3 Sheets- Sheet 1

M. J. MULLINS.
Tenoning-Machine.

No. 206,121. Patented July 16, 1878.

Fig. 1.

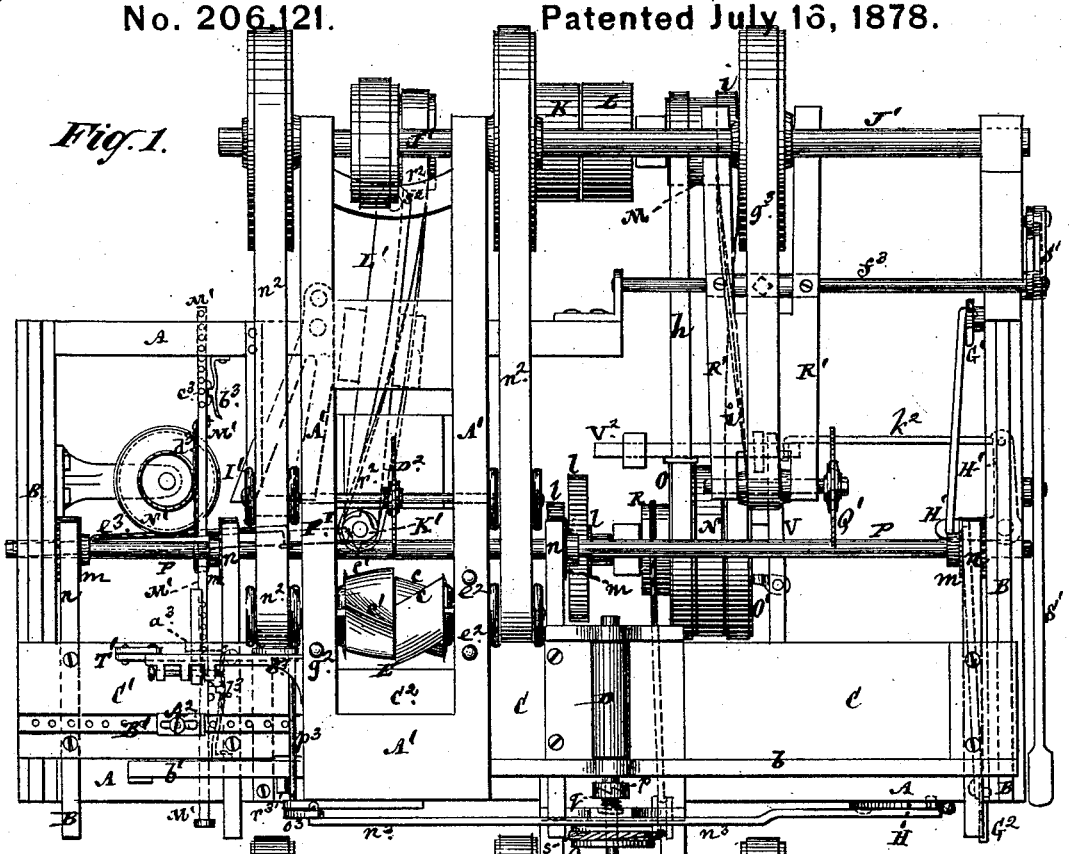
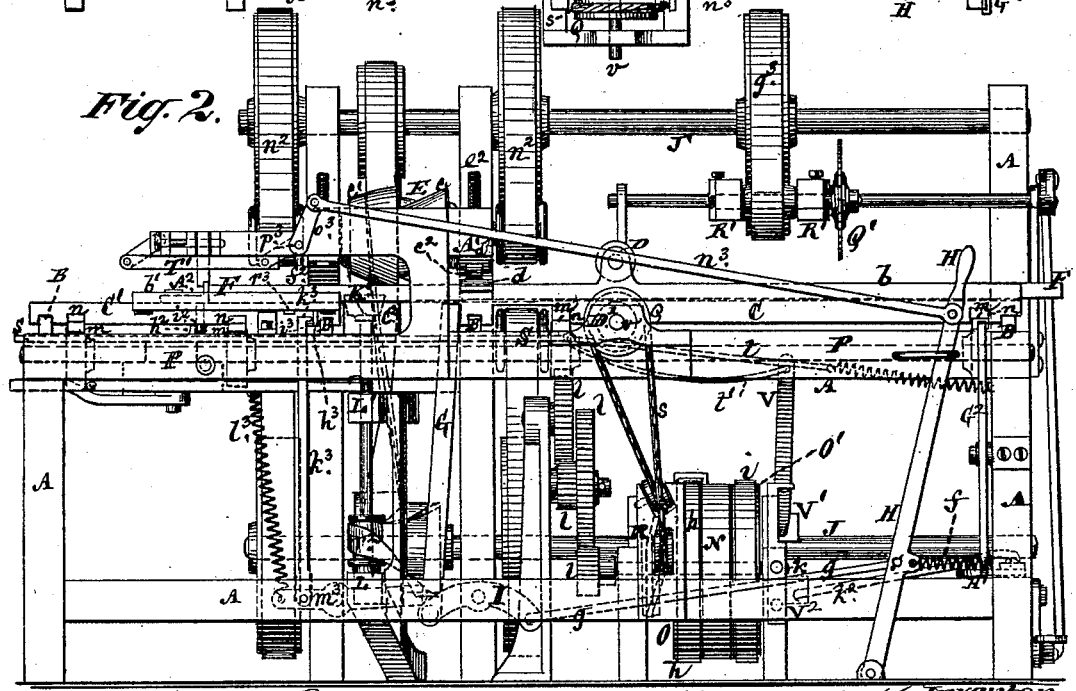


