Oct. 28, 1941. J. H. FARRELL 2,260,662

TENONING MACHINE

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Fig. 1.

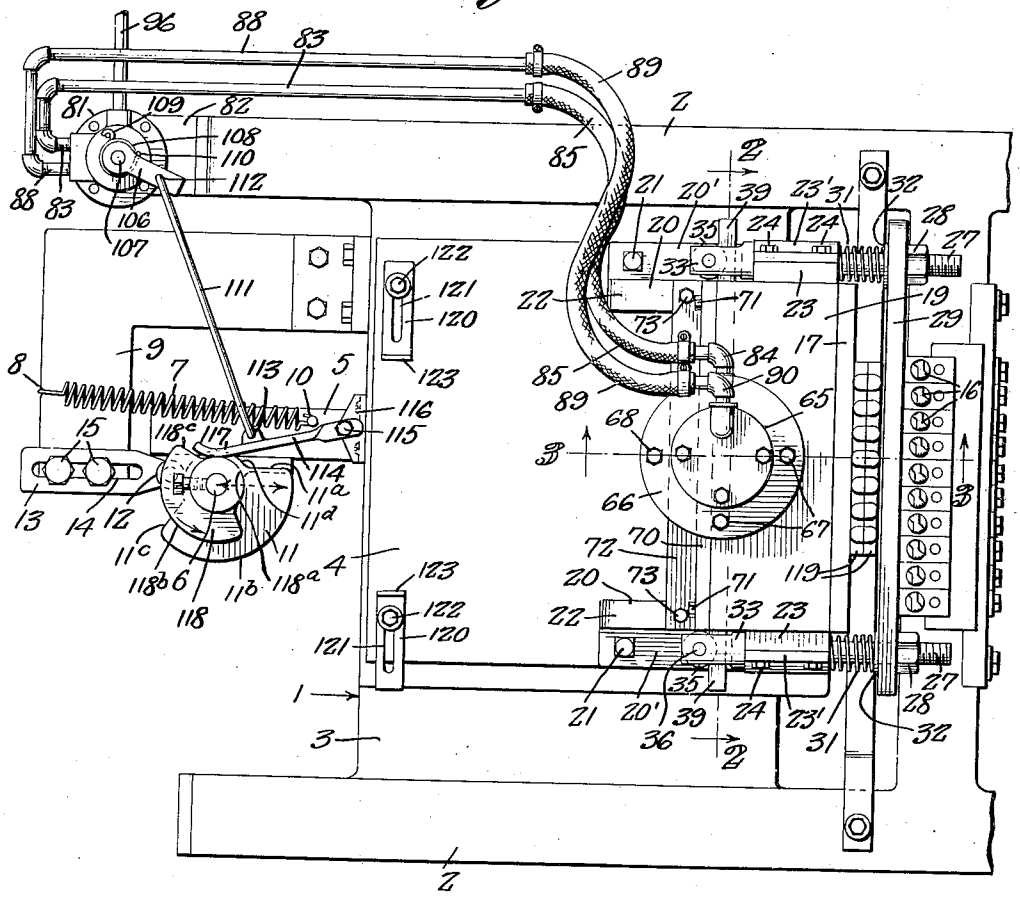


Fig. 7.

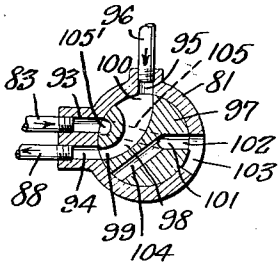
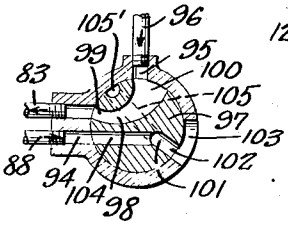


Fig. 6.



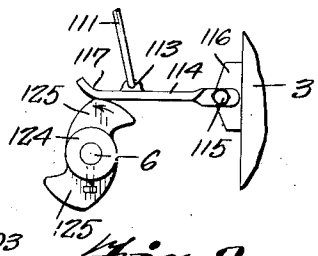


Fig. 8.

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Fig. 2.

