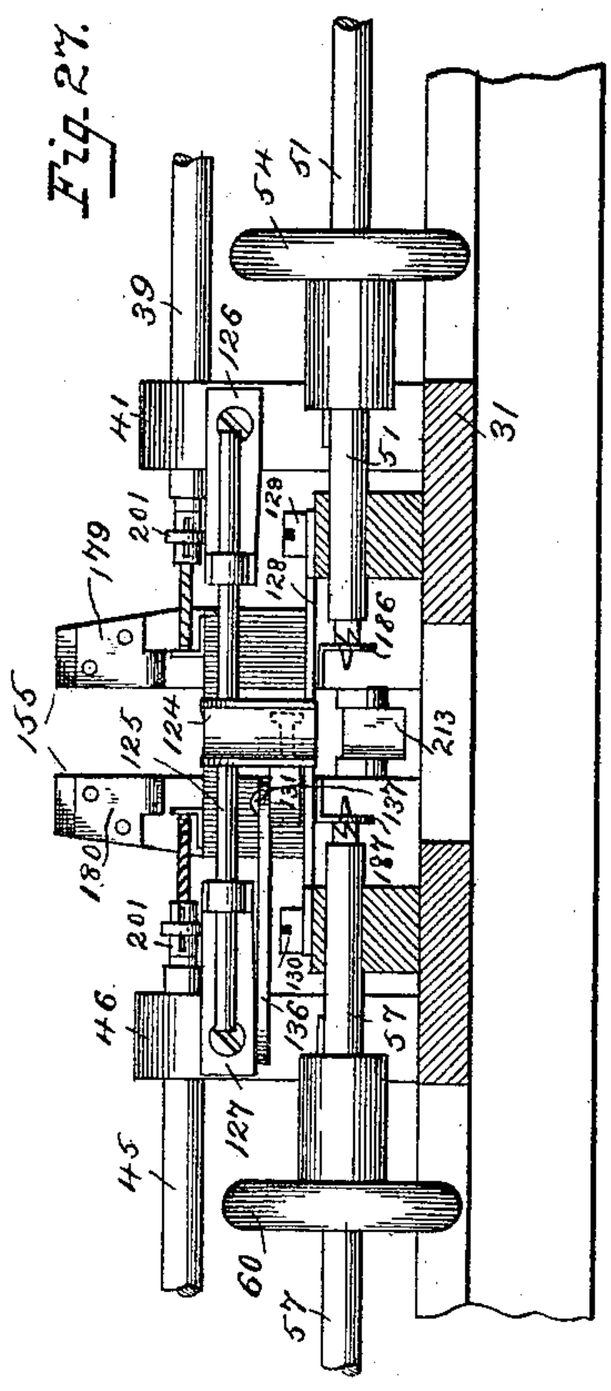
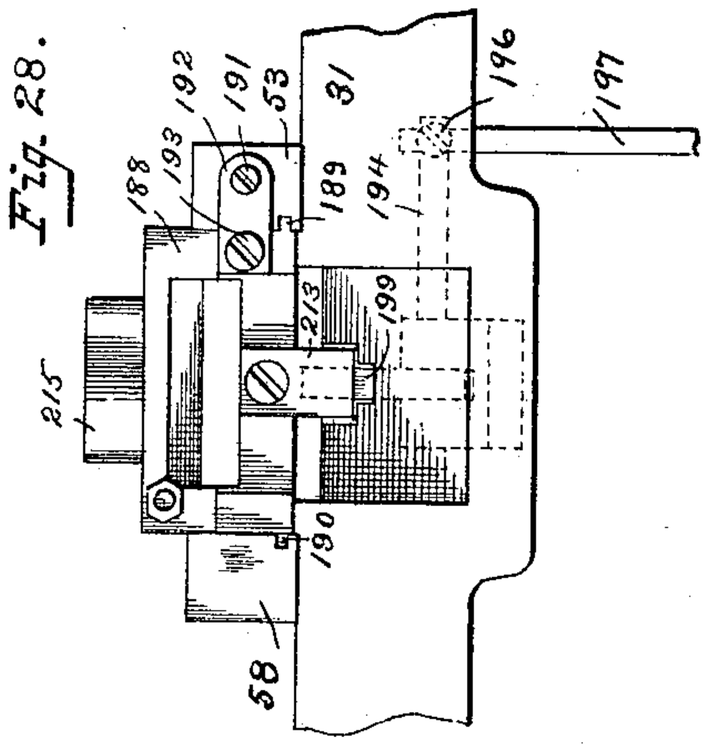


Fig. 28.