Fig. 2.



Witnesses: John Becker, Fred. Haynes

Inventor: Michael J. Mullins, by his Attorneys Brown & Allen

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Fig. 3.

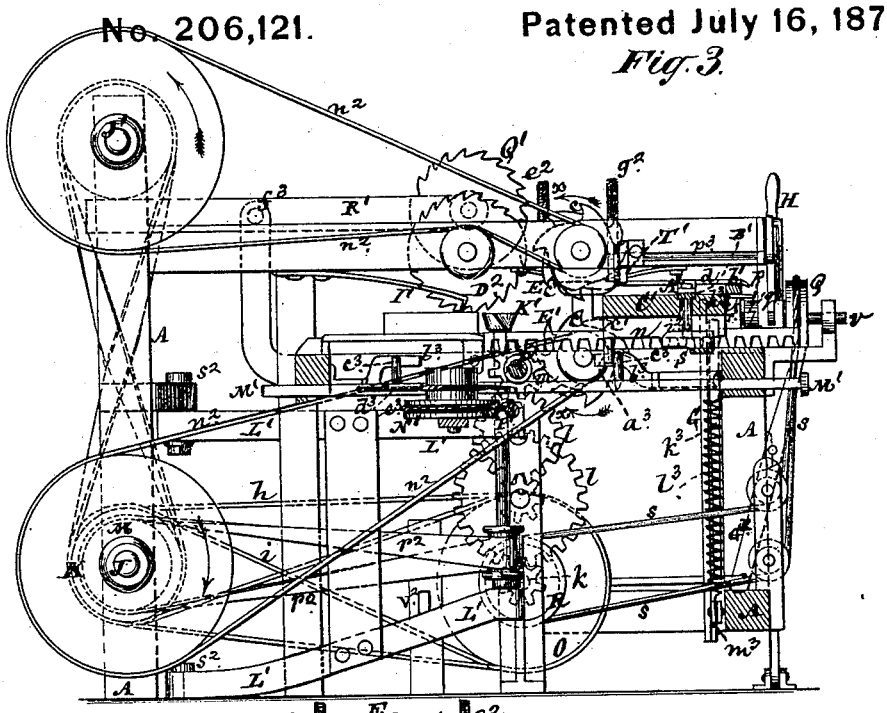


Fig. 4.