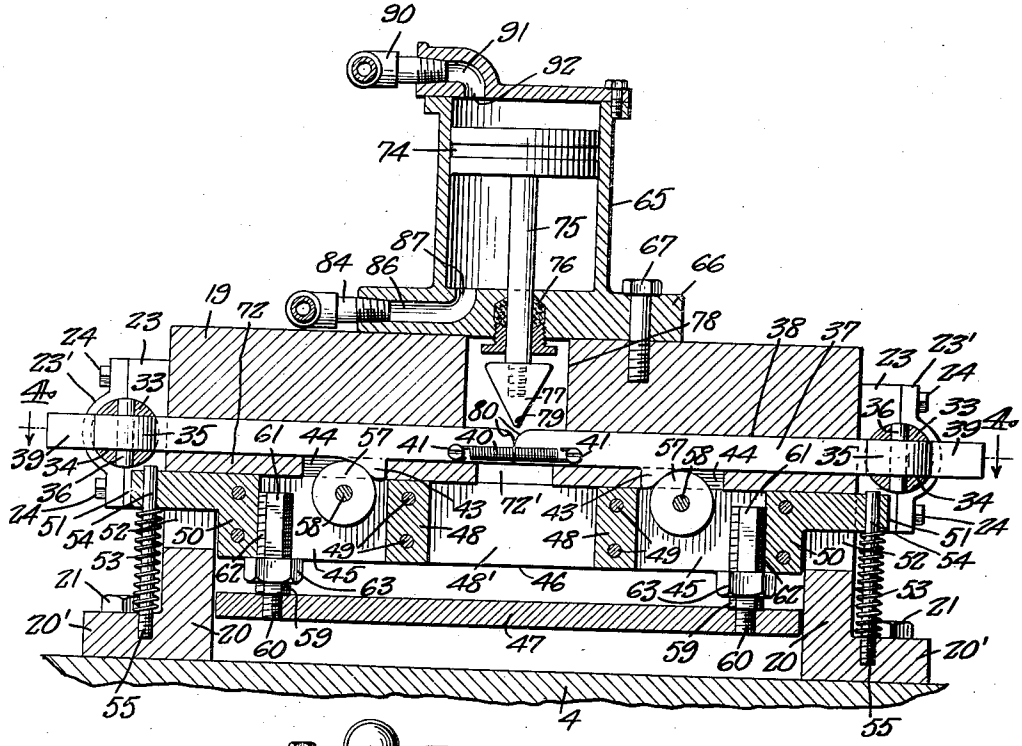
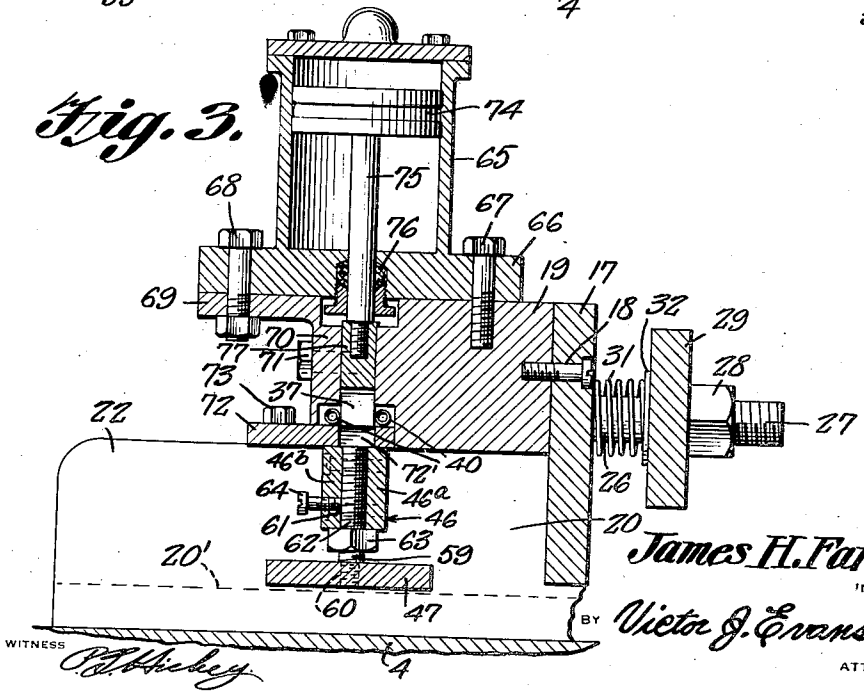


Fig. 3.



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Fig. 4.

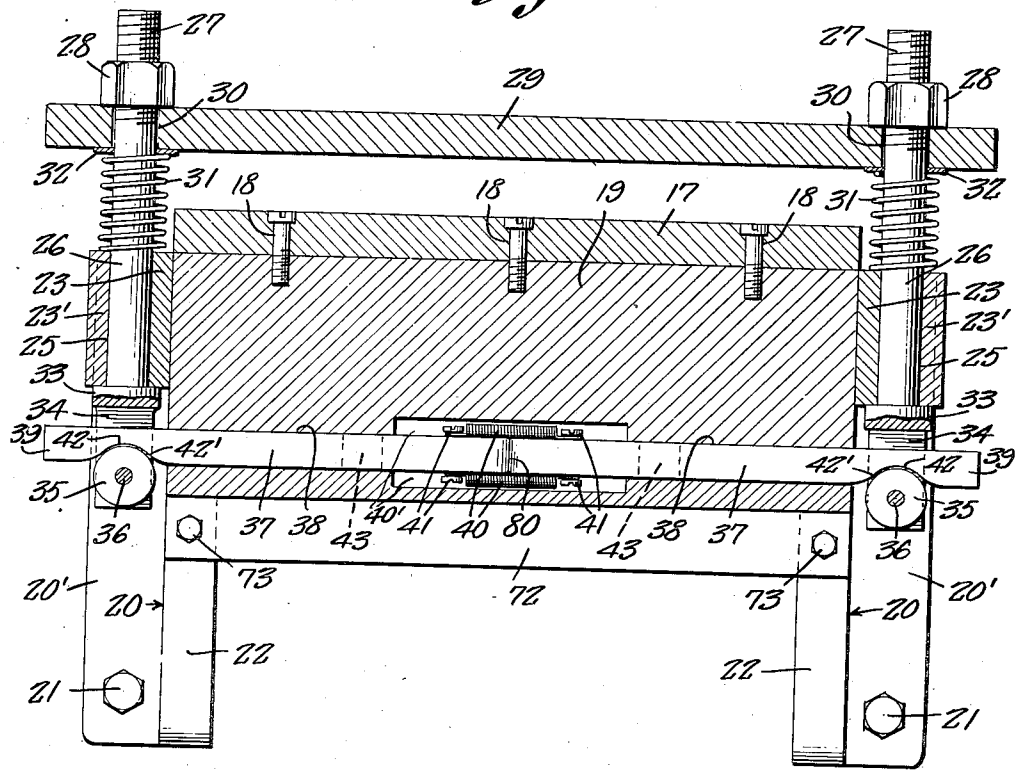
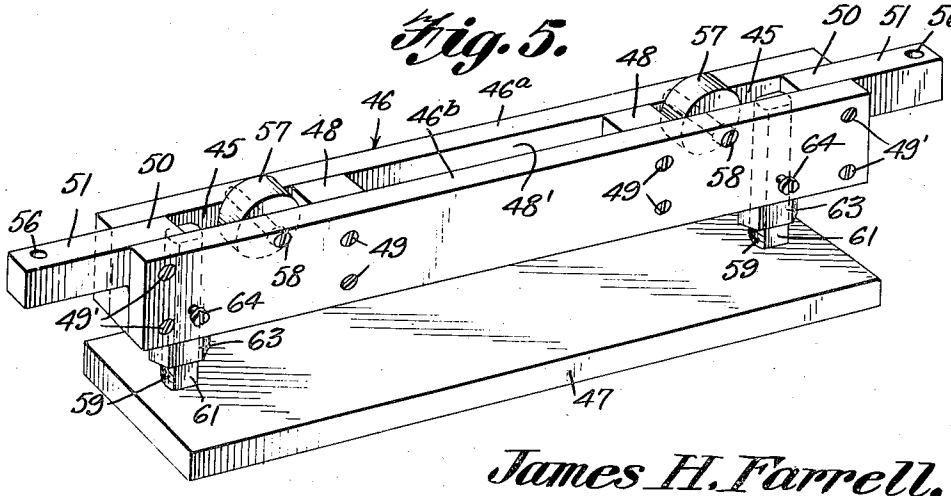


Fig. 5.