Attest:
Court. Alcooper
R. E. Somes.

Inventor:
C. E. Bickford,
By F. E. Somes
Associate Attorney.

(No Model.) 6 Sheets—Sheet 6.

C. E. BICKFORD.

AUTOMATIC WOOD PLANING AND DRILLING MACHINE.

No. 385,835. Patented July 10, 1888.

Fig. 29.

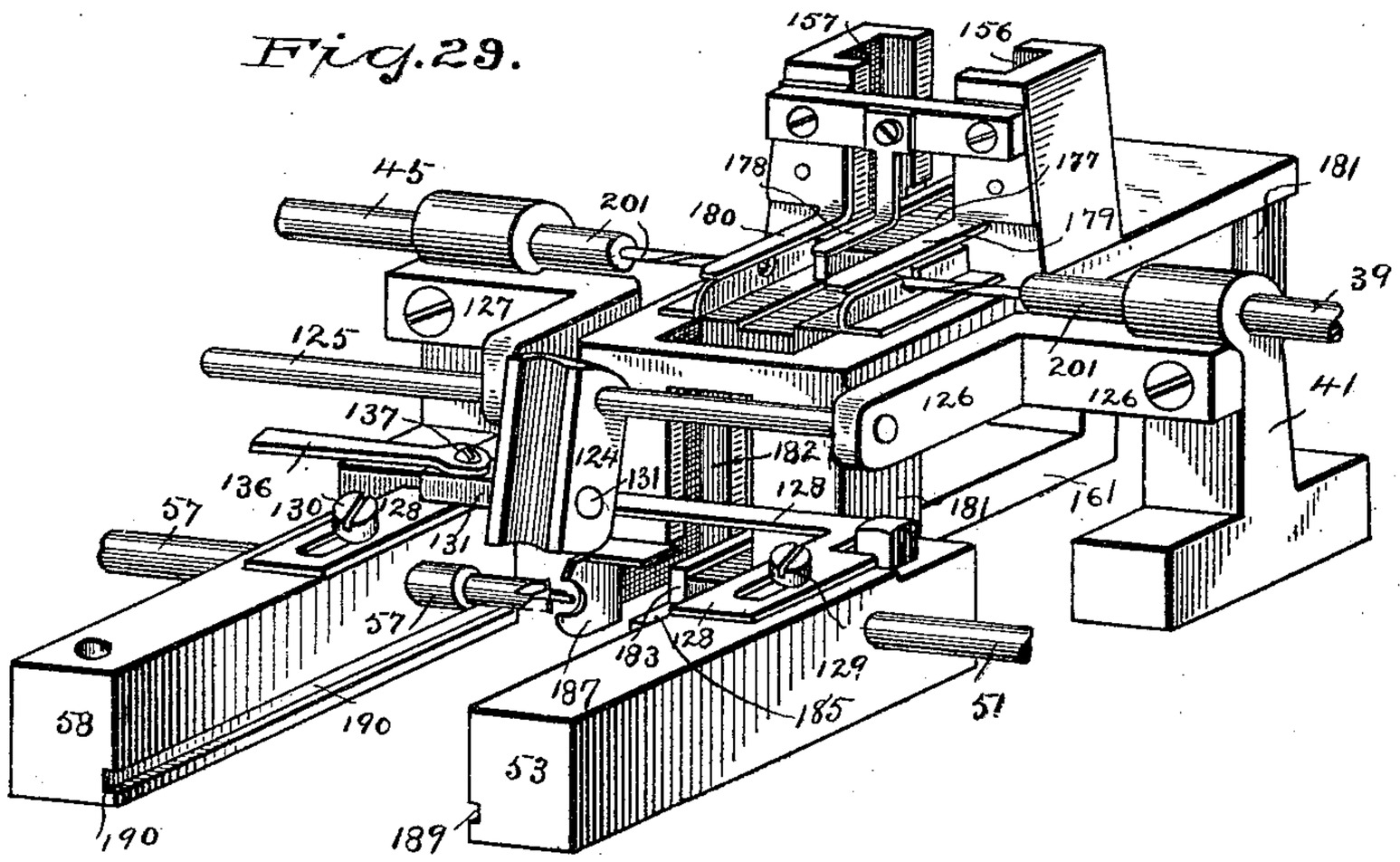
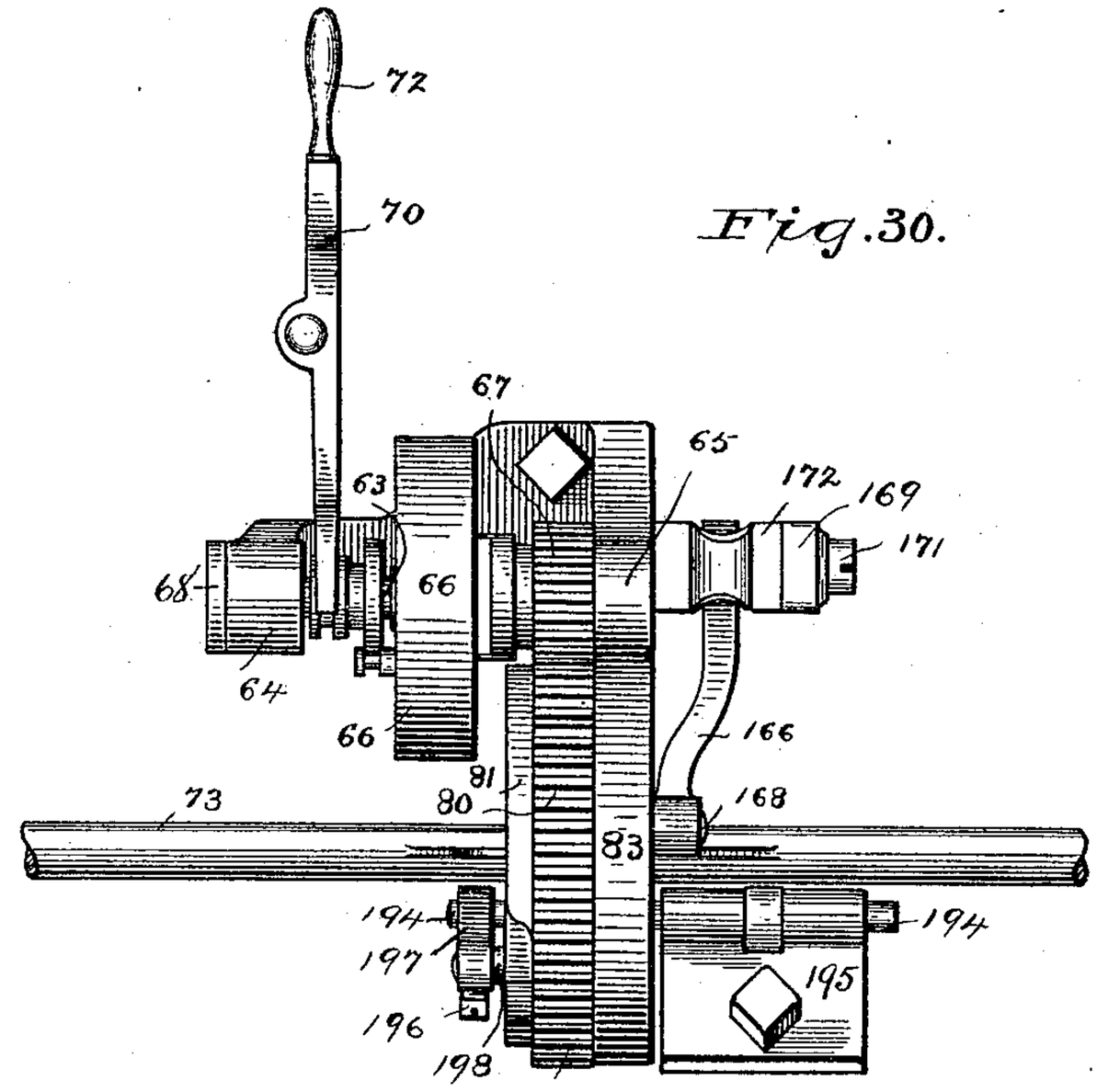


Fig. 30.