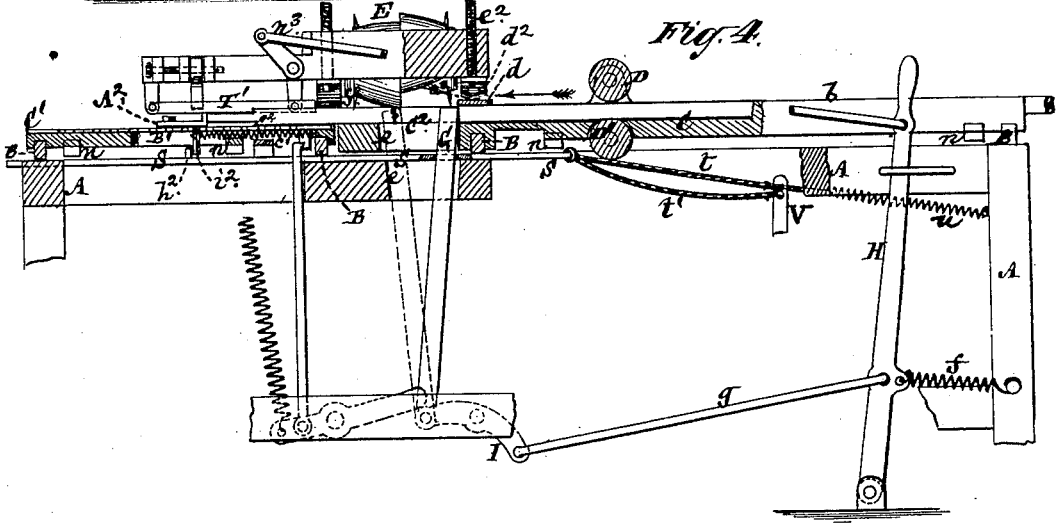


Fig. 5.

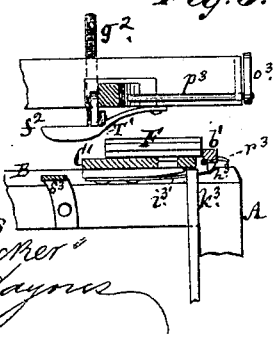
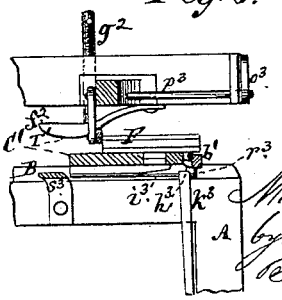


Fig. 6.



Witnesses
John Becker
Fred. Haynes

Inventor
Michael J. Mullins
by his Attorneys
Brown & Allen

3 Sheets—Sheet 3.

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Fig. 7.

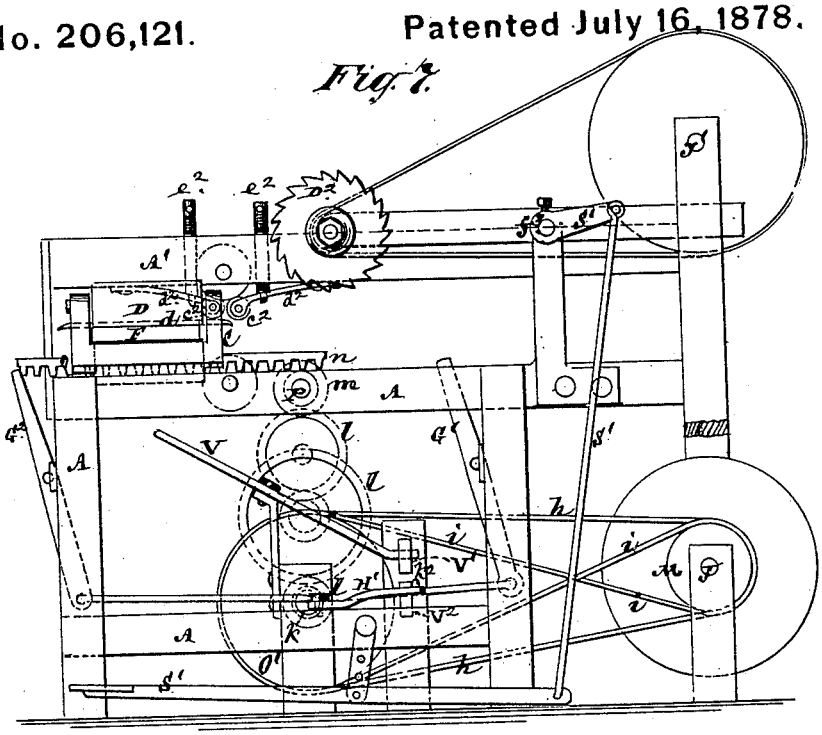


Fig. 8.