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WITNESS

Patented Oct. 28, 1941 2,260,662

UNITED STATES PATENT OFFICE

2,260,662

TENONING MACHINE

James H. Farrell, High Point, N. C.

Application November 13, 1939, Serial No. 304,254

4 Claims. (Cl. 144—278)

This invention relates to power actuated work holding means for wood working machines and more particularly for application and use as an attachment to or as an incorporated means or mechanism in a shaper or machine for cutting and forming mortises and tenons, the prime object being to provide a simple yet practical and efficient power actuated work clamping means which is automatically operated and controlled in timed relation to the cutting and shaping mechanism of the machine.

A particular object is to produce a mechanism in a unitary assembly which is readily attached to a conventional mortising and tenoning machine or the like without alteration in the regular mechanism of the machine or in the attachment itself.

A further object is to provide a unitary construction and arrangement in the work holding attachment whereby boards to be mortised or tenoned or similarly cut and formed may be held in either a vertical or a horizontal position by separate work gripping or clamping elements which are separately usable but operated simultaneously by power actuated means common to both the vertical and the horizontal holding elements and under the same operating control.

With the foregoing and other objects and advantages to be attained, as will hereinafter more fully appear, the invention consists in the novel general structure and in the several parts and combinations and arrangements of parts thereof as hereinafter described and set forth with distinguishing particularity in the appended claims, reference being had to the accompanying drawings illustrating a practical adaptation of the invention, in which—

Figure 1 is a fragmentary top plan view illustrative of the essential parts of a conventional mortising and tenoning machine which directly enter into the operation and control of the work holding means of the present invention and illustrating the work holding means as installed upon the machine;

Figure 2 is a fragmentary view on an enlarged scale and in section taken on or about the line 2—2 of Figure 1;

Figure 3 is a section, on the same scale as in Figure 2, but taken on the transverse line 3—3 of Figure 1;

Figure 4 is a view partly in top plan and partly in horizontal section taken substantially on the line 4—4 of Figure 2;

Figure 5 is a perspective view of the horizontal work clamping unit detached;

Figure 6 is a sectional view of the pressure fluid controlling valve as set in normal position for supplying the fluid to the lower portion of the power cylinder to lift the piston;

Figure 7 is a similar view showing the pressure fluid controlling valve rotated to the position for supplying the fluid to the upper portion of the cylinder to move the piston downward; and

Figure 8 is a detail view of a modified form of cam element for controlling the operation of the pressure fluid controlling valve.

Referring now to the drawings in detail, the numeral 1 designates generally the main body frame of a conventional mortising and tenoning machine comprising the upright side members 2, horizontal top cross framing 3 and the regular sub-framing (not shown) which supports obvious parts of the general mechanism, also not shown, because not entering in detail into the function and operation of the work holding means of the present invention. Suffice it to merely describe a regular work carrying horizontal top body or head 4, shown in top plan in Figure 1 and fragmentarily in vertical section in Figure 2. This working body or head 4 is merely shown conventionally and of a general rectangular form, it being mounted in a conventional manner on the top cross framing 3 of the machine so as to be selectively reciprocated either in a straight longitudinal direction only, or in a combined longitudinal and transverse direction and with orbital motion, either circularly or elliptically, depending upon the character of the cutting and forming operations to be performed by the machine, that is to say, as to whether the boards to be cut are placed and held horizontally in the machine for plain cutting operation by movement only longitudinally endwise into engagement with the cutters and likewise withdrawn from the cutters or placed and held vertically when the mortising and tenoning operation is performed by moving the end portions of the boards laterally into engagement with and past the cutters for straight across cutting and formation or first longitudinally into engagement with the cutters and then causing the work to travel in an orbit about the respective cutters, either in a substantially true circle or elliptically for that particular kind of cutting and formation, as the case may be.

As far as the present invention is concerned, only a portion of the mechanism for imparting the longitudinal movement to the work carrying body or head 4 in the straight longitudinal direction for plain cutting operation on either the

horizontally positioned or vertically positioned boards, as hereinabove described, and in the same direction in the initial operation of the body or head 4 when the cutting operations are performed on the vertically positioned boards with the combined orbital travel of the boards about the cutters in that particular character of work.

Only a portion 5 of a regular reciprocatory undercarriage which effects the straight longitudinal reciprocation of the working body or head 4 in the plain cutting and forming operations and a corresponding initial forward and final return movement of said working body or head 4 for partial orbital cutting and forming operations is illustrated conventionally in Figure 1, it being understood that on the major portion of said carriage 5 (not shown) is carried the regular means which effects the orbital travel of the working body or head 4 and is automatically operated and controlled in timed relation to the actuating means for the carriage 5 itself, which latter means will now be described. In the structure shown, the carriage portion 5 has a vertical driving shaft 6 journaled thereon adjacent the rear end thereof, said shaft being constantly rotated by a conventional driving connection with a motor (not shown) which latter, obviously, is either carried on the carriage 5 or is mounted on the main frame of the machine with a suitable provision in the driving connection between it and the shaft 6 to compensate for the reciprocation of the carriage.

A conventional spring element 7 is attached at one end, as at 8, to a rigid and stationary angular extension 9 of the main frame 1 of the machine, the opposite end of the spring element being attached, as at 10, to the carriage 5, said spring element yieldably holding the carriage in a normally retracted position and reacting to return the carriage to such position after each forward actuation thereof, the forward actuation of the carriage being effected by a rotating cam 11 which is fixedly set on the driving shaft 6 so as to rotate with the latter. Said cam is held, under the influence of the spring element 7, in constant contact with an antifriction roller 12 journaled on the inner end portion of a stop bracket 13 which is longitudinally slotted, as at 14, and bolted through the slot into the frame extension 9, as at 15, whereby to be longitudinally adjusted.