Witnesses.

H. A. Lamb.

N. L. Hollamer.

80

Inventor.

C. Elmer Bickford.

By F. C. Somes,

Associate Attorney.

UNITED STATES PATENT OFFICE.

C. ELMER BICKFORD, OF WINCHENDON, MASSACHUSETTS.

AUTOMATIC WOOD PLANING AND DRILLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 385,835, dated July 10, 1888.

Application filed November 8, 1886. Serial No. 218,344. (No model.)

To all whom it may concern:

Be it known that I, C. ELMER BICKFORD, of Winchendon, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Automatic Wood Drilling and Turning Machines, of which the following, taken in connection with the accompanying drawings, is a specification.

The object of my invention is to produce an automatic wood drilling and turning machine that will automatically drill and turn pail-handles, spools, and other like articles of wood or similar material.

It consists in the construction and arrangement of mechanisms adapted to automatically take from the hopper a rectangular block of wood sawed to dimension, drill a hole through it lengthwise, then carry it to the turning devices, where it will be roughed off to its approximate diametrical shape, afterward being reduced to its absolute shape by a gaged cutter and delivered from the machine in a finished, drilled, and turned state.

Figures 1 and 2 represent, respectively, in front elevation and plan, my automatic wood drilling and turning lathe; and Fig. 3 is a vertical cross-section of same on line 25 25 of Fig. 1, looking toward left-hand end of lathe. Fig. 4 is a partial section of drill-chuck, showing method of adjusting and holding drill; and Fig. 5 is a vertical cross-section of same on line 26 26. Fig. 6 is a front elevation of screw-drill stop. Fig. 7 is a side elevation of key for screw-drill stop. Fig. 8 represents details of construction of spur-chuck, driving-spindle, and step; and Fig. 9 is a vertical cross-section of step of same on line 27 27. Fig. 10 is a rear elevation of spring used in connection with hopper-feeding mechanism, and Fig. 11 is a vertical cross-section of same on line 28 28. Figs. 12, 13, 14 are detailed views of gouge-driving mechanism, respectively in front elevation, side elevation as viewed from left-hand side of lathe, and side elevation as viewed from right-hand side of lathe. Figs. 15, 16, 17, and 18 represent, respectively, a wood pail-handle in its four stages of production—namely, first, cut to dimension in the usual manner as it is placed in hopper; second, after being drilled; third, after being roughed off; fourth, after being gage-cutter finished and delivered from the lathe as a pail-handle in a drilled and turned state, after which it may be polished in the usual manner. Fig. 19 is a vertical longitudinal section of drill-spindle-thrust bearing on line 29 of Fig. 2, with end of drill-spindle in side elevation, showing arrangement of thrust-bearing; and Fig. 20 is a full vertical cross-section of Fig. 19 through keyway. Figs. 21, 22, and 23 represent, respectively, gage-cutter in plane, front, and side elevation. Fig. 24 represents gage-cutter cam-wheel in side elevation as viewed from left-hand side of lathe, and Fig. 25 represents gage-cutter cam-wheel in front elevation. Fig. 26 is a detail view of the chuck and cam-shafts with parts thereon. Fig. 27 is a detached rear view of the feeding mechanism, the chuck, and the drill-shafts. Fig. 28 is a detached rear view of cutter-carriage and a portion of the operating mechanism therefor. Fig. 29 is a perspective view of the feeding mechanism, the chuck-shafts, and the drill-shafts. Fig. 30 is a bottom plan view of the chuck and part of the cam-shaft on a line above the driving-pulleys and shaft.