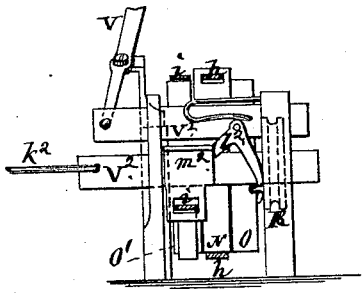
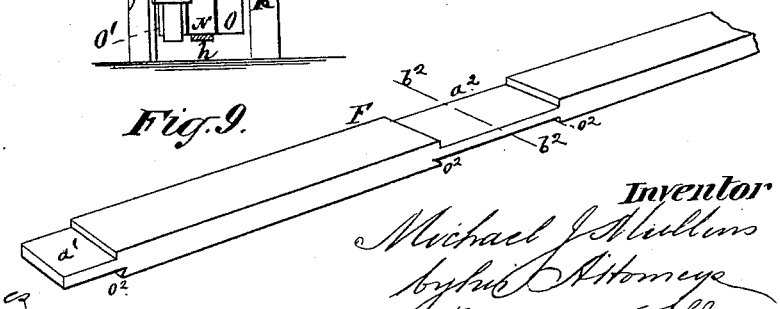


Fig. 9.



Witnesses
John Becker
Fred Haynes

Inventor
Michael J. Mullins
by his Attorneys
Brown & Allen

UNITED STATES PATENT OFFICE.

MICHAEL J. MULLINS, OF NEW YORK, N. Y.

IMPROVEMENT IN TENONING-MACHINES.

Specification forming part of Letters Patent No. **206,121**, dated July 16, 1878; application filed June 8, 1878.

To all whom it may concern:

Be it known that I, MICHAEL J. MULLINS, of the city and State of New York, have invented certain new and useful Improvements in Tenoning-Machines, of which the following is a description, reference being had to the accompanying drawings, forming part of this specification.

The object of this invention is to produce a number of flat tenoned pieces of any desired length, for the making of frames and other articles, from a plank, board, or one continuous length of stuff, as the latter is passed lengthwise through the machine.

The invention consists in various novel constructions and combinations of devices, whereby the above object is attained in a very perfect manner, the same including a reciprocating carriage, along which the plank or stuff is or may be automatically fed; movable or adjustable stops that gage the length of the first end tenon, and determine the length of the tenoned pieces or sections into which the plank is subsequently cut; rotary tenoning-cutters capable of reducing both sides of the plank, to form a double tenon, as the carriage, with the stuff on it, is fed up to the said cutters; a saw for transversely dividing each double tenon and cutting up the plank into sections or pieces of uniform length; means for beveling the shoulders of the tenons when necessary; also, means for securing a uniform length of remnant; likewise device for effecting a separate delivery of the tenoned sections and remnants; also, mechanism for automatically actuating the several parts in timely relation with each other.

In the accompanying drawings, Figure 1 represents a plan view of a tenoning-machine constructed in accordance with my invention. Fig. 2 is a front longitudinal elevation of the same. Fig. 3 is a sectional end elevation thereof. Fig. 4 is a sectional longitudinal elevation, in part, mainly in illustration of the starting mechanism. Figs. 5 and 6 are sectional end elevations, in part, mainly showing a movable guide-strip in different positions. Fig. 7 is a front-end elevation, and Fig. 8 a rear view, of certain belt-shifting mechanism. Fig. 9 is a view, in perspective, of a piece of stuff as cut by the machine to form tenons.

A is the frame of the machine, which frame may be of any suitable construction, and is provided with cross-rails B B, for a sectionally-constructed carriage, C C^1, to travel on. The section C of the carriage is provided on its upper surface with a front or outer longitudinal strip, *b*, which serves as a guide and back support for the stuff when being fed up to and against the cutters; and the carriage-section C^1 is also provided with an outer guiding-strip, b^1.

D D^1 are feed-rollers on said section C of the carriage, the upper roller, D, serving as a pressure-roller to bear down on the stuff, and the lower roller, D^1, as a feeding-roller.