At the forward end of the machine is the usual battery of cutters 16 which are obviously mounted on the upper ends of vertical spindles laterally alined in a transverse row and driven in a conventional manner by means (not shown). As hereinabove described, the cam 11, in its rotation, effects a straight reciprocation of the working body or head 4 for the plain cutting of the boards and also for a corresponding movement of the working body or head 4 in the initial cutting and final retraction of the boards in connection with the orbital cutting of the tenons, the forward travel of the carriage 5 being effected by the engagement of the leading radial cam surface 11^a of the cam 11 with the antifriction roller 12 of the stop bracket 13, the carriage being held for a considerable period of time at the end of its forward stroke by the concentric circular peripheral portion 11^b of the cam riding in engagement with the antifriction roller 12, that is to say, until the receding radial return portion 11^c at the opposite end of said concentric portion 11^b passes the roller 12 and the low concentric portion 11^d is brought into engagement with the roller 12 under the reactive influence of the spring element 7. It is during this period when the carriage 5 is at rest at the end of its forward stroke that the aforesaid orbital travel of the working body or head 4 occurs. In this connection, it is here noted that if only plain cutting is to be performed, the particular mechanism which effects the orbital travel of the working body or head 4 is placed in an inoperative condition by conventional means (not shown) provided for the purpose in the regularly connected or coactive operating assembly of the machine.

Further description of the conventional mortising and tenoning machine and detailed illustration other than that shown in the accompanying drawings is deemed unnecessary for a full understanding of the construction and operation of the work holding means of the present invention to be now described.

Obviously, inasmuch as the work is placed in either a vertical position or a horizontal position, according to the kind of cutting and forming operation to be performed, separate holding means is provided for each working position. As shown, the vertical holding means comprises an abutment plate 17 (see Figures 1, 3 and 4) which is screwed or bolted, as at 18, to the forward longitudinal side face of an elongated body block 19 which extends transversely of the working body or head 4 adjacent the forward end of the latter. As shown, the block 19 is supported at its opposite ends on right angular base members 20 which are bolted through their outwardly disposed horizontal bottom flanges 20', as at 21, to the top face of the working body or head 4. Obviously, the base members 20 may be either formed integrally with the body block 19 or separately therefrom, as desired, but, in any case, it is preferable to extend said base members 20 a considerable distance beyond the inner longitudinal side of the body block 19, as at 22, and shown more clearly in Figures 1, 3 and 4.

Capped bearing brackets 23 are attached to the opposite ends of the body block 19, preferably by bolts 24 which are inserted through alined apertures in the body of the bracket 23 and the cap 23' thereof and into registered screw-threaded openings (not shown) provided therefor in the end of the body block, the bolts 24 thus constituting common supporting means for the attachment of the bracket to the body block as well as the cap member to the bracket. The bearing brackets 23 and their cap members 23' are jointly bored horizontally, as at 25 (see Figure 4), in which bores supporting bars 26 are slidably fitted for longitudinal reciprocation, said bars 26 being of a length to project a considerable distance beyond the forward ends of the bearing brackets 23 and having their end portions screw-threaded, as at 27, for the reception of nuts 28, which latter constitute adjustable abutments for a rectangular flatfaced clamping plate 29 whose opposite end portions are provided with apertures 30 of a diameter to fit loosely on the supporting bars 26. The clamping plate 29, which is located in opposed relation to the abutment plate 17 on the body block 19, is yieldably held away from the abutment plate by helical springs 31 which are coiled loosely about the supporting bars 26 and interposed between the forward ends of the bearing brackets 23 and washers 32 which are sleeved loosely on said supporting bars 26 between the outer ends of the springs 31 and adjacent inner face portions

of said clamping plate 29. In this connection, it is noted that the nuts 28 are adjusted on the screw-threaded portions 27 of said supporting bars 26 to vary the normally spaced parallel position of the clamping plate 29 relative to the abutment plate 17.

The supporting bars 26 are formed with enlargements 33 at their inner ends, said enlargements affording annular stop shoulders which are held normally against the adjacent inner ends of the bearing brackets 23 under the influence of the springs 31 which, as above described, also yieldably hold the clamping plate 29 in its normal spaced relation to the abutment plate 17. The end enlargements 33 of the supporting bars 26 are longitudinally slotted, as at 34, in which slotted portions thrust rollers 35 are located just within the extreme end portions of said enlargements 33 and being journaled on transverse pintles 36 which latter are fitted at their opposite ends in apertures provided therefor in the companion arms of the bifurcated enlargements 33.

It is here pointed out that the end enlargement 33 of each supporting bar 26 is of ample length so that considerable space may be provided between the base of the bifurcation of the enlargement and the periphery of the thrust roller 35 for the passage of a reciprocatory operating bar 37, the major body portion of which latter is mounted in a slideway 38 provided therefor in the body block 19, the outer end portion 39 of said bar 37 extending through the bifurcated portion of said enlargement 33 of the supporting bar 26 and normally some distance therebeyond (see Figures 2 and 4). There are two of these operating bars 37 (one correlated to each of the supporting bars 26) and the pair of operating bars 37 are yieldably held with their inner ends in abutting contact with each other by a pair of spring elements 40 which are respectively located on opposite sides of the meeting end portions of said pair of operating bars 37, said spring elements being respectively attached at their opposite ends to the adjacent side faces of the bars, as at 41. As the two bars 37 are exactly alike in structural form and operation a description of one will suffice. Each bar is provided near its outer end portion 39 with a recess 42 which is of compound curvature to provide a camming portion 42' at its inner end, said recess, in the normal retracted position of the bar 37, having the thrust roller 35 received therein (see Figure 4), at which time the correlated supporting bar 26 is held in its normal retracted position under the influence of its spring 31 as hereinbefore described.