The main driving-shaft 30 is mounted in the frame 31 in bearings 32 and 33, and is held in its position lengthwise by means of collars 34 and 35, which are secured to the shaft 30, which is driven by means of main pulley 36, which is fastened to the shaft and is driven by belt. (Not shown.) The shaft 30 has fastened to it the double-crown driving-pulleys 37 and 38.

The left-hand drill-spindle, 39, mounted in bearings 40 and 41, which are bolted to frame, and having straight pulley 42 secured to spindle, is rotated by means of belt 43, running from the crown 44 of double-crown driving-pulley 37 over straight pulley 42.

The right-hand drill-spindle, 45, mounted in bearings 46 and 47, which are bolted to frame, and having straight pulley 48 secured to spindle, is rotated by means of belt 49, running from crown 50 of double-crown driving-pulley 38 over straight pulley 48.

The left-hand spur-chuck spindle, 51, mounted in bearings 52 and 53, which are bolted to frame, and having straight balance-pulley 54 secured to spindle, is rotated by means of belt 55, running from crown 56 of double-crown driving-pulley 37 over straight balance-pulley 54.

The right-hand spur-chuck spindle, 57, mounted in bearings 58 and 59, which are bolted to frame, and having straight balance-

pulley 60 secured to spindle, is rotated by means of belt 61, running from crown 62 of double-crown driving-pulley 38 over straight balance-pulley 60.

Intermediate shaft, 63, mounted in bearings 64 and 65, which are fastened to frame, is provided with the clutch-pulley 66 and gear 67. The shaft is held in its longitudinal position by reason of its right-hand end being held against a stop, 172, supported in a slotted bracket, 169, by a screw, 171, as hereinafter described, and at its left-hand end by means of plug-stop 68 of bearing 64. The pulley 66 is rotated by means of belt 214, running from main driving-shaft 30 over clutch-pulley 66. The clutch-lever 70, (see Fig. 3,) having its fulcrum in bearing 71, which is fastened to frame, is provided at one end with the handle 72 and at the other end with clutch mechanism of the common style, so that when in use the pulley 66 is driven by belt 214, and by means of operating the clutch mechanism in the usual manner the shaft 63, to which the gear 67 is fastened, will be driven by pulley 66.

To the feed-shaft 73, mounted in bearings 74 and 75, are fastened the drill-feed cam-wheels 76 and 77, spur-chuck-feed cam-wheels 78 and 79, feed-shaft gear 80, gage-cutter-feed cam-wheel 81, gouge-cutter-feed cam-wheel 141, collars 82 and 84, and hopper-feed cam-wheel 83. The drill-feed cam-wheels 76 and 77 serve as collars to keep feed-shaft 73 in its longitudinal position. The feed-shaft gear 80 is arranged to mesh with and to be driven by gear 67.

The left-hand drill-spindle, 39, is provided with thrust-bearing 85, which is shown in detail by Figs. 19 and 20. The thrust-bearing, in which the spindle is free to rotate, is provided with key 86, which holds the spindle in its position by means of the engagement of the key with circular groove 87. Both drill-spindles and both spur-chuck spindles are provided with thrust-bearings similar in construction to thrust-bearing described, and any well-known style of thrust-bearing may be used, except that they must operate substantially as hereinafter stated, and all said spindles are reciprocated in a similar manner by means of devices hereinafter described.

Thrust-bearing 85 is provided with projection 88, which is provided with recess 89, into which is fitted one end of the lever 90, which is pivoted by means of fulcrum-pin 91 and support 92, which is secured to frame, the other end of the lever being provided with pin 93 and wheel 94, the arrangement being such, as shown, that the revolving of the cam-wheel 76 will cause the necessary reciprocating movement of the drill-spindle 39.

The reciprocating movement of the right-hand drill-spindle, 45, is obtained in a similar manner, as above stated, by means of thrust-bearing 95, projection 96, provided with recess 97, lever 98, fulcrum-pin 99, and support 100, pin 101 and wheel 102, and cam-wheel 77.

The forward movement of the left-hand spur-chuck spindle, 51, is obtained by means of thrust-bearing 103, projection 104, recess 105, lever 106, fulcrum-pin 107 and support 108, pin 109 and wheel 110, and cam-wheel 78, and said spindle is returned by spring 122.