E E are rotary tenoning-cutters or cutter-heads, arranged one above the other, and operated so that they rotate as indicated by arrows *x* in Fig. 3, which cause them to cut in a crosswise direction against the stuff as the carriage-sections C C^1 are moved across the main frame toward and past the cutters. Said cutters, which have their axes in planes at right angles to the feed-rollers D D^1, are carried in a cross-frame, A^1, which is mounted on and secured to the main frame A. Each of said cutters is constructed with reversely angular or spiral cutting knives or edges, *c* c^1, arranged intermediately of or in staggering relation with one another, on opposite sides of a plane intersecting the cutters through their center, to facilitate the cutting of the tenon. Said cutter-heads E E′, having their knives or cutters *c* c^1 arranged as described, it is my intention to make the subject of a separate application for Letters Patent.

Fitted on or over the portion of the carriage C lying back of the upper feed-roller D is a guard, *d*, under which the plank or stuff F passes as it is fed by the rollers to be operated on by the cutters. This guard serves to keep the forward portion of the stuff down to its place.

The plank or stuff F to be worked, when first introduced over the carriage-section C, has its position determined to regulate the length of the first tenon by the forward end of the stuff being brought up against a stop-lever, G, when the latter is raised for the purpose, as shown in Fig. 4, which lever is forced back, by the longitudinal movement of the stuff, against a fixed stop, *e*, that is in line with a plane intersecting the rotary cutters E

E′, centrally in a transverse direction, in order that said cutters will only cut a single tenon on the forward end of the stuff at starting. The normal position of this stop-lever G is down or out of the way of the stuff, and it is only when cutting the first tenon that it is raised to bring it in contact with the forward end of the stuff, it being at other times held down or out of the way by a spring, *f*, applied to a hand-lever, H, which is used to raise the stop-lever, and which is connected, by a rod, *g*, with a lever, I, that has the lower end of the stop-lever G pivoted to it.

J is the main shaft of the machine, provided with fast and loose pulleys K L, by which said shaft is put in or out of motion. Upon said shaft J is a drum, M, from which motion is communicated, either by a straight belt, *h*, or a cross-belt, *i*, to a pulley, N, fast on a counter-shaft, *k*, accordingly as either of said belts is thrown from loose pulleys O O′ onto the fast pulley N. The shaft *k* is connected, by gears *l*, with an upper shaft, P, which extends longitudinally through the machine, and has pinions *m* on it. These pinions engage with racks *n*, secured to the carriage-sections C C¹, for the purpose of traversing the carriage to and fro on the rails B B, to bring the stuff up to and away from the cutters.

When the carriage C C¹ is in its normal position, it lies along or over the front side of the main frame A, and its lower feed-roller D¹ is caused to engage, by a half-clutch, *p*, with a corresponding half-clutch, *q*, on a shaft, *v*, of a pulley, Q, by which motion is communicated to the feed-roller D¹, said pulley Q deriving its motion, by a band, *s*, from a pulley, R, fast to the loose pulley O, which band is directed by suitable guide-pulleys in passing from R to Q.

The stop-lever G passes through a longitudinal bar, S, which is free to slide in direction of its length within the upper part of the main frame. One end of this bar S has attached to it a cord or chain, *t*, which is secured to a spring, *u*, that serves to draw the bar S back or toward the front end of the carriage-section C. This cord or chain always remains under tension by the spring *u*, while another cord or chain, *t′*, which is also attached to the same end of the bar S, (or it may be a slack continuation of the first-named cord or chain *t*,) connects said bar S with a belt-shifting lever, V, that controls the straight belt *h*, the use and action of which will be hereinafter described.

C² is a stationary bed-piece interposed between the carriage-sections C C¹ opposite the cutter-heads E E′, and serving as a lower support for the plank or stuff under operation, as the carriage-sections C C¹ are moved on the rails B B by the racks *n* toward and past opposite sides of said cutter-heads, to carry the plank between the cutter-heads, for the purpose of reducing it on both sides to form the tenon.