When the two operating bars 37 are simultaneously moved longitudinally apart by power means to be later more fully described, and said bars being held to a definite line of reciprocation by the slideway 38 of the body block 19, the camming effect of the inner end portions 42' of the recesses 42 in said bars 37 against the thrust rollers 35 causes a retractive longitudinal movement of the supporting bars 26, whereby the clamping plate 29 is accordingly moved toward the abutment plate 17 so as to grip the work previously placed vertically between said plates 17 and 29 in their normal spaced relation to each other, and, of course, for the accommodation of such work of a given thickness, the spacing of the plate 29 relative to the plate 17 having been previously adjusted by turning the nuts 28 inwardly or outwardly on the screw-threaded portions 27 of the supporting bars 26 as hereinbefore described.

To grip and hold the horizontally positioned work on the top face of the working body or head 4 for that character of cutting operation to be accordingly performed as hereinbefore described, special clamping means is provided for use separately from the vertical clamping means but preferably operated simultaneously therewith and by the same power means. As shown, the cooperative pair of operating bars 37 are each provided adjacent their inner ends with a cam projection 43 on a longitudinal side at right angles to the side in which the aforesaid cam recess 42 is provided, said cam projections 43 working in lateral slots 44 provided in the body block 19 and establishing communication between the bottom of the slideway 38 and registered longitudinally slotted portions 45 of a vertically movable elongated carrier frame 46 located beneath the body block 19 and supporting a clamping plate 47.

The carrier frame 46, as shown more clearly in Figure 5, comprises a spaced pair of elongated rectangular side bars 46^a and 46^b, said bars being separated intermediate their ends by rectangular strut blocks 48 and fastened together by transverse bolts 49 which are inserted through alined openings provided therefor in the blocks 48 and opposite side bars 46^a and 46^b, respectively, whereby, not only are the parts securely fastened together, but ample rigidity is given to the structure. At the opposite ends of the carrier frame 46 strut blocks 50 are inserted between the side bars 46^a and 46^b and fastened in place, the same as the aforesaid blocks 48, by bolts or other suitable fasteners 49'.

The end strut blocks 50 are provided with rightangular extensions 51 at their upper ends, said extensions 51 being of rectangular form and projected some distance beyond the adjacent end portions of the body block 19 through rectangular openings 52 provided in the adjacent upper portions of the base members 20 and just below the plane of the underside of the body block 19 (see Figure 2). The rectangular openings 52 are elongated vertically to afford ample clearance for down and up operating movement of the carrier frame 46, as will be later more fully described, and said carrier frame 46 is yieldably held in a normally raised position in close relation to the underside of the body block 19 by helical spring elements 53 interposed between the horizontal bottom flanges 20' of the base members 20 and the undersides of the rectangular extensions 51 of the end strut blocks 50 of the carrier frame 46 (see Figure 2). As shown, the spring elements 53 are coiled about vertical guide studs 54 whose lower end portions are screw-threaded, as at 55, and fitted tightly in counterpart screw-threaded sockets provided therefor in the flange portions 20' of said base members 20, the upper end portions of said guide studs 54 being slidably fitted in guide bores 56 provided therefor in the outer end portions of said rectangular extensions 51 of the end strut blocks 50, as shown more clearly in Figure 5. The spring elements 53 react to restore the carrier frame 46 to its normal raised position after each downward actuation of the carrier frame which is effected by outward longitudinal movement of the operating bars 36, during which movement of said operating bars 37 the cam projections 43 on the bars engage thrust rollers 57 located in the longitudinally slotted portions 45

of the carrier frame which are in registration with the aforesaid slots **44** through which communication is established between said slotted portions **45** of the carrier frame and the slideway **38** in which said operating bars **37** work, said thrust rollers **57** being journaled on transverse pintles **58** which are fitted at their opposite ends in apertures provided therefor in the adjacent portions of the side bars **46a** and **46b**, respectively, of the carrier frame **46**, and the peripheral portions of said rollers **57** above their respective pintles **58** being projected into said communicating slots **44** in the path of the cam projections **43** of the operating bars **37**.

The clamping plate **47** is mounted on the carrier frame **46** with provision for its adjustment in spaced working relation to the top face of the work carrying body or head **4** of the mortising and tenoning machine. This mounting, as shown, comprises a pair of supporting and adjusting studs **59**, the lower end portions of which are reduced and screw-threaded, as at **60**, and fitted tightly in counterpart screw-threaded openings provided therefor in the adjacent end portions of the clamping plate **47**, the shoulders formed on said studs **59** at the bases of said reduced screw-threaded end portions **60** impinging the adjacent top face portions of said clamping plate **47**. The entire body portion of each stud **59** above the clamping plate **47**, except for flattened surfaces **61** on opposite sides thereof, being screw-threaded, as at **62**, for the reception of adjustable abutment nuts **63** which are turned upwardly or downwardly, as the case may be, in the adjustment of said clamping plate **47** toward or away from the carrier frame **46**, said abutment nuts **63** bearing against the adjacent underside portions of the carrier frame and resisting pressure against the underside of the clamping plate **47** tending to move the latter toward the carrier frame **46**. The thickness of the studs **59** between their opposite flattened longitudinal faces **61**, is substantially the same as the distance between the two side bars **46a** and **46b** of the carrier frame **46** between which side bars **46a** and **46b** the portions of the studs **59** above the abutment nuts **63** are inserted with a rather snug fit.

For setting the studs **59** in their longitudinal adjustment in the carrier frame **46**, setscrews **64** are provided on the outer side bar **46b** so as to be tightened against the adjacent flat longitudinal faces **61** of the studs **59** prior to the setting of the abutment nuts **63** against the underside of the carrier frame **46**, that is to say, the stud **59**, with the setscrew **64** and the abutment nut **63** loosened, is moved to the proper position for the desired longitudinal adjustment thereof and the setscrew **64** then tightened against the stud, after which the nut **63** is turned on the stud until the nut is brought tight against the adjacent under portion of the carrier frame **46**. By the foregoing it is obvious that the clamping plate **47** is readily adjusted for its proper spaced working relation to the top face of the work carrying body or head **4** with substantial abutment provision between said plate **47** and carrier frame **46** to effectively clamp the work between said plate **47** and the work carrying body or head **4** under the pressure of the power means to be now described.