The forward movement of the right-hand spur-chuck spindle, 57, is obtained by means of thrust-bearing 111, projection 112, recess 113, lever 114, fulcrum-pin 115, support 116, pin 117, and wheel 118, and cam-wheel 79, and said spindle is returned by spring 120. The forward motion of right-hand spur-chuck spindle is carried by means of spring 119, fastened to lever 114, as shown in detail in Fig. 8, for reasons hereinafter given. The lever 114 is also provided with spring 120, which is constructed as follows: The spring being pivoted on pin 115, one end of spring is fastened to support 116, the other end pressing against pin 121 in lever 114 with a force requisite to keep wheel 118 always in contact with and subject to the cam action of cam-wheel 79. In a similar manner lever 106 is provided with spring 122, which is constructed as follows: The spring being pivoted on pin 107, one end of the spring is fastened to support 108, the other end pressing against pin 123 in lever 114 with a force requisite to keep wheel 110 always in contact with and subject to the action of cam-wheel 78.

The gouge-cutter-feed mechanism is constructed as follows: The gouge 124, of the usual construction, is fastened to round rod 125, which travels horizontally in bearings 126 and 127, which are secured, respectively, to bearing-supports 41 and 46. The gouge-gage 128, against which the gouge rests, is adjustable by means of slots, through which screws 129 and 130 pass and fasten gage to frame. The gouge-gage 128 has a section, as shown in Fig. 3, and being horizontally located and being also adjustable by means of slots through which set-screws 129 and 130 pass, as previously described, it serves as a gage and back-rest for the gouge, which can be set, as desired, at any angle, as its supporting-rod 125 is capable of turning in its bearings 126 and 127. To the gouge is swivelly fitted the pin and block 131, so made that the rotative setting of the gouge by means of its gage 128 will not interfere with its reciprocating action. Side lever 132, which is fastened to shaft 133, mounted in bearing 58, fastened to frame, is connected to block 131 by means of pin 135, connecting-rod 136, and pin 137. It will thus be seen that when the gouge is turned in setting, the swivel-block 131, to which rod 136 is pivoted, will turn in its socket, and thus permit the longitudinal movement of the gouge. The lower end of shaft 133 has fastened to it side lever 138, which is pivoted to forked cam-rod 139 by means of pin 140. The gouge-cutter-feed cam-wheel 141 and forked cam-rod 139 are held laterally in position by means of collars 82 and 84. The cam-wheel 141 is provided with the pawls 142 and 143. Pawl 142, pivoted by means of pivot 144, is provided

with lip 145, which is arranged to engage pin 146, which is fastened to collar 82, the pawl being held against collar by means of spring 147, fastened to staple 148. Pawl 143, pivoted by means of pivot 149, is provided with lip 150, which is also arranged to engage pin 146, the pawl being held against collar by means of spring 151, fastened to staple 152. The forked cam-rod 139, guided between cam-wheel 141 and collar 84 and by feed-shaft 73, has a reciprocating movement in use by reason of engagement of pin 153, which is operated by cam-wheel 141. The cam-wheel 141 being driven by the engagement of pin 146 of collar 82 with lip of pawl, the overhanging end of each pawl is arranged to strike piece 154, fastened to frame, in such a manner as to throw the pawl out of engagement with pin 146, thereby permitting cam-wheel 141 to remain at rest during about one-half of a revolution of feed-shaft 73, or until pin 146 engages with the lip of pawl not in contact with piece 154. The result of the gouge-cutter-feed mechanism operating as described will be the intermittent reciprocating motion of the gouge.

The hopper 155 is provided with two ways, 156 and 157, one at each side, in which are stacked blocks to be operated upon. The feed-carriage 158 is guided and travels in ways 159 by means of the following mechanisms, (see Fig. 3:) adjustable bolt and nuts 160, pin 161, link 162, pin 163, forked rod 164, pivot-pin 165, fastened to end of bent lever 166, which is pivoted by pin 250, (shown in Fig. 26,) fastened opposite pin 167 to bearing-support 65, and is provided with pin 168, which is operated by cam-wheel 83, slotted bracket 169, provided with pin 167, which fits fork of rod 164, is adjustable by means of slot 170, and screw 171, which passes through slot and so fastens slotted bracket 169 to piece 172, which is fastened to bearing-support 65.