As hereinbefore observed, it is only necessary, when starting on the work, to cut a single tenon, a^1, as shown in Fig. 9, on the forward end of the plank, the stop-lever G then being specially raised for the purpose, and adjusted as it is moved by the feed of the plank up against the fixed stop *e*, to bring the front end of the plank opposite one-half the length of the cutter-heads, as shown by dotted lines in Fig. 4. After this first single tenon a^1 has been cut upon the forward end of the plank, the carriage-sections C C¹ been worked by their racks *n* to the front side of the machine again, and the stop-lever G allowed to drop and resume its normal position, then in or during each succeeding longitudinal feed of the plank it is arrested in front to determine the proper position of each succeeding double tenon a^2, Fig. 9, throughout its length, by feeding it up against an adjustable gage, A², on a bar, B′, which latter is fitted so as to be capable of a restricted sliding movement in and along the carriage-section C¹ against the tension of a spring, c^1.

The gage A², by its adjustment, determines the length of each tenoned section or piece formed by dividing the plank centrally in a transverse direction successively through each double tenon a^2, as indicated by the line b^2 in Fig. 9, as or immediately after each double tenon is formed by the cutter-heads E E′. Said double tenons are successively divided as formed in the plank by extending the motion of the carriage or carriage-sections C C¹ on the rails B B farther than is necessary to merely cut the double tenon, and so as to bring the latter against and past a centrally-dividing saw, D², immediately in rear of the cutter-heads E E′, after which the carriage C C¹ is returned to its normal position on the front side of the machine again, the cut section of the plank tenoned on both ends having in the meantime been removed. Thus it is only a single tenon that is brought up against the gage A² each time the plank is fed forward by the rollers D D¹.

The plank F is kept down on the carriage C C¹, while being forced up to and acted upon by the cutters, in part by the guard or plate *d* at the inner end of the carriage-section C and rollers c^2 c^2, arranged to bear down on said plate and carried by arms d^2 d^2, (see Fig. 7,) attached to the under surface of one side of the cross-frame A¹, and adjustable by screws e^2 e^2, the guard or plate *d* preventing any bruising of the plank or stuff on its upper surface, and the duplicate rollers c^2 c^2, by their arrangement one in advance of the other, maintaining the pressure on the holding-down plate or guard *d* during the feed of the work to the cutters.

On the opposite side of the cross-frame A¹ (see Figs. 5 and 6) is also a shoe, f^2, adjustable by a screw, g^2, to assist in holding down the stuff when under operation by the cutters.

Attached to the slotted sliding bar S, through which the slot-lever G passes, is an inwardly-projecting arm, h^2, (see Fig. 4,) against which a pin, i^2, attached to the gage A², bears, so that not only when the plank F is first moved forward

longitudinally on its carriage against the raised stop-lever G, but also during the succeeding operations when cutting a double tenon, the adjustable gage A^2 is caused to be forced back, and the sliding bar S to be moved longitudinally in a backward direction against the tension of the spring *u*, which will cause the slack cord or chain *t'* to draw on the lever V, and, by means of a belt-shifting sliding bar, V^1, shift the straight belt *h* from the loose pulley *o* onto the fast pulley N. (See Figs. 1 and 8.) This will arrest the motion of the working feed-roller D^1, by reason of said roller deriving its motion from the pulley R, fast to the loose pulley O; and by the straight belt *h* being thrown onto the fast pulley N, motion is communicated from the shaft *k*, through the gears *l*, to the pinions *m*, which, by their gear with the racks *n*, move the carriage C C^1 inward, thereby disconnecting the half-clutches *p q*, by which the feed-roller D^1 is actuated, and causing the plank or stuff F to be forced up to or against and between the cutters E E', and, in case of a double tenon, past the saw D^2, to divide the double tenon. At the termination of this inward movement of the carriage C C^1, one of the racks *n* of said carriage strikes a lever, G^1, which is connected with a bell-crank, H', (see Figs. 1 and 7,) that, in its turn, is connected by a rod, k^2, with a sliding shifting-bar, V^2, of the cross-belt *i*. Pivoted to the other belt-shifting bar, V^1, is a hooked coupling-lever, l^2, that engages with or against a projection, m^2, on the bar V^2, when the other bar, V^1, is adjusted to throw the straight belt *h* onto the fast pulley N. (See Fig. 8.) So soon, then, as the rack of the carriage C C^1 strikes the lever G^1, it first shifts the straight belt *h* from the fast pulley N back onto the loose pulley O by or through the intervention of the hooked coupling l^2, and throws the cross-belt *i* from the loose pulley O' onto the fast pulley N, whereby the motion of the carriage C C^1 returns it to its normal position on the front side of the machine, the hooked coupling-lever l^2 in such action clearing the projection m^2. As the carriage C C^1, however, returns to its normal position on the front side of the machine, the rack connected with the carriage which previously operated the lever G^1 strikes at its opposite end a lever, G^2, that is also connected with the bell-crank H^1, which, in being moved, draws back the sliding bar V^2, and removes the cross-belt *i* from the fast pulley N back to the loose pulley O'.