The power means for actuating the operating bars **37** which in turn effect the actuation of the clamping plates **29** and **47** through the associated instrumentalities, as hereinbefore described, comprises a power cylinder **65** having a substantial annularly flanged base **66**, the major portion of which is bolted, as at **67**, to the top face of the body block **19**, and an overhanging portion of the base flange **66** being bolted, as at **68**, to an arcuate supporting ledge **69** corresponding to the curvature of said overhanging base flange portion **66** of the cylinder and formed as an integral extension of an elongated cover plate **70** which is bolted at intervals throughout its length to the rear vertical face of the body block **19**, as at **71**, said plate **70** constituting a side closure for the slideway **38**, which latter is formed by cutting and grooving the body block **19** for the accommodation of the operating bars **37**. In this connection, it is noted that the bottom edge of the cover plate **70** terminates short of the plane of the bottom face of the body block **19** at a distance just sufficient for the reception thereunder of a horizontal filler plate **72** which constitutes the bottom wall of the slideway **38** and extends a considerable distance laterally from the outer vertical face of the cover plate **70** and is bolted at its opposite ends, as at **73**, to the top faces of the extensions **22** of the base members **20** which support the body block **19**. It is in this bottom plate **72** that the communicating slots **44** are provided between the slideway **38** and the longitudinally slotted portions **45** of the carrier frame **46**, in which slots **44** the cam projections **43** of the operating bars **37** and thrust rollers **57** work. It is further noted that elongated lateral enlargements **40'** of the slideway **38**, provided in the body block **19** and cover plate **70** for the accommodation of the spring elements **40**, are also covered by the adjacent middle body portions of the bottom plate **72** at opposite sides of a central longitudinal slot **72'** provided in the plate (see Figures 2 and 3), said slot **72'** coinciding communicably above a longer slot **48'** in the carrier frame **46** between the strut blocks **48** thereof.

Within the cylinder **65** is a piston **74** having a downwardly extending axial stem **75** which reciprocates through a conventional packed opening **76** in the bottom wall of the cylinder and carries at its lower end a wedge-shaped head **77**. As shown, the head **77** is of a triangular prismatic form having two opposite flat faces square with the base thereof and transversely with respect to its two inclined faces which have a wedging effect upon the meeting ends of the operating bars **37** as will presently more fully appear. The opposite flat vertical side faces of the head **77** have a rather snug sliding engagement with the opposed side faces of a guide opening **78** provided in the body block **19**, said opening **78** being preferably elongated in the lengthwise direction of the underlying slideway **38** with which it communicates (see Figures 2 and 3) so that the opposite ends of the rectangular opening **78** thus formed are spaced some distance from the adjacent base ends of said head **77**. The apex edge **79** of the head **77** is coincident with the vertical plane of the meeting ends of the operating bars **37** in their normally retracted positions. Preferably, the apex edge portion **79** of the head **77** is rounded slightly to relieve it of acute sharpness and the upper corners of the meeting ends of said operating bars **37** are also preferably rounded off, as at **80**, so that said edge portion **79** of the head **77** enters easily between the ends of the bars **37** when the head is forced downwardly by fluid pressure applied to the top face of the piston **74** and thereby causing simultane-

ous outward longitudinal movement of said bars 37, as will later more fully appear.

Leading from a controlling valve, designated generally by the numeral 81 and fixedly mounted on a bracket extension 82 of the main frame 2 of the mortising and tenoning machine, is a pressure fluid conducting pipe 83 which is connected at its end remote from the valve 81 to an intake fitting 84 at the lower end of the cylinder 65 by a flexible hose 85, said flexible hose being provided to compensate for both the reciprocatory and the orbital travel of the work carrying body or head 4 on which the cylinder 65 is carried. The intake fitting 84 is communicably connected to the lower inlet passageway 86 of the cylinder, said passageway 86 being provided in the base flange 66 of the cylinder and extending into the bottom wall of the cylinder with an upturned inner end portion terminating in a port opening 87 directly in the lower portion of the cylinder (see Figure 2). Also leading from the valve 81 is a pressure fluid conducting pipe 88 having a flexible hose connection 89 to a fitting 90 which is communicably connected to an upper inlet passageway 91 in the head of the cylinder 65 and having a downturned end portion terminating in a port 92 opening directly into the upper portion of the cylinder.

It is here noted that when pressure fluid is admitted into the lower portion of the cylinder 65 below the piston 74 and pressure fluid is evacuated from the cylinder above the piston, the piston is moved upwardly and thereby retracting the head 77 from engagement with the operating bars 37, and, inversely, when the pressure fluid is supplied to the cylinder above the piston and the pressure fluid is evacuated from the cylinder below the piston, the piston is moved downwardly and the head 77 is thereby forced between the meeting inner ends of the bars 37.

As shown, the valve 81 comprises a body casing having a bore with which the two conducting pipes 83 and 88 communicate through parallel ports 93 and 94, respectively, at one side of the valve body, and the valve body having an inlet port 95 to which is connected a pipe 96 leading from a source of pressure fluid (not shown) preferably compressed air, although, obviously, steam or hydraulic pressure may be employed if desired. Rotatable within the bore of the valve body is a circular plug 97 having a curved passageway 98, one end port 99 of which is restricted and brought alternately into communicable registration with the ports 93 and 94 of the valve body in the operation of said plug, the opposite end port of said passageway 98 being widened, as at 100, so as to be in communication with the port 95 of the valve body when its end port 99 is in communicable registration with either one of the ports 93 and 94.