The position of the carriage is regulated by the use of bolt and nuts 160, by unscrewing one nut and screwing up the other, as will be obvious. The distance of travel of the carriage is regulated as follows: The arm 164 is pivoted in a slot on pin 167 and is operated by pin 165 in the lever-arm 166. As the pivot-pin 167 is supported by the bracket 169, which is adjustable on screw 171, said pin may be adjusted in the slot of the rod 164, and as it is moved in relation to the pin 165 the short arm of the rod 164 is shortened or lengthened and the throw of its long arm regulated at will. Cam-wheel 83 is adjustable by means of slots 173 and 174, struck on a curve concentric with its center, and screws 175 and 176, which fasten cam-wheel to feed-shaft gear 80.

The plunger 158 comprises a frame-work provided at the top with the upper face, 177, formed integrally with and operating at the upper part of said plunger, and which in use will move laterally and push the lowermost block from the bottom of the pile in the hopper backward into position to be drilled, where it is held by means of spring 178, fastened to the lower end of the hopper and projecting rearwardly therefrom, as shown in detail by Figs. 10 and 11. The block is meanwhile held and guided by springs 179 and 180, fastened to hopper, which projects rearwardly therefrom, and are arranged to prevent the block while being drilled from being forced back toward the hopper by bearing upon each end thereof. The frame 181, in which the plunger 158 moves, is provided with a vertical chute, 182, through which the block after being drilled falls, being pushed onward after the drilling is completed by the action of said upper face, 177, when it drops down the chute 182 onto fingers 184 and 185, carried by the lower face, 183, of the plunger. The block is next carried forward to position for spur-chucks by means of the forward movement of the lower face, 183, of the plunger, which lower face is located opposite the space between the chuck-spindles 51 57, where said block is held in position vertically by fingers 184 and 185, one on each side of and carried by face 183, and laterally by springs 186 and 187, fastened to the frame. It will be understood that the upper face, 177, and lower face, 183, are each fastened to said plunger and move simultaneously therewith and with each other. While the upper face, 177, is forcing one drilled block backward to the chute 182 of the frame the lower face, 183, is simultaneously carrying the block next in advance thereof forward into position for the spur-chucks.

The gage-cutter 215, of the usual style, (shown in detail by Figs. 21, 22, and 23,) is fastened in the usual manner and in its correct position to gage cutter carriage 188, which is operated in horizontal grooved ways 189 and 190, provided, respectively, in bearing-supports 53 and 58. The movement of the cutter-carriage is stopped by adjustable screw-stop 191, which is secured to carriage on one side by means of piece 192 and screw 193 and strikes against bearing-support 53, thereby positively limiting the movement of the cutter-carriage.

Gage-cutter cam-wheel 81, fastened to shaft 73 or cast with gear 80, (shown in detail in Figs. 24 and 25,) operates the gage-cutter carriage as follows: The shaft 194, mounted in bearing 195, which is fastened to frame, has to one end adjustably fastened by means of set-screw 196 the lever 197, which is provided with pin 198, which is operated by its engagement with cam-wheel 81. To the other end of the shaft is secured the lever 199, provided with spring 200, both lever and spring being fitted, as shown, in recess 212 in carriage, and the lever operating against a removable plate, 213, secured by a screw to the gage cutter carriage 188.

By means of the mechanisms described the cam-wheel 81 in operation gives to the gage-cutter carriage 188 a reciprocating motion.

The spring 200 is used to give yielding mo-

tion to gage-cutter, so as to prevent accidents to mechanism and clogging of lathe in case of excessive work being required of gage-cutter.

The use of spring 119 in thrust-bearing 111 is for a similar purpose, viz: to prevent heating of bearings due to excessive thrust of spindle 57, due to uneven lengths of blocks required to be held by spur-chucks. It is also used to cause the forward motion of the right-hand spur-chuck spindle.