After each double tenon has been cut upon or in the plank, and the latter has been transversely divided through the center of said tenon, the carriage C C^1, as it finishes its inward movement, causes the cut section to pass under a spring-hook, I', Fig. 3, which, during the return movement of the carriage, causes the cut section to be delivered from off the latter.

J' is an upper shaft, which receives its motion by suitable belts and pulleys from the lower shaft J. These two shafts serve, by pulleys on them and bands n^2 n^2, connecting said pulleys with pulleys on the cutters or cutter-heads E E' and dividing-saw D^2, to rotate said cutters and saw.

In some kinds of tenoned work it is desirable to give a dovetail or bevel shape to the shoulder of the tenon on one side of the tenoned piece or strip, as shown at o^2, Figs. 4 and 9. To this end a rotary cutter, K', is interposed between the cutter-heads E E' and the saw D^2. This cutter K' (see Figs. 1 and 3) is carried by an upright shaft, which is driven by a band, r^2, from a pulley on the shaft J, and is supported in a swinging frame, L', having its center of motion at s^2, to provide for the adjustment of the cutter K', first to cut one beveled shoulder, o^2, on the under side of a double tenon as the latter is being formed on or in the plank, and subsequently to cut an opposite dovetailed or beveled shoulder on said under side of the tenon as the carriage C C^1 moves back with the work away from the cutters. This alternatively opposite lateral adjustment of the cutter K' relatively to the shoulders of the double tenon is effected (see more particularly Figs. 1 and 3) by a lip, a^3, on the section C^1 of the carriage, first liberating one, and in its return stroke the other, of two spring-catches, b^3, from a cross sliding bar, M', and subsequently striking one or the other of two pins or stops, c^3, adjusted to project at suitable points from the bar M, and so to move said bar in the direction the carriage is traveling till the bar is arrested again by one or other of the spring-catches. The bar M' consequently has a reciprocating movement in direction of its length, and, by means of a cord, band, or chain, d^3, connected with it, is made to communicate a reciprocating circular movement to a pulley, N', which carries a cord or chain, e^3, having its ends united to a rod, P'. This rod P' is connected to the swinging frame L', and, accordingly as it is reciprocated by the means just described, the cutter K' is adjusted to work on opposite ends of the double tenon. A rack-and-pinion motion may be substituted for the cord or chain and pulley motion, to adjust the swinging frame L', and with it the rotating cutter K', alternately into opposite lateral positions.

Q' is a circular saw, carried by a raising and lowering frame, R', which is here represented as attached to a rock-shaft, f^3, and as made capable of being rocked to raise and lower the saw by means of a treadle mechanism, S'. Said saw is driven by a band, g^3, from a pulley on the shaft J', and is arranged in such relation to the carriage C C^1 that when the latter is run toward and past the cutters E E', the forward portion of the carriage passes under the saw Q', so that on bringing down said saw as the carriage commences to pass under it for the last time, as regards a plank of given length thereon, said plank is cut transversely by the saw Q' at or near its rear end, to leave a square finish and remnant of given dimensions after the whole plank has been tenoned

and cut up. This provides for any number of planks in succession readily being fed or followed up in each other's wake along the carriage, and so that the remnants of the several planks will be of a uniform length, which admits of said remnants being used to advantage.

As, however, these remnants will not be of the length of the several tenoned sections or pieces previously formed from the planks, it is not desirable that they should be delivered along with said tenoned sections. To provide for this I hinge the strip b^1 on the outer front margin of the section C^1 of the carriage, (see more particularly Figs. 4, 5, and 6,) so that said strip may be lowered, as shown in Fig. 6, to pass off the remnant from the front side of the machine as the carriage moves toward the cutters, and the advance edge of the remnant is caused to strike or be intercepted by a gate, T′, specially lowered for the purpose.