The valve plug 97 is also provided with an exhaust passage 101 of substantially Y-shape, the port 102 at the end of its stem portion being in communication with an elongated outlet opening 103 of the valve body at all times, whether the port 99 of the pressure fluid supply passageway 98 of the plug is in registration with the port 93 to which the conducting pipe 83 is connected or the port 94 to which the conducting pipe 88 is connected, but one branch 104 of the Y-shaped exhaust passageway is located and correlated for communicable registration only with the fluid pressure outlet port 93 and the opposite branch 105 of said passageway 101 being located and correlated only to the pressure fluid outlet port 94. In other words, as illustrated in Figure 6, wherein the valve plug 97 is in its normal position, the port 99 of the supply passageway 98 is in communicable registration with the outlet port 93 and pressure fluid is then supplied through the conducting pipe 83 and hose connection 85 to the lower portion of the power cylinder 65, and the branch 104 of the Y-shaped exhaust passageway is in communication with the port 94 to which the conducting pipe 88 is connected and whereby the pressure fluid is evacuated from the upper portion of the cylinder 65 and the piston 74 is moved upwardly by the fluid pressure thereunder.

When the valve plug 97 is turned to the position as illustrated in Figure 7, the port 99 of the supply passageway 98 in the plug is brought into communicable registration with the outlet port 94, whereupon the pressure fluid is conducted through the pipe 88 and the hose connection 89 into the upper portion of the cylinder 65. In this operated position of the valve plug 97, a peripheral recess 105' in the plug 97 and constituting the terminal of the branch 105 of the exhaust passageway 101 is in communicable registration with the port 93 to which the conducting pipe 83 is connected, whereby the pressure fluid is evacuated from the lower portion of the cylinder 65 and the piston 74 is moved downwardly under the fluid pressure now applied thereabove.

The illustration of the controlling valve 81 in Figures 1, 6 and 7 is more or less schematic and conventional, but, as indicated in Figures 6 and 7, the branch 104 of the exhaust passageway 101 is in the same plane as the port 99 of the supply passageway 98, while the branch 105 of said exhaust passageway 101 is in a plane below that of the supply passageway 98, as indicated by the dotted lines, said branch 105 terminating communicably with the peripheral recess 105', which latter, in the operated position shown in Figure 7, is brought into communicable registration with the port 94 to which the conducting pipe 88 is communicably attached.

As hereinabove stated, the normal position of the valve plug 97 is that illustrated in Figure 6. In this position, an operating arm 106 which is secured to the upper end portion of an axial stem 107 extending upwardly of the top of the plug, is set in the angular position as shown in Figure 1, in which position said arm 106 is yieldably held by a spring 108 which is coiled about the stem 107 and secured at one end to the top of the valve body casing, as at 109, the opposite end of the spring being engaged with the arm 106, as at 110, whereby, when the arm 106 is moved from its normal position, the spring 108 is wound and thereby reacts to return the arm 106 to its normal position when relieved of the force which moved it from such position. The operating arm 106 has a pitman rod 111 attached at one end thereto, as at 112, the opposite end of said rod 111 being pivotally attached, as at 113, to an actuator lever 114, which latter is pivotally attached, as at 115, to a bracket 116 fixedly secured to the rear portion of the cross framing 3 of the machine.

As shown, the actuator lever 114 extends normally at an angle downwardly from its pivot 115, with its free end portion 117 resting against the concentric low portion 118a of an auxiliary cam 118 which is fixed on the driving shaft 6 above the cam 11 which controls the reciprocation of the work carrying body or head 4 as hereinbefore described. In this connection, it is here noted

that the actuator lever 114 is held against the cam 118 under the influence of the spring 108 which is wound about the stem 107 of the valve plug 97 and attached at its ends to the valve body casing and said operating arm 106, respectively, as just above described. The concentric periphery 118b of the high portion of the cam 118 is at a distance from the periphery of the low portion 118a thereof to hold the actuator lever 114 in a raised straight longitudinal position after moving from its normal position through an angle sufficient to move the operating arm 106 through the angle necessary for rotating the valve plug 97 from its normal position shown in Figure 6 to the operated position shown in Figure 7 with the effect as hereinbefore described.

The length of the high concentric peripheral portion 118b between the leading radial camming surface 118a and the receding radial portion 118c of the cam 118 is proportioned to the length of the concentric high peripheral portion 11b of the cam 11 which controls the actuation of the undercarriage 5 of the machine and said cam 118 is also set on the driving shaft 6 in working relation to the cam 11 so that, when the actuator lever 114 is moved by the cam 118 from its normal position shown in Figure 1 to the operated position hereinbefore described, the valve plug 97 is accordingly rotated to the operated position shown in Figure 7 because of the pitman rod connection between the actuator lever 114 and the operating arm 106 of the plug. This actuation occurs just prior to the forward movement of the undercarriage 5 and effects the simultaneous clamping movement of the clamping plates 29 and 47 as hereinbefore described, the valve plug 97 being retained in its operated position throughout the forward movement of the undercarriage 5 and the return movement thereof, and for a time after the undercarriage is fully retracted. The work, designated by the numeral 119 and comprising two boards placed back to back in vertical position loosely between the abutment plate 17 and clamping plate 29 while the work carrying body or head 4 is at rest as shown in Figure 1 is, due to the above noted operation of the valve plug 97, securely clamped and held throughout the entire time the work carrying body or head 4 is traveling in any of the directions in which it operates and, of course, while the cutting operations are being performed, it being understood that the operator places the work between the abutment plate 17 and clamping plate 29 and also removes the work during the period that the work carrying body or head 4 is at rest and at which time the clamping plate 29 is held removed from the abutment plate 17 under the reactive influence of the springs 31 which have been compressed during the movement of the clamping plate 29 into clamping relation to the work. The same is true as to the operation of the clamping plate 47 when the work is placed horizontally and flatwise upon the work carrying body or head 4 in the performance of that particular cutting operation as hereinbefore described.

Conventional means for locating the work horizontally on the work carrying body or head 4 may be provided as indicated at 120 in Figure 1, said means, as shown, comprising elongated plates provided with longitudinal slots 121 through which the plates may be bolted to the top face of the body or head 4, as at 122, and the plates having turned up inner end portions 123 between which the work is placed after the plates have been accordingly adjusted on the body or head 4 for work of a given width. However, in so far as the present invention is concerned, other provision may be obviously made for the purpose, and similarly for positioning the vertical work with relation to the abutment plate 17.