Each drill-spindle is constructed with a socket to receive adjustable positive stop-drill chuck 201, which is shown in detail by Figs. 4, 5, 6, and 7, and is made as follows: Shank 202 is made to fit drill-spindle socket. The drill-chuck is provided with transverse slot 208, adapted to receive key 206. The projecting end 203 is threaded and is provided with threaded stop 204, which is provided with slots 205, adapted to receive the key 206, which is provided with recess 207, adapted to receive drill. The chuck is provided with central bore, 209, to receive drill, and set-screw 210, to fasten drill 201 in chuck. Drill-chuck for right-hand spindle, 45, is preferably provided with a left-hand drill and rotated in the same direction as drill-chuck for left-hand spindle.

The drill-spindles may be directly provided with the adjustable stop devices instead of having them applied to drill-chuck.

The detailed operation of the different parts of my machine have been previously fully described.

The operation of my wood drilling and turning machine adapted to produce wood pail-handles in a finished, drilled, and turned state from rectangular blocks is as follows:

All the mechanisms previously described having been correctly adjusted, timed, and set, the machine having been put in operation, and the hopper having been supplied with blocks of a shape as represented by Fig. 15, the first forward stroke of plunger and upper face will push the bottom block from the hopper to its position in front of drills, where it is held in position by means of the spring devices while the drills drill a hole through the block, as represented by Fig. 16. The feed of the drills is as follows: Both drills advance until they nearly meet in the center of the block, thereby leaving a small portion of the block near its center not drilled, which portion is removed by the right-hand drill, which has a greater travel than the left-hand drill. Motion is imparted to these drills by their respective cams, which latter are shaped and timed accordingly.

In practice it is very important that drills should have an adjustable positive stop. Otherwise, as is now the case in lathes in common use, the drill or drills are liable, after being adjusted, to slip, and many blocks are spoiled or are defective for the reason that the drills do not drill the hole entirely through the block. After the block has been drilled and the drills have been withdrawn from block by the action of the cams 76 and 77, the second forward movement of the plunger and upper face pushes the second block into position to be drilled, and as it is pushed forward it pushes the first block into the chute, down which it falls to the bottom thereof, where, when the third block is pushed forward to be drilled, the first block is carried forward by the lower face, and is held by the fingers and spring devices until it is taken by the left and right hand spur-chucks and rapidly rotated. While rotating, the gouge travels from right to left and roughs off the block, as represented by Fig. 17. When the gouge reaches its left-hand position, it remains at rest until the gage-cutter advances and gives the finishing gage-cut to the block, which then becomes a pail-handle in a finished, drilled, and turned state, as represented by Fig. 18. After the gage-cutter has performed its work and while it is returning to its backward position, the spur-chucks are withdrawn, thereby releasing the pail-handle, which is pushed from its position and falls through the frame into a proper receptable. The second block is roughed off by the gouge-cutter while traveling from left to right.

All the operations being automatically, regularly, and consecutively performed and the hopper and lathe being supplied with blocks, the number of pail-handles produced is represented by the number of forward movements of the plunger.

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

1. The combination, with the hopper 155, having vertical ways 156 157, and springs 178, 179, and 180, projecting rearwardly from the lower end of said hopper, of the plunger 158, located below the lower end of said ways and springs, the upper face-piece, 177, and mechanism for reciprocating it beneath said hopper and springs, substantially as described.

2. The adjustable positive stop drill chuck 201, comprising the screw-threaded end 203, having transverse slot 208 and central bore, 209, the screw-threaded stop 204, provided with slots 205, and the key 206, filling said slots, substantially as described.

3. The supports 53 and 58, having horizontal grooves 189 190, in combination with the gage-cutter carriage 188, sliding in said grooves and provided with the recess 212, the adjustable positive stop 192 191, abutting against support 53 and limiting the inward movement of said carriage, and the lever 199, having spring 200, seated in said recess 212, said spring imparting a yielding inward motion to said carriage when said lever is operated, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 4th day of November, A. D. 1886.

C. ELMER BICKFORD.

Witnesses:

JACOB NASCHOLD,

PAUL DIETRICH.