The hinged strip b^1 is held in its raised position by a toe, h^3, bearing against the end of a spring, i^3, on the under side of the carriage-section C^1. Said strip is liberated, when required to be lowered, by pulling down on a hook-bar, k^3, which engages with the spring i^3, whereby the toe h^3 is free to clear the end of the spring.

To pull down the hook-bar k^3 against the tension of a spring, l^3, which serves to raise it again, said bar is pivoted to a lever, m^3, which rests on the lever I, that carries the stop-lever G, so that when the latter is raised by movement of the hand-lever H the hook-bar is lowered, as then required, for discharge of the remnant. The same motion of the hand-lever H also serves to lower the gate T′ by means of a rod, n^3, connecting said hand-lever with a crank, o^3, on a rock-shaft, p^3, which forms one of the working-joints or center-pins of the gate, that is hung or constructed to have a parallel motion when being raised and lowered; but said gate may be otherwise constructed and operated.

A lip, r^3, on the hinged strip b^1 serves to automatically raise said strip after the remnant has been cleared from the carriage-section C^1, by said lip coming in contact with a fixed stop, s^3, as the carriage C C^1 approaches or passes by the cutters.

I claim—

1. The combination of the reciprocating carriage, formed in sections to leave a break or opening in it, with upper and lower rotating cutter-heads, arranged in relation with said carriage-sections, substantially as and for the purpose specified.

2. The combination of the saw D^2, for dividing the double tenon, with the cutter-heads E E′, constructed as described, and the reciprocating divided carriage C C^1, substantially as specified.

3. The combination, with the section C of the reciprocating carriage, of the feed-rollers D D^1, the half-clutch p, attached to one of said rollers, and the rotating half-chuck q, having a fixed relation relatively to said carriage, substantially as specified.

4. The combination, with the carriage-sections C C^1, the cutter-heads E E′, having duplicate rows of cutters c c^1, and the stop e, of the stop-lever G, capable of motion in direction of the length of the carriage, and adjustable up and down between the carriage-sections, essentially as and for the purpose described.

5. The adjustable and yielding gage A^2, attached to the carriage-section C^1, in combination with the carriage-section C and the rotating cutter-heads E E′, substantially as specified.

6. The sliding bar S, in combination with the yielding gage A^2, the stop-lever G, the taut and slack cords t t', attached to said bar, and the belt-shifting lever V, essentially as and for the purposes described.

7. The combination, with the reciprocating carriage C C^1, of the reversely-operating loose pulleys O O′, the intermediate fast pulley N, with its shaft k, the gears l, connecting said shaft with the pinions m, by which the carriage is moved backward and forward, the belt-shifting lever V, having attached to it a sliding bar, V^1, for controlling one of the belts by which motion is given to the carriage, the levers G G^1, controlling the other belt, by which the motion of the carriage is reversed, and the hooked coupling-lever l^2, essentially as and for the purposes specified.

8. The spring hook or clearer I′, in combination with the reciprocating carriage C C^1, the cutter-heads E E′, and the saw D^2, by which the plank is cut up into tenoned sections, essentially as described.

9. The hinged rising and falling outer guiding-strip b^1 on the carriage-section C^1, in combination with the rising and falling gate T′, and means for raising and lowering said strip and gate, substantially as specified.

10. The combination, with the reciprocating carriage C C^1 and the upper and lower rotating cutter-heads E E′, of the rotating cutter K′, carried by a laterally-swinging frame or support, and means applied to the carriage for automatically adjusting said cutter-head K′ successively into opposite lateral positions, whereby it is made to cut a dovetail or bevel on opposite ends of the double tenon as the carriage is moved backward and forward, essentially as described.

11. The saw Q′, made capable of adjustment up or down, for regulating the length of the remnant and squaring the rear end of the plank, in combination with the reciprocating carriage C C^1, the adjustable gage A^2, the rotating cutter-heads E E′, and the saw D^2, for dividing the double tenon, substantially as specified.

M. J. MULLINS.

Witnesses:
OWEN PRENTISS,
T. J. KEANE.