In some cases, particularly when the work carrying body or head 4 is only reciprocated in a straight line for plain cutting operations, as hereinbefore described, speedier operation of said work carrying body or head 4 may be accomplished by substituting a double cam 124 in place of the hereinbefore described cam 118 as shown in Figure 8, the diametrically opposed wings 125 of said cam 124 acting alternately upon the actuator lever 114 in substantially the same manner as the aforesaid cam 118, it being, of course, understood that when the double cam 124 is used, a corresponding double cam (not shown) must be used in connection therewith in place of the hereinbefore described cam 11 which controls the reciprocation of the undercarriage 5.

By the use of the fluid pressure actuated work clamping means of the present invention all manual labor is eliminated except in the placing of the work in and removing it from between the clamping plates 29 and 47 and their respective abutments.

While the herein illustrated and described structure embodies a practical adaptation of the invention, it is obvious that considerable alteration and modification may be made therein without departing from the spirit and scope of the invention as defined by the appended claims. The invention, therefore, is not limited to the specific construction and arrangement shown.

What is claimed is:

1. In a conventional machine of the character described and including a work carrier movable into and out of working relation to the cutting means of the machine and having provision for intermittently actuating said work carrier from and back to a normal position in which it is retained throughout a substantial period of rest, the combination therewith of a vertical abutment provided at the forward end of the work carrier in the direction of travel of the latter toward the cutting means of the machine, a work clamping plate movably mounted in opposed cooperative relation to said vertical abutment and having provision in its support for yieldably holding it normally spaced ahead of said abutment, said work carrier having a horizontal work supporting portion, a clamping plate mounted above and having provision for guided vertical movement toward and from said horizontal work supporting portion, means for yieldably holding said horizontal clamping plate in normal spaced relation to said horizontal work supporting portion of the work carrier, and controlled fluid pressure power means for effecting a simultaneous actuation of said vertical and horizontal clamping plates respectively toward said vertical abutment and said horizontal work supporting portion of the work carrier, said power means comprising a longitudinally alined pair of reciprocatory actuator bars each common to both the vertical clamping plate and the horizontal clamping plate and having portions coacting in interengagement with supporting portions of said clamping plates whereby forced longitudinal movement of said actuator bars apart is translated into like movement of said supporting portions of the clamping plates perpendicularly with

respect to the actuator bars and in the direction away from the vertical abutment and the horizontal supporting portion of the work carrier, respectively, spring means connecting said actuator bars and yieldably holding them in normal abutting relation to each other, a vertically disposed power cylinder mounted on said work carrier above said actuator bars, a reciprocatory piston in said cylinder, said piston having an axial stem extending downwardly therefrom and projected with leaktight fitting through an opening provided therefor in the bottom end wall of the cylinder, a wedge-shaped head secured on the lower end portion of the piston stem outside the cylinder, the apex edge portion of said head terminating above said actuator bars and coinciding with the vertical plane where the ends of said actuator bars meet in normal abutting relation to each other, and valve controlled means for alternately supplying fluid under pressure to the cylinder at either side of the piston therein and simultaneously evacuating the pressure fluid from the cylinder at the side of the piston opposite to that at which the fluid is supplied.

2. The herein described work holding means comprising, in combination with a work carrier movable into and out of cooperative relation to the cutting element of a mortising and tenoning machine or the like, a reciprocatory undercarriage having provision for effecting the operation of the work carrier, said undercarriage also having provision for retracting it to a normal inactive position and for yieldably holding it in such position, means including a rotating cam mounted on said undercarriage and constantly held in working relation to a stationary stop element on the frame of the machine under the influence of the retracting and yieldable holding means of said undercarriage, said cam being formed to effect movement of said undercarriage from its normal position and having opposed concentric portions, one portion for the holding of the undercarriage at rest in its retracted position during a definite period of time and the other portion for likewise holding the undercarriage in its operated position, work clamping and holding means on said work carrier, said means including a power cylinder, a valve controlling a supply of fluid under pressure to said power cylinder whereby to alternately render the work clamping and holding means effective and ineffective, and actuating means for said valve including an auxiliary cam rotating with said undercarriage actuating cam in timed relation thereto, said auxiliary cam having a low concentric portion and an opposed high concentric portion, an actuator lever in cooperative relation to said auxiliary cam and having an operable connection with said controlling valve whereby the valve is reciprocated for the control of the alternate supply of pressure fluid to the power cylinder, the connection between said actuator lever and the valve including means for yieldably holding said actuator lever constantly in engagement with said auxiliary cam.

3. In a machine of the character described, including a base, a work carrier movable into and out of working relation to a cutting means of the machine, a vertical abutment at the forward end of the work carrier in the direction of travel of the latter towards the cutting means of the machine, a work clamping plate movably mounted in opposed cooperative relation to said vertical abutment, two horizontally movable reciprocating elements mounted in the carrier and having their ends normally spring held in engagement with each other, a cam carried by each of the elements and adapted to engage the work clamping plate on the outward movement thereof, a V-shaped head adapted to be moved between the abutting ends of the elements, a power means for operating said V-shaped head, a second working plate movable at right angles to the first work clamping plate, and cams carried by the reciprocating elements for operating the second work clamping plate at right angles to the first work clamping plate, whereby the two work clamping plates are simultaneously moved to clamping position.

4. In a machine of the character described, including a base, a work carrier movable into and out of working relation to a cutting means of the machine, a cam for causing such movement of the work carrier, a vertical abutment at the forward end of the work carrier in the direction of travel of the latter towards the cutting means of the machine, a work clamping plate movably mounted in opposed cooperative relation to said vertical abutment, two horizontally movable reciprocating elements mounted in the carrier in the same plane and having spring means for normally holding the ends thereof in engagement with each other, a cam carrier by the outer end of each reciprocating element and engaging the work clamping plate, a second work clamping plate arranged at right angles to the first work clamping plate, a cam carried by each reciprocating element arranged at right angles to the first mentioned cam and engaging the second work clamping plate, and a vertically movable wedge shaped head adapted to be forced between the abutting ends of the reciprocating elements for forcing the same outwardly to cause the cams to simultaneously move to clamping position.